

Assessment of knowledge, perception, and practice patterns of Jordanian optometrists during COVID-19 pandemic: a cross-sectional online survey

Mera F. Haddad¹, Yousef Khader²

¹Faculty of Applied Medical Sciences, Department of Allied Medical Sciences, Jordan University of Science and Technology, Irbid 22110, Jordan

²Faculty of Medicine, Department of Public Health, Jordan University of Science and Technology, Irbid 22110, Jordan

Correspondence to: Mera F. Haddad. Faculty of Applied Medical Sciences, Department of Allied Medical Sciences, Jordan University of Science and Technology, POBox 3030, Irbid 22110, Jordan. mfhaddad@just.edu.jo

Received: 2022-06-06 Accepted: 2022-09-05

Abstract

• **AIM:** To investigate knowledge, risk perception, and attitude towards corona virus disease 2019 (COVID-19) and infection control measures among optometrists in Jordan.

• **METHODS:** A cross-sectional survey was distributed through social media platforms to optometrists registered with the Jordanian syndicate and Jordanian association of optics. Information on participants' socio-demographic characteristics, knowledge of clinical features of COVID-19, risk assessment and infection control measures for preventing disease transmission were collected.

• **RESULTS:** A total of 135 optometrists (80 females and 55 males) with a mean age of 32±10y responded to the survey. Most optometrists were aware of COVID-19 symptoms, modes of transmission and measures for preventing COVID-19 and transmission in the ophthalmic setup. However, more than half of the optometrists did not receive any training about protection or infection control by their employers at their work place. Social media was the most common source of information on COVID-19 (76%). Most optometrists (85.2%) thought that the virus could be detected in tears, and 45.9% thought that red eye is a symptom of COVID-19.

• **CONCLUSION:** Optometrists in Jordan are aware of the clinical features and preventive measures related to COVID-19 infection. However, training on infection control is lacking and needs to be improved. Guidelines by international professional optometric associations should be

promoted through regional and national associations to all registered optometrists and access to peer review. Journals should be encouraged to ensure that the knowledge about the pandemic is up to date and accurate.

• **KEYWORDS:** knowledge; perceptions; practice; optometrists; COVID-19; Jordan

DOI:10.18240/ijo.2022.11.01

Citation: Haddad MF, Khader Y. Assessment of knowledge, perception, and practice patterns of Jordanian optometrists during COVID-19 pandemic: a cross-sectional online survey. *Int J Ophthalmol* 2022;15(11):1729-1735

INTRODUCTION

In December 2019, the severe acute respiratory syndrome coronavirus 2 (SARS-COV-2) emerged, resulting in an ongoing outbreak of pneumonia in China and spread all over the world^[1-2]. Corona virus disease 2019 (COVID-19) has rapidly evolved causing severe illness and death of thousands of people worldwide. It is known to affect the elderly and people with medical comorbidities but there have been deaths of all ages^[2]. COVID-19 spread fear and panic among the population due to its course of transmission and high diffusion by direct contact with infected persons. This panic was also increased by the fact that the transmission of the virus occurred from asymptomatic individuals^[3].

Different variants of SARS-COV-2 have been identified since the emergence of COVID-19 infection disease. The Delta variant, which was designated by the World Health Organization (WHO) as a variant of concern^[4] due to its severe disease course and reduced effectiveness of treatment resulting in high fatalities around the world. Currently the virus has spread worldwide as Omicron variant. This is a heavily mutated variant of SARS-COV-2 with high transmissibility rate, but reduced severity of the disease^[5].

Hundreds of reports have been published about the ocular involvement in the course of COVID-19 disease, as some have considered the eye a potential site for virus transmission^[6]. Conjunctivitis is considered the most common and obvious

sign of ocular involvement^[7-9] manifested as conjunctival hyperemia, chemosis, epiphora, and increased secretions. These manifestations were reported in moderate, severe and critical cases confirmed with COVID-19^[10]. Zuo *et al*^[11] reported a case with atypical keratitis, that is different from the common keratitis, as a clinical manifestation of COVID-19 which could appear third earlier than fever and cough. Eyelid manifestations of COVID-19 have also been reported. These include: dryness, pain, foreign body sensation, itching and Meibomian orifices abnormalities^[12-13]. Other reports suggested involvement of the tear film^[10,14-15].

Ophthalmologists and optometrists are ranked at higher risk for COVID-19 infection. Various ways of transmission have been reported in ophthalmology clinics and this applies to optometry clinics and shops as they share many similar testing settings. Loon^[15] suggested that the close testing distance between the patient and the optometrist/ophthalmologist is considered a potential risk for the transmission of the virus through the eyes. The virus is believed to be transmitted from an infected person to the ophthalmologist or optometrist by spreading respiratory particles during sneezing, coughing, talking or breathing^[16] and also from one patient to another through the use of reusable eye equipment *e.g.* the Goldmann applanation tonometer, trial contact lenses and trial frames^[15]. These ways of transmission can also happen from asymptomatic and presymptomatic patients^[3]. The virus can also be transmitted by contact with infectious particles located on surfaces. van Doremalen *et al*^[17] found stable virus particles on plastic and stainless-steel surfaces after up to 72h of exposure to the virus.

Ophthalmic manifestations may present during COVID-19 infection or they may develop several weeks after recovery^[18-19]. Therefore, ophthalmologists and optometrists should be aware of these ocular associations in order to look for specific signs, diagnose and manage the ocular condition and thus limit the spread of infection. In addition, they can diagnose and initiate early treatment for life and vision threatening complications which have also been reported as a complication of COVID-19^[20-22].

This study aimed to assess the awareness and knowledge of Jordanian optometrists about COVID-19 and assess their practice patterns during the pandemic.

SUBJECTS AND METHODS

Ethical Approval The questionnaire was anonymous to maintain the privacy and confidentiality of all information collected in the study. All procedures performed in the study were in accordance with the ethical standards of the institutional research committee. The ethics approval for conducting this study was granted by the Institutional Review Board (IRB) committee at Jordan University of Science and Technology.

Study Population The study population consisted of optometrists who work in hospitals, private clinics or optical shops in Jordan. Optometrists were contacted using social media platforms such as Facebook and WhatsApp. The Facebook group included qualified optometrists registered with the Jordanian optometric association and the WhatsApp groups included qualified optometrists in the Jordanian Scientific Committee and alumni of optometry residing in Jordan and registered with the Jordanian Association of Optics. The participants were from the North, Middle and South of Jordan.

Questionnaire Development, Administration, and Design

An online survey was constructed using Google forms and a link to the questionnaire was sent to participants through Facebook or WhatsApp from the November 25 to December 10, 2021 using convenience sampling. The questions included in the survey were derived from two other published studies related to dentists^[23] and ophthalmologists^[24] but modified to use with optometrists (the study sample in this work). The items included in this survey were validated in the two previous studies in Jordan^[22-23]. The face and content validity were established according to the guide presented by Gaur *et al*^[25]. The questionnaire was reviewed by a senior epidemiologist and senior optometrist who agreed on that the tool covers appropriate and adequate items to measure awareness, knowledge, and practices of optometrists about COVID-19 (good face validity). The content validity of the tool was established by three subject matter experts who reached a consensus on retaining all items in the tool. Qualified practicing optometrists were asked to complete a questionnaire which included 37 questions divided into 6 categories: 1) socio-demographic information of the participants such as age, gender, location and work place, 2) knowledge about COVID-19 pandemic in terms of clinical features, symptoms, transmission and methods of prevention, 3) skills in dealing with suspected cases which describe the ability of optometrists to follow cross infection control, 4) precautionary behaviors that the optometrist adopts as preventive measures against COVID-19, 5) risk perception and attitude towards dealing with confirmed or suspected COVID-19 cases, 6) the readiness and preparedness to work attending COVID-19.

Data Analysis Data were analyzed using the Statistical Package for Social Sciences (SPSS) software version 20 (SPSS®: Inc., Chicago, IL, USA). Data were described using means, standard deviations (SD), and percentages.

RESULTS

Characteristics of Participants A total of 135 optometrists (80 females and 55 males) successfully completed the questionnaire forming a response rate of about 33.75% (135 out of 400 invited optometrists). The average age of the study group was 32±10y and it ranged from 19 to 59y. The

participants were from different cities in Jordan, 38 (28.1%) from the north, 91 (67.4%) from the middle, and 6 (4.4%) from the south of Jordan. The years of experience as practicing optometrists ranged from 1-38y with an average of 10±9y. Most of the optometrists were working in the private sector 100 (74.1%) and the rest were distributed in academia 18 (13.3%), the Royal medical services 16 (11.9%) and the public sector 1 (0.7%).

Awareness About Incubation Period, Clinical Features and Modes of Transmission of COVID-19 Infection The majority of participants 128 (94.8%) had updated information about COVID-19. Most of the participants 131 (97%) were aware of the protective measures that should be taken to protect themselves from the infection, although more than half of the participants 72 (53.3%) did not receive any training about protection or infection control by their employers at their work place.

Knowledge about the incubation period of the virus was divided equally between participants. One third of the participants (32.6%) mentioned an incubation period of 2-14d, the second third (33.3%) thought it was 7-14d and the rest 43 (31.9%) assumed it was 7-21d. Most of the participants were able to identify common symptoms of COVID-19. Most participants reported fever, shortness of breath, headache and coughing as the most common symptoms of the infection. These were followed by muscle and joint pain and sore throat. Red eye was reported by 62 (45.9%) of the optometrists. Other symptoms, as reported by the participants, are shown in Table 1. Regarding the mode of transmission of COVID-19 in optical shops and ophthalmic clinics, the majority reported regular and common ways of infection transmission like sneezing and coughing, hand shaking, touching the surfaces and door knobs. Whereas, touching the eye and the tear film, using the slit lamp and the trial frame were reported by the majority as specific transmission methods of infection in optical shops from the patient and the optometrist and from one patient to another (Table 1).

Sources of Information on COVID-19 When the participants were asked about the source of information about the virus, different sources were reported with varying proportions as presented in Table 2.

Awareness of Risk Assessment and Prevention of COVID-19 Transmission in Optical Shops and Clinics When the optometrists were asked if patients attending eye clinics or optical shops were at higher risk of contracting the infection, 70 (51.9%) answered yes, 46 (34.1%) answered no and 19 (14.1%) did not know. In addition, a large percentage (87.4%) of the participants agreed that COVID-19 can be transmitted from asymptomatic patients to the optometrist during eye examination.

Table 1 Awareness of optometrists about incubation period, symptoms, and mode of transmission of COVID-19

Variables	n (%)
Incubation period (d)	
1-14	44 (32.6)
7-14	45 (33.3)
7-21	43 (31.9)
Symptoms of COVID-19	
Fever	134 (99.3)
Coughing	111 (82.2)
Runny nose	53 (39.3)
Sore throat	92 (68.1)
Shortness of breath	124 (91.9)
Joint and muscle pain	86 (63.7)
Red eyes	62 (45.9)
Skin rash	16 (11.9)
Headache	95 (70.4)
Vomiting	37 (27.4)
Diarrhea	78 (57.8)
May present with no symptoms	94 (69.6)
Mode of transmission	
Coughing and sneezing	128 (94.8)
Hand shaking	127 (94.1)
Surfaces and door knobs	128 (94.8)
Air pollen	57 (42.2)
Touching the eyes and tears of patient	115 (85.2)
Trial frame	116 (85.9)
The use of slit amp	113 (83.7)
Eye drops	62 (45.9)
Sharing of the white coat	100 (74.1)

Regarding the prevention measures for COVID19 transmission, all the optometrists agreed that washing hands frequently by soap and water is the most important measure to prevent transmission of COVID-19. Other general and specific measures are listed in Table 3.

Perception of COVID-19 and Attitude Toward Managing Suspects/Confirmed Cases of COVID-19 Attending Optical Shops and Eye Clinics Almost one third of the participant 37 (27.4%) perceived COVID-19 as very dangerous, 88 (65.2%) thought it was moderately dangerous and 10 (7.4%) as slightly dangerous. Therefore, 103 (76.3%) were ready to treat patients who cough or sneeze in their clinic but with extra precautions and only 13 (9.6%) thought of not treating those patients and send them to the hospital straight away. Table 4 lists the responses of optometrists regarding dealing with suspects/confirmed cases of COVID-19 at optical shops or eye clinics.

Preparedness of Optical Shops and Clinics to Work During COVID-19 When the participants were asked about their preparedness to work during the pandemic, 94 (69.6%) considered themselves able to deal with the virus spread

Table 2 Source of information of COVID-19 as reported by participants

Source of information	<i>n</i> (%)
Email newsletter from international professional organizations	27 (20)
Google search engine	62 (45.9)
Social media platforms	103 (76.3)
Local hospitals	26 (19.3)
Local professional organizations (syndicate/optometric association)	35 (25.9)
Peer reviewed journals	9 (6.7)

Table 3 Participants responses regarding the protocol that should be followed to prevent COVID-19 transmission in optical shops/clinics

Prevention measures	<i>n</i> (%)
Washing hands frequently by soap and water	135 (100)
Wearing face masks during eye exam	131 (97)
Changing face masks and gloves regularly between patients	109 (80.7)
wear personal protective equipment	112 (83)
Avoid sharing instrumentation between testing rooms	111 (82.2)
Disinfecting the surfaces and testing instruments <i>e.g.</i> trial frames and instruments	128 (93.3)
Clean and disinfect trial contact lenses	99 (73.3)

Table 4 Recorded responses for the participants regarding dealing with suspects/confirmed cases with COVID-19

Items	<i>n</i> (%)	
	Yes	No
Would you accept referrals of suspected or confirmed cases with COVID-19?	44 (32.6)	91 (67.4)
Prefer not to deal with glasses or contacts for suspected or confirmed cases of COVID-19	102 (75.6)	33 (24.4)
Would you accept cases from ophthalmologists suspected to be infected with COVID-19?	50 (37)	85 (63)
Do you think the prescriptions delivery from ophthalmologists should be changed?	108 (80)	27 (20)
Dou you consider yourself prepared to deal with COVID-19 spread?	94 (69.6)	41 (30.4)
Do you know what to do in case you have symptoms of the virus?	126 (93.3)	9 (6.7)

whereas 41 (30.4%) said they were still anxious to deal with the uncontrolled spread of the virus. Nevertheless, 126 (93.3%) optometrists knew how to act in case of unprotected exposure or if they felt any symptoms of the virus.

When the participants were asked about the measures they adopted to reduce the transmission/spread of the infection at their clinics and optical shops, 112 (83%) reported that they reduced the number of appointments, and 119 (88.1%) said that they allowed sufficient time between appointments. In terms of attending the clinic/shop for appointments, 106 (78.5%) optometrists informed their patients not to bring more than one companion if necessary. Most importantly, 111 (82.2%) optometrists asked their patients not to attend in case any symptoms appeared on the day of the appointment.

DISCUSSION

This study provides an insight on the attitude and perception of optometrists on infection control to COVID-19 pandemic. More than half of the optometrists reported that they did not get any instructions or guideline on the preventive measures against COVID-19 at their work place. However, most of them showed good knowledge and up to date information about the virus and prevention methods against it. This is with no doubt

due to the news of the pandemic occupying the media since its emergence in 2019. This justifies our finding of social media as being the primary source of information about the pandemic, since these have attained wide global penetrance for the past few years. These platforms allow the subject to rapidly receive and share information globally. In addition, people during this difficult time are heavily reliant on maintaining connectivity using global digital social networks, to facilitate interaction and information sharing about the virus due to strict measures regarding physical distancing^[26].

Although these platforms have played a key role in public health promotion^[27-28], most of the contents are shared without editorial oversight, unlike traditional media methods which are more controlled by intermediaries who take responsibility related to information verification and sharing^[29]. According to Gupta *et al*^[30], social media channels were the most important sources of information as well as misinformation. As a result, scientific misinformation spread may cause potential harm due to mistaken beliefs by authors. Unlike peer-reviewed articles where the information is evidence-based. It is surprising, though, that these articles are least readable by eye care providers. It could be that these articles were only accessible

to academics participating in this study as this is reflected by the small number of optometrists working in academia (13.3%) which was very close to the number of participants who used peer reviewed articles (6.7%).

Most of the optometrists could identify the general symptoms of COVID-19 which is very important in order to take the necessary action in case of contact with suspected patients and also in the control of the spread of the disease. Interestingly, red eye was only reported by 45% of the optometrists. This exactly matches with the controversial information published of ocular involvement during COVID-19 infection.

The majority of the optometrists could identify methods of transmission, either common methods among the public or specific to optometry clinic and ophthalmic patients. Awareness of methods of transmission is essential to take prevention measures especially during proximal eye testing using the slitlamp biomicroscope or the applanation tonometer or the trial frame. Especially that some early ocular manifestations of the virus in the eye such as conjunctivitis and possible occurrence in the tear film^[31] have been reported. In this context, advice to eye wear protection (goggles) and face masks at all times during the examination and avoidance of touching any mucosal membranes in the eye *e.g.* conjunctiva was documented^[32-33]. Therefore particular care should be taken when examining the ocular media because of both the proximity to patients' nose and mouth, and the potential exposure to tears which may contain the virus^[34].

All the optometrists reported that frequent hand washing and wearing masks are among the most important protective measures against transmission of the virus. This agrees with the guidelines provided by the American optometric association (AOA)^[35] and many other studies concerning wearing masks and eye protection when engaged in close patient contact (less than 1.5 m). These protective measures proved to be very successful in protecting against COVID-19 transmission. Wang *et al*^[36] found that wearing masks by all household members prior to symptom onset was 79% effective in reducing transmission of the virus and using chlorine or ethanol base disinfectants was 77% effective. Chu *et al*^[37] analyzed 172 studies results regarding protective measures against COVID-19. All the 172 studies confirmed that physical distancing of 1 m or more, wearing face masks by health care workers and people in the community were very effective in reducing transmission of the virus and eye protection added an additional benefit.

Almost half of the participants in this work agreed that optometrists are at high risk of getting the infection. In fact, many studies emphasized on the transmission of COVID-19 through the ocular surface. Since infectious droplets and body fluids can contaminate the conjunctival epithelium^[38]

the respiratory particles are capable of utilizing the eye as a portal of entry to the human body and inducing ocular complications^[39]. Nonetheless the majority of optometrists did not mind to treat patients who sneeze or cough in their clinics but with extra precautions.

The majority of optometrists refused to accept and treat patient suspected to have COVID-19, and even did not prefer to deal with glasses and contact lenses belonging to suspected cases. This is not surprising due to the testing settings of ophthalmic patients considering the distance between the optometrist and the patient especially when using the slitlamp. There is an evidence that COVID-19 virus remains on hard surfaces including spectacles for hours and days and then can be transferred to hands and faces of the wearer^[40]. Similarly, dealing with contact lenses for suspected cases is also not preferred since transmission of the virus through the tears and conjunctiva is possible and has been investigated^[15].

Most of the optometrists agreed that the delivery of prescriptions from the ophthalmic clinics to optical shops should take another form such as electronic prescriptions. E-prescribing during the pandemic has been discussed. In Newzeland e-prescribing was accelerated to minimize the use of paper scripts and reduce the contact between health care providers and patients^[41] in England more than 85% of primary care prescriptions were processed electronically during the pandemic^[42] even televideoconsultation for patients with COVID-19 has been experienced in the pandemic in Italy^[43]. In Jordan, positive attitudes towards utilization of electronic prescription was expressed by physicians in all medical fields^[44] and the program "Hakeem electronic services" has been used as an electronic prescribing platforms. However, there has not been any update on its use during the pandemic.

Over two years since the emergence of COVID-19 infection and the sequel of variants appears to be far from ended. Therefore, 70% of the optometrists showed their preparedness to work during the pandemic. This agrees with their perception about the virus as 65.2% thought it was moderately (and not very) dangerous. Extra precautions though, were listed by the optometrists as a condition to resume working in their shops or clinics such as reducing the number of appointments and allowing sufficient time between them, allowing no more than one companion if necessary and ask the patient not to attend if they have any symptoms. These precaution measures adopted by the optometrists in optical shops and clinics in Jordan provide safe services without increasing the incidence of infection.

This work has several limitations. The first one is the period at which the questionnaire was collected. This was a mixed period of the two most common variants of SARS-COV-2 infection; Delta and Omicron which are different in the

severity of the disease course, transmission, effectivity of treatments and response to vaccination. This could result in bias (mix) of the reported knowledge of symptoms, preventive measures and mode of transmission. The second limitation is the reduced number of respondents which resulted in lower than expected sample size. This also could be due to the time of the questionnaire which was after the situation went back to normal after the lockdown and the optometrists were busy preparing their shops and clinics while adapting to the new preventive measures to limit the spread of infection.

In conclusion, optometrists in Jordan were aware of COVID-19 in terms of incubation period, symptoms, mode of transmission, and prevention measures in optical shops and clinics. It is worrying though, that the primary source of information was social media platforms. This may hold mistaken or inaccurate information about the infection. Guidelines released by international professional organizations such as the American Optometric Association (AOA) should be promoted through regional and national associations to all registered optometrists to ensure that their knowledge about the pandemic is up to date and accurate. In addition, access to peer reviewed Journals especially the ones concerning ocular involvement and prevention should be encouraged and disseminated. This surely will impact the way the optometrists deal with suspected or infected cases thus limiting the transmission of the infection and protect themselves against it.

ACKNOWLEDGEMENTS

The authors would like to thank all participants who participated in this study.

Authors' contributions: Haddad MF: Modifying and refining the survey, data collection, interpretation of the results, writing the manuscript; Khader Y: Designing the original survey, interpretation of the results, writing and reviewing the manuscript.

Foundation: Supported by the Deanship of Research at Jordan University of Science and Technology.

Conflicts of Interest: Haddad MF, None; Khader Y, None.

REFERENCES

- 1 Li Q, Guan X, Wu P, *et al.* Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med* 2020;382(13):1199-1207.
- 2 Paules CI, Marston HD, Fauci AS. Coronavirus infections-more than just the common cold. *JAMA* 2020;323(8):707-708.
- 3 Bai Y, Yao LS, Wei T, Tian F, Jin DY, Chen LJ, Wang MY. Presumed asymptomatic carrier transmission of COVID-19. *JAMA* 2020;323(14):1406-1407.
- 4 World Health Organization. WHO designates new COVID strain Omicron as 'variant of concern'. 2021. <https://www.aljazeera.com/news/2021/11/26/who-designates-new-covid-strain-omicron-variant-of-concern>

- 5 Diseases NCfIaR. Omicron Variant: What You Need to Know. Centers for Disease Control and Prevention. 2022.
- 6 Peiris JSM, Yuen KY, Osterhaus ADME, Stöhr K. The severe acute respiratory syndrome. *N Engl J Med* 2003;349(25):2431-2441.
- 7 Sindhuja K, Lomi N, Asif MI, Tandon R. Clinical profile and prevalence of conjunctivitis in mild COVID-19 patients in a tertiary care COVID-19 hospital: a retrospective cross-sectional study. *Indian J Ophthalmol* 2020;68(8):1546-1550.
- 8 Chen LW, Deng CH, Chen XH, Zhang X, Chen B, Yu HM, Qin YJ, Xiao K, Zhang H, Sun XF. Ocular manifestations and clinical characteristics of 535 cases of COVID-19 in Wuhan, China: a cross-sectional study. *Acta Ophthalmol* 2020;98(8):e951-e959.
- 9 Chen L, Liu MZ, Zhang Z, Qiao K, Huang T, Chen MH, Xin N, Huang ZL, Liu L, Zhang GM, Wang JT. Ocular manifestations of a hospitalised patient with confirmed 2019 novel coronavirus disease. *Br J Ophthalmol* 2020;104(6):748-751.
- 10 Wu P, Duan F, Luo CH, Liu Q, Qu XG, Liang L, Wu KL. Characteristics of ocular findings of patients with coronavirus disease 2019 (COVID-19) in Hubei Province, China. *JAMA Ophthalmol* 2020;138(5):575-578.
- 11 Zuo DM, Xue LP, Fan H, Yang SL, Li LC, Luo JH, Zang S, Xiao J. COVID-19 infection with keratitis as the first clinical manifestation. *Int J Ophthalmol* 2022;15(9):1544-1548.
- 12 Meduri A, Oliverio GW, Mancuso G, Giuffrida A, Guarneri C, Venanzi Rullo E, Nunnari G, Aragona P. Ocular surface manifestation of COVID-19 and tear film analysis. *Sci Rep* 2020;10:20178.
- 13 Aggarwal K, Agarwal A, Jaiswal N, Dahiya N, Ahuja A, Mahajan S, Tong L, Duggal M, Singh M, Agrawal R, Gupta V. Ocular surface manifestations of coronavirus disease 2019 (COVID-19): a systematic review and meta-analysis. *PLoS One* 2020;15(11):e0241661.
- 14 Xia JH, Tong JP, Liu MY, Shen Y, Guo DY. Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection. *J Med Virol* 2020;92(6):589-594.
- 15 Loon SC. The severe acute respiratory syndrome coronavirus in tears. *Br J Ophthalmol* 2004;88(7):861-863.
- 16 Leung NHL, Chu DKW, Shiu EYC, Chan KH, McDevitt JJ, Hau BJP, Yen HL, Li YG, Ip DKM, Peiris JSM, Seto WH, Leung GM, Milton DK, Cowling BJ. Respiratory virus shedding in exhaled breath and efficacy of face masks. *Nat Med* 2020;26(5):676-680.
- 17 van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, Tamin A, Harcourt JL, Thornburg NJ, Gerber SI, Lloyd-Smith JO, de Wit E, Munster VJ. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med* 2020;382(16):1564-1567.
- 18 Nayak B, Poddar C, Panigrahi MK, Tripathy S, Mishra B. Late manifestation of follicular conjunctivitis in ventilated patient following COVID-19 positive severe pneumonia. *Indian J Ophthalmol* 2020;68(8):1675-1677.
- 19 Sen M, Honavar SG, Sharma N, Sachdev MS. COVID-19 and eye: a review of ophthalmic manifestations of COVID-19. *Indian J Ophthalmol* 2021;69(3):488-509.

- 20 Invernizzi A, Pellegrini M, Messenio D, Cereda M, Olivieri P, Brambilla AM, Staurengi G. Impending central retinal vein occlusion in a patient with coronavirus disease 2019 (COVID-19). *Ocular Immunol Inflamm* 2020;28(8):1290-1292.
- 21 Acharya S, Diamond M, Anwar S, Glaser A, Tyagi P. Unique case of central retinal artery occlusion secondary to COVID-19 disease. *IDCases* 2020;21:e00867.
- 22 Gascon P, Briantais A, Bertrand E, Ramtohl P, Comet A, Beylerian M, Sauvan L, Swiader L, Durand JM, Denis D. COVID-19-associated retinopathy: a case report. *Ocul Immunol Inflamm* 2020;28(8):1293-1297.
- 23 Khader Y, Al Nsour M, Al-Batayneh OB, Saadeh R, Bashier H, Alfaqih M, Al-Azzam S, AlShurman BA. Dentists' awareness, perception, and attitude regarding COVID-19 and infection control: cross-sectional study among Jordanian dentists. *JMIR Public Health Surveill* 2020;6(2):e18798.
- 24 Jammal HM, Alqudah NM, Khader Y. Awareness, perceptions, and attitude regarding coronavirus disease 2019 (COVID-19) among ophthalmologists in Jordan: cross-sectional online survey. *Clin Ophthalmol* 2020;14:2195-2202.
- 25 Gaur PS, Zimba O, Agarwal V, Gupta L. Reporting survey based studies - a primer for authors. *J Korean Med Sci* 2020;35(45): e398.
- 26 Limaye RJ, Sauer M, Ali J, Bernstein J, Wahl B, Barnhill A, Labrique A. Building trust while influencing online COVID-19 content in the social media world. *Lancet Digit Health* 2020;2(6):e277-e278.
- 27 Coomes EA, Haghbayan H, Finken LR, Quadros KK, Bagai A, Cheema AN. Information on cardiovascular disease in the digital era: results from a cross-sectional patient survey. *Can J Cardiol* 2019;35(6):791-794.
- 28 Warren KE, Wen LS. Measles, social media and surveillance in Baltimore City. *J Public Health (Oxf)* 2016;39(3):e73-e78.
- 29 Eysenbach G. From intermediation to disintermediation and apomediation: new models for consumers to access and assess the credibility of health information in the age of Web2.0. *Stud Health Technol Inform* 2007;129(Pt 1):162-166.
- 30 Gupta L, Gasparyan AY, Misra DP, Agarwal V, Zimba O, Yessirkepov M. Information and misinformation on COVID-19: a cross-sectional survey study. *J Korean Med Sci* 2020;35(27):e256.
- 31 Karimi S, Arabi A, Shahraki T, Safi S. Detection of severe acute respiratory syndrome Coronavirus-2 in the tears of patients with Coronavirus disease 2019. *Eye (Lond)* 2020;34(7):1220-1223.
- 32 World Health Organization. Laboratory testing for 2019 novel coronavirus (2019-nCoV) in suspected human cases. Interim guidance, 2020. <https://www.who.int/publications/i/item/10665-331501>
- 33 World Health Organization. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected. Interim guidance, 2020. <https://www.who.int/publications/i/item/10665-331495>
- 34 Li JPO, Lam DSC, Chen YX, Ting DSW. Novel Coronavirus disease 2019 (COVID-19): the importance of recognising possible early ocular manifestation and using protective eyewear. *Br J Ophthalmol* 2020;104(3):297-298.
- 35 American Optometric Association. Updated Eye Protection, Face Mask and Contingency Planning for Doctors of Optometry and Their Staff in Response to the COVID-19 Pandemic. 2021; 1-8. <https://www.aoa.org/AOA/Documents/Advocacy/HPI/HPICoVID19UpdatedFDAGuidanceonFaceMasks>
- 36 Wang Y, Tian HY, Zhang L, Zhang M, Guo DD, Wu WT, Zhang XX, Kan GL, Jia L, Huo D, Liu BW, Wang XL, Sun Y, Wang QY, Yang P, MacIntyre CR. Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. *BMJ Glob Health* 2020;5(5):e002794.
- 37 Chu DK, Akl EA, Duda S, Solo K, Yaacoub S, Schünemann HJ. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. *Lancet* 2020;395(10242):1973-1987.
- 38 Olofsson S, Kumlin U, Dimock K, Arnberg N. Avian influenza and sialic acid receptors: more than meets the eye? *Lancet Infect Dis* 2005;5(3):184-188.
- 39 Belser JA, Rota PA, Tumpey TM. Ocular tropism of respiratory viruses. *Microbiol Mol Biol Rev* 2013;77(1):144-156.
- 40 American Optometric Association. Contact lens wear & coronavirus: do's & don't. 2020. https://www.aaopt.org/docs/covid-19/aa011-contact-lens-wear-coronavirus.pdf?sfvrsn=4d10ad23_0
- 41 Imlach F, McKinlay E, Kennedy J, Morris C, Pledger M, Cumming J, McBride-Henry K. E-prescribing and access to prescription medicines during lockdown: experience of patients in Aotearoa/New Zealand. *BMC Fam Pract* 2021;22(1):140.
- 42 Turnbull A. Increase in use of electronic prescriptions during COVID-19 pandemic. *Independent Nurse* 2020.
- 43 Morosini P, Campanella N, Lucci G, Giorgetti A, Lorenzetti V, Manfrini E, Moretti A. The telemedicine consultation in support of home management of the patient with CoViD-19 by general practitioner: the results in some municipalities of the Marche Region. *Recenti Prog Med* 2020;111(7):454-460.
- 44 El-Dahiyat F, Kayyali R, Bidgood P. Physicians' perception of generic and electronic prescribing: a descriptive study from Jordan. *J Pharm Policy Pract* 2014;7:7.