Impact of COVID-19-associated anxiety on the adherence to intravitreal injection in patients with macular diseases a year after the initial outbreak

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Abstract

Background: As the primary burden of treating COVID-19 patients began to ease in the United Kingdom, ophthalmology clinic volume within the National Health Service has since recovered. Alarmingly, the rate of non-attendance remains higher than the pre-pandemic level.

Purpose: The purpose was to assess how the perceived risk of contracting coronavirus disease 2019 (COVID-19) influences the willingness of individuals with sight-threatening macular conditions to attend intravitreal anti-vascular endothelial growth factor (anti-VEGF) injection appointments during the second wave of the pandemic.

Methods: This prospective cross-sectional survey was conducted at the Macular Treatment Centre, Manchester Royal Eye Hospital. Patients who missed their appointment in January 2021 were invited to complete an anonymous survey over the telephone. The survey consisted of two parts: (1) a 23-item questionnaire aiming to assess fear of contracting COVID-19 in different hospital-related settings; and (2) the validated COVID-19 Anxiety Syndrome Scale (C-19ASS) to evaluate COVID-19-related anxiety.

Results: A total of 104 patients agreed to participate in the survey. Only a small proportion of patients believed COVID-19 vaccination (23 out of 88, 26.1%) had influenced their willingness to attend injection appointments. Majority of patients felt concerned about contracting COVID-19 during hospital appointments ($n = 63$, 60.6%). Only a minority of patients ($n = 36$, 34.6%) agreed with the hospital guidance on minimising clinical examinations during clinic visit. The C-19ASS was significantly higher in female patients, those older than 70 years and those with mobility issues. Higher C-19ASS, older age and living alone were predictors of clinic nonattendance.

Conclusion: COVID-19 anxiety and fear of viral exposure could adversely affect patient adherence to clinic appointments during the pandemic. Particular attention should be provided to older patients, those who live alone and patients with impaired mobility. This is particularly relevant as hospital eye services across the world are in the process of restarting.

Keywords: anxiety, clinic attendance, COVID-19, Did-Not-Attend, macular diseases, pandemic

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Introduction

Coronavirus disease 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[1] The rapid spread of COVID-19 evolved into an unprecedented global health crisis,[2] compelling national governments, including the United Kingdom, to announce national lockdown policies.[3] During the first wave of COVID-19 pandemic, health care systems had undergone dramatic restructuring to cope with the predicted high numbers of COVID-19 patients, which led to the cancellation and disruption of much nonemergency care,

including ophthalmology clinics. To mitigate the risk of exposure to COVID-19, eye services across the world had to limit clinic capacity to reduce patient volume,[4–6] while national ophthalmological authorities such as the Royal College of Ophthalmologists (RCOphth) had issued guidance on how to triage patients,[7] which led to the cancellation of routine clinic appointments and subsequent reduction in clinic volume. Worryingly though, some patients had still been reluctant to attend appointments deemed time-critical due to fear of contracting the infection.[8,9]

Treatment options for most retinal conditions involve face-to-face, time-critical interventions, for example, intravitreal injection of anti-vascular endothelial growth factors (anti-VEGF) for macular diseases. Although face-to-face appointments were only reserved for those with imminently sight-threatening conditions or emergencies, the ophthalmology community had reached a consensus that the continuity of treatment and monitoring of macular diseases was imperative even amid the pandemic.[7] Nevertheless, emerging data have demonstrated an increased number of patients would still suffer from visual-threatening consequences of delayed treatments due to the pandemic.[10,11]

A year has passed since the first wave of COVID-19 outbreak. As the primary burden of treating COVID-19 patients began to ease, RCOphth had developed new guidance on the resumption of hospital eye services, including medical retina clinics.[12] Clinic volume has since rebounded, but alarmingly the rate of nonattendance remained higher than the prepandemic level. This study aimed to improve our understanding of the perceptions of patients who missed clinic appointments in an attempt to provide an insight into solving the issue of nonattendance in the National Health Service (NHS) in the United Kingdom. We surveyed individuals with sight-threatening macular conditions receiving regular intravitreal anti-VEGF injections to gauge their perceived risk of contracting COVID-19 and their level of anxiety. Further, we identified the demographic and psychosocial factors associated with clinic nonattendance caused by COVID-19-related fear and anxiety.

Methods

This noninterventional survey study was conducted at the Macular Treatment Centre (MTC),

Manchester Royal Eye Hospital, between 4 and 29 January 2021. MTC is a tertiary 'one-stop' centre for diagnosing and treating macular diseases in Greater Manchester and the North West region of England. It consists of one large central centre and three peripheral units. Patients attending MTC typically have macular disorders that require regular monitoring or treatment in the form of intravitreal anti-VEGF injections. The survey was carried out during the second wave of COVID-19 after the third national lockdown was announced in England. The Medical Research Council guidelines do not require ethical approval as the study is not randomised or alter the treatment protocols of the patients involved. However, this study was approved by the Manchester University NHS Foundation Trust Clinical Audit and Risk Management Department with the Registration Title, 'How does COVID-19 fear and anxiety affect intravitreal injection adherence in patients with macular disorders', and conformed to the standards described in the Declaration of Helsinki.

Participant selection

All patients who had missed their scheduled MTC appointment in the study period were invited to participate in this survey over the telephone. Eligible patients were those older than 18 years diagnosed with macular disorders requiring intravitreal anti-VEGF injection. Exclusion criteria included preexisting mental health issues such as general anxiety disorder and depression, dementia and hearing problems or language barriers that prevented the patients from understanding the survey questions. Patients who could not be reached after three separate attempts, and who declined to participate were also excluded. Verbal informed consent was obtained by authors based on a standardised telephone consent script from all participants. The consent information was recorded on patient's clinical note and electronic records. Written confirmation of prior consent was sought when the patients attended their next hospital appointment. All data were anonymised.

Medical record review

Demographic information and clinical data including the best-corrected visual acuity (BCVA) of the affected eye or the worse seeing eye in bilateral cases (expressed as Early Treatment Diabetic Retinopathy Study letter score), laterality, diagnosis, presence of significant systemic comorbidities that increase the risk of severe COVID-19

infection (diabetes, respiratory disease, hypertension, cardiovascular disorders, kidney disease and immunosuppression), clinic location (central or peripheral) and history of mental health problem were collected from electronic health records (Medisoft, Leeds, UK) based on the most recent clinic encounter.

Survey design

The two-part telephone survey consisted of a 23-item questionnaire and the COVID-19 Anxiety Syndrome Scale (C-19ASS).[13] The survey questions aimed to assess individual circumstances, fear of contracting COVID-19 in different settings and attitudes towards precautionary measures implemented by the hospital. The C-19ASS is a validated assessment tool for COVID-19 anxiety. Respondents were asked to indicate the degree to which they agree with each of the nine items on a 5-point Likert-type scale. Scores range from 9 to 45 by adding the numerical results for each statement. Authors administering the survey were provided with a detailed script outlining how to introduce the questionnaire, the exact phrase for each question and alternative phrasing for clarification.

Statistical analysis. The Mann–Whitney *U* test and chi-square/Fisher's exact tests were used for pairwise comparisons of continuous and categorical variables, respectively. A multivariable linear regression analysis was performed to identify baseline parameters of predictive value for the C-19ASS score. A multivariable logistic regression model was built for the willingness of respondents to attend hospital appointments during the pandemic. All explanatory variables with potential impact on the outcome ($p < 0.20$) in univariable analysis were included in the final multivariable model. Statistical analysis was performed using SPSS (IBM Corp., Armonk, New York, USA). Values of $p \leq 0.05$ were classified as significant.

Results

From 4 to 29 January 2021, 2680 appointments were scheduled (1080 at MTC Central, 1600 at peripheral MTC clinics), 233 patients (8.7%) Did-Not-Attend (DNA) their booked appointments. DNA rate in January 2021 was significantly higher than that in February 2020 (8.7% *versus* 6.3%, $p < 0.001$), the month before the first national lockdown, but lower than April 2020 (8.7% *versus* 21.5%, $p < 0.001$). Of the

233 patients that DNA their appointments, 24 patients were excluded due to preexisting mental health issues and 8 were excluded due to being unable to understand or hear the survey questions. One hundred thirty patients were successfully contacted (55.8%), and 104 (80%) agreed to participate in the survey. The mean (±SD) age of the respondents was 70.9 (±14.3) years, and 56 (54.4%) were men (Table 1). A total of 53 participants (51%) were being treated for age-related macular degeneration (AMD), 30 (28.8%) for diabetic macular oedema (DMO), 17 (16.3%) for retinal vein occlusions (RVO), 2 for myopic choroidal neovascularisation (CNV) and 2 for other macular pathologies (such as uveitic central macular oedema). The median BCVA was 65 letters [interquartile range (IQR), 45–74 letters]. A total of 32 respondents (30.8%) had mobility issues, 53 (51%) lived alone rather than living with family or spouse and 46 (44.2%) had significant systemic comorbidities under the management of hospital specialists. According to the self-reports in telephone interviews, the most common reason for nonattendance was COVID-19 anxiety (33, 31.7%), forgetting about the appointment (31, 29.3%), unexpected commitments in life (16, 15.4%), feeling unwell (10, 9.6%), work-related inconvenience (7, 6.7%) and transport-related issues (7, 6.7%). A summary of the results of the survey is displayed in Table 2.

Although most of the respondents had received at least the first dose of COVID-19 vaccination (88, 84.6%), only 23 (26.1%) of the vaccinated patients believed the jab had influenced their willingness to attend hospital appointments. More than half of the respondents (58, 55.8%) personally knew someone who had contracted COVID-19, but only 22 (32.4%) of these patients believed that had discouraged them from going to the hospital.

Regarding compliance to national lockdown rules, as expected, most patients (71, 68.3%) adhered to government guidance and only went out shopping for essential items and attending hospital appointments, and 17 (15.9%) respondents decided not to leave home at all. In contrast, a small number of individuals (4, 3.8%) confessed that they were going out as usual. A higher number of patients with mobility issues, patients who DNA due to anxiety and fear associated with COVID-19 and those with C-19ASS scores higher than 15 stated that they did not leave home at all.

Table 1. Demographics and clinical information of survey respondents.

Baseline characteristics	*N* = 104	Percentage
Sex		
Male	56	53.8
Female	48	46.2
Age, years (mean ± SD)	70.9 ± 14.3	
Laterality		
Left	31	29.8
Right	49	47.1
Both	24	23.1
Diagnosis		
Wet AMD	53	51
DMO	30	28.8
RVO	17	16.3
Myopic CNV	2	1.9
Other	2	1.9
BCVA (median, IQR)	65, 45–74	
What was the reason for DNA?		
COVID-19 anxiety	33	31.7
Other reasons	71	68.3
Impaired mobility	32	30.7
Living situation (lives alone)	53	51.0
Significant systemic comorbidities (such as diabetes, respiratory disease, hypertension, cardiovascular disorders, kidney disease and immunosuppression)?	46	44.2
Vaccination status (vaccinated)	88	84.6

BCVA, best-corrected visual acuity; DMO, diabetic macular oedema; DNA, Did-Not-Attend; IQR, interquartile range; myopic CNV, myopic choroidal neovascularisation; RVO, retinal vein occlusion; wet AMD, wet age-related macular degeneration.

Around half of the respondents felt concerned about contracting COVID-19 during their journey to/from hospital (51, 49.0%) and spreading the virus to other people (55, 52.9%), while most patients (63, 60.6%) were also worried about catching COVID-19 inside hospital facilities. Interestingly, 22 (21.2%) patients reported no concern at all. Looking at different subgroups

(Table 3), fewer male patients and those younger than 70 years were worried about contracting COVID-19 inside hospital facilities ($p = 0.005$ and 0.009, respectively). However, more respondents who were older than 70 years felt concerned about contracting COVID-19 during their journey to clinics ($p = 0.047$). Significantly less patients who were following national lockdown rules (which allowed attending hospital appointments) felt concerned about catching COVID-19 during their journey to hospital ($p = 0.042$) and at eye clinic ($p = 0.003$). Interestingly, more of these patients agreed to attend hospital appointment during the pandemic if one was scheduled ($p = 0.003$). On the contrary, more patients who did not leave home at all were afraid of catching COVID-19 during their journey to clinics ($p = 0.003$) and at hospital ($p = 0.001$), spreading the virus to others ($p = 0.033$) and being seen as breaking lockdown rule ($p = 0.022$).

Almost all the respondents felt confident in the precautionary measures implemented at the hospital during their appointments, such as staff wearing adequate PPE (100, 96.2%), social distancing at the waiting area (102, 98.1%) and reception (95, 91.3%) and availability of masks (90, 86.5%) and hand sanitisers (100, 96.2%) to patients. However, only 36 patients (34.6%) agreed with the RCOphth guidance on minimising clinical examinations during the clinic.

The result of the C-19ASS is presented in Figure 1. The mean (±SD) C-19ASS score was 16.6 ± 8.5. The C-19ASS was significantly higher in female patients compared with male (19.3 ± 8.2 *versus* 14.4 ± 8.2, $p = 0.005$), in patients older than 70 years (18.9 ± 8.4 *versus* 13.9 ± 7.8, $p = 0.002$) and in patients with mobility issues (20.9 ± 8.1 *versus* 14.6 ± 8.0, $p < 0.001$), while no significant difference in C-19ASS scores was found between those living alone or with family, nor between those with other systemic comorbidities that required hospital visits and those who were healthy in general. Interestingly, the mean C-19ASS score in the vaccinated patients was higher than that in those who were not vaccinated, although it was not statistically significant (17.3 ± 8.8 *versus* 12.7 ± 5.6, $p = 0.87$). Multivariable linear regression model demonstrated that impaired mobility was a significant independent predictor for a higher C-19ASS score ($p = 0.008$), while other demographic and disease factors were not shown to influence the C-19ASS score.

Table 2. Overall results of the survey questions.

Survey questions	*N* = 104	Percentage
1. How strictly do you comply to lockdown rules?		
Only leave home for essential shopping or hospital appointments	71	68.3
Do not leave home at all	17	16.3
Currently shielding	11	10.6
Go out as usual	4	3.8
Prefers not say	1	0.9
2. If you have been vaccinated, does vaccination/nonvaccination influence your decision on attending hospital appointment?	23 of 88	26.1
3. Are you aware of the implication of not receiving your treatment in the form of intravitreal injections?	95	91.3
4. How much difficulty is your reduced vision causing you?		
No difficulty	28	26.9
Mild difficulty	28	26.9
Moderate difficulty	14	13.5
Severe difficulty	17	16.3
Very severe difficulty	17	16.3
5. Do you know anyone who had contracted COVID-19?	58	55.8
If yes to above question, does that affect your decision of nonattendance?	22 of 58	32.4
6. Are you concerned about catching COVID-19 during journey to/from hospital	41	49.0
7. Are you concerned about COVID-19 exposure at eye clinic?	63	60.6
8. Are you concerned about spreading COVID-19 to other people?	55	52.9
9. Are you concerned about being seen as breaking lockdown rule?	26	26.0
10. Do you feel confident in the following precautionary measures?		
Staffs wearing adequate PPE	100	96.2
Social distancing at waiting area	102	98.1
Maintaining social distancing while queuing at reception area	95	91.3
Availability of mask for patients	90	86.5
Availability of alcohol gel at reception	100	96.2
Minimal examination by staffs	36	34.6
11. If the hospital schedules an appointment for you during the pandemic, would you go?	86	82.7

PPE, personal protective equipment.

Table 3. Patient perspectives on their concern regarding COVID-19 pandemic.

Subgroups (N)	Are you concerned about the following?								If the hospital schedules an appointment for you during the pandemic, would you attend? (responded 'yes')	
	Catching COVID-19 during journey to/from hospital		COVID-19 exposure at eye clinic		Spreading COVID-19 to other people		Being seen as breaking lockdown rule			
	N (%)	p value	N (%)	p value	N (%)	p value	N (%)	p value	N (%)	p value
Age groups										
<70 (47)	18 (38.3)	0.047	22 (46.8)	0.009	23 (48.9)	0.464	9 (19.1)	0.211	46 (97.9)	<0.001
≥70 (57)	33 (57.9)		41 (71.9)		32 (56.1)		17 (29.8)		40 (70.2)	
Sex										
Male (56)	23 (41.1)	0.079	27 (48.2)	0.005	30 (53.6)	0.880	13 (27.1)	0.650	51 (91.1)	0.015
Female (48)	28 (58.3)		36 (75.0)		25 (52.1)		13 (23.2)		35 (72.9)	
Mobility issues										
Yes (32)	20 (62.5)	0.067	26 (81.3)	0.004	19 (59.4)	0.377	8 (25.0)	1.000	23 (71.9)	0.052
No (72)	31 (43.1)		37 (51.4)		36 (50.0)		18 (25.0)		63 (87.5)	
Living situation										
Alone (51)	25 (49.0)	0.997	30 (58.8)	0.720	26 (51.0)	0.703	14 (27.5)	0.571	37 (72.5)	0.007
With family (53)	26 (49.1)		33 (62.3)		29 (54.7)		12 (22.6)		49 (92.5)	
Comorbidities										
Yes (46)	24 (52.2)	0.569	30 (65.2)	0.388	22 (47.8)	0.357	13 (28.3)	0.494	34 (73.9)	0.035
No (58)	27 (56.6)		33 (56.9)		33 (56.9)		13 (22.4)		52 (89.7)	
Compliance										
Following national rules	30 (42.3)	0.042	36 (50.7)	0.003	34 (47.9)	0.134	16 (22.5)	0.395	64 (90.1)	0.003
Other	21 (63.6)		27 (81.8)		21 (63.6)		10 (30.3)		22 (66.7)	
Do not leave home at all	14 (82.4)	0.003	17 (100)	0.001	13 (76.5)	0.033	8 (47.1)	0.022	7 (41.2)	0.001
Other	37 (42.5)		46 (52.9)		42 (48.3)		18 (20.7)		79 (90.8)	
Currently shielding	6 (54.5)	0.699	9 (81.8)	0.194	6 (54.5)	0.907	1 (9.1)	0.284	10 (90.9)	0.685
Other	45 (48.4)		54 (58.1)		49 (52.7)		25 (26.9)		76 (81.7)	
Go out as usual	1 (25)	0.618	1 (25)	0.298	2 (50)	1.000	1 (25)	1.000	4 (100)	0.599
Other	50 (50)		62 (62)		53 (53)		25 (25)		82 (82)	

Analysis based on age group (up to 70 years *versus* over 70 years), sex (male *versus* female), presence of impaired mobility, living situation (living alone *versus* living with family or spouse), presence of significant systemic comorbidities and compliance to national lockdown rules (displayed as individual category of categories *versus* other categories).
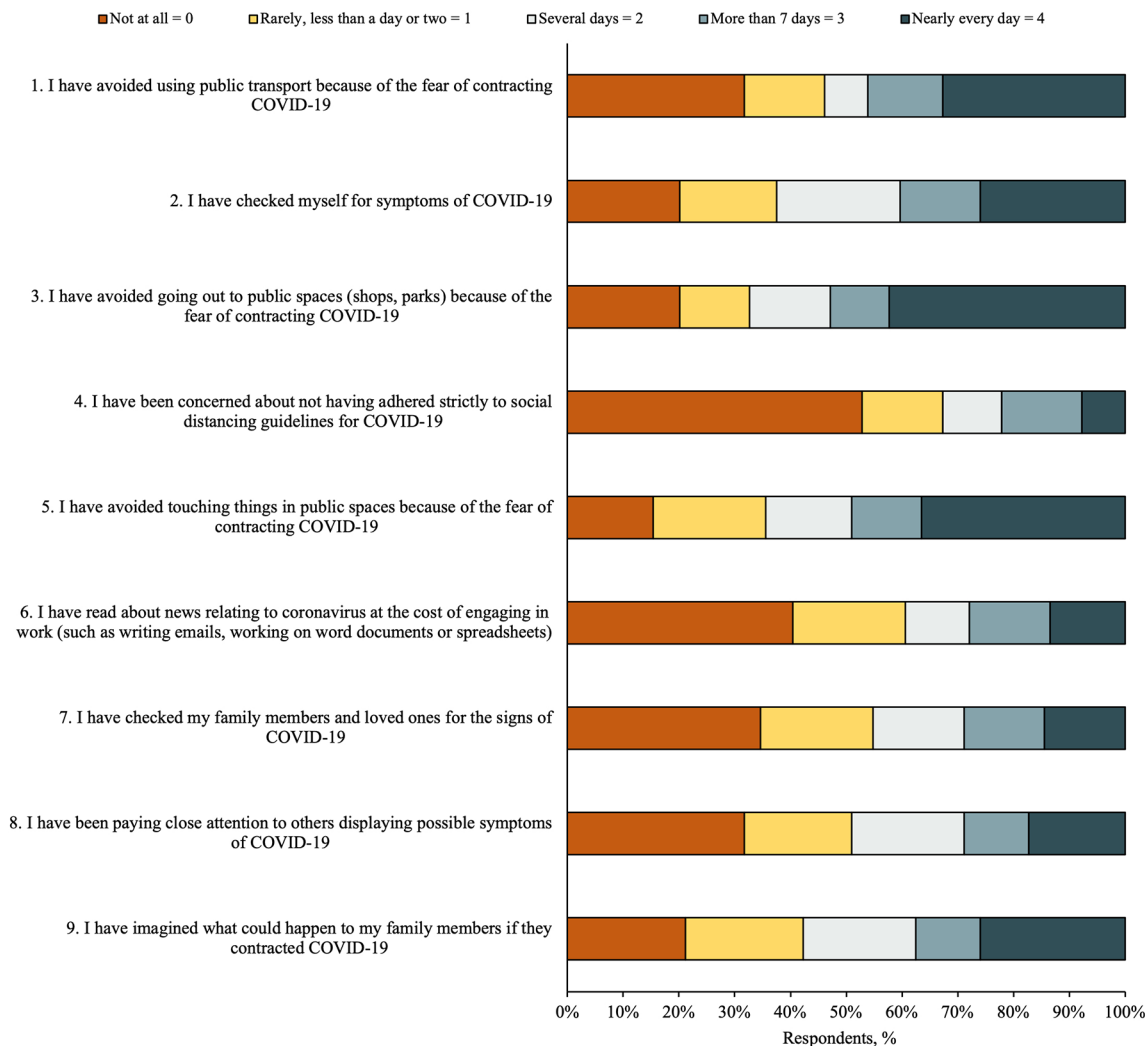
Stacked-bar charts show the percentage distribution of responses to the 9 Linkert-style items of C-19ASS.

Figure 1. Patient responses to the statement items from COVID-19 Anxiety Syndrome Scale.

Overall, 33 (31.7%) patients stated their reason for DNA was related to COVID-19 anxiety. C-19ASS score was a predictor of nonattendance due to COVID-19-associated anxiety, that is, for every score increase in C-19ASS, a patient was 111.7% more likely [odds ratio (OR), 1.117; $p = 0.041$] to DNA (Table 4). Age was also found to influence clinic attendance; each year older in age corresponded to the patient being 112.6% more likely to miss an appointment due to anxiety associated with COVID-19 (OR, 1.126; $p = 0.004$). On the other hand, patients who did not know anyone who had contracted COVID-19 were 97.1% less likely (OR, 0.029; $p = 0.002$) to miss their appointment. Other determining factors included living alone rather than living with family or spouse (OR, 32.68; $p < 0.001$) and being worried about contracting COVID-19 during the journey to/from hospital (OR, 5.093; $p = 0.043$).

Discussion

During the first wave of the pandemic, there was a significant decline in patients seeking emergency care or attending scheduled hospital appointments.[14] Previous studies had suggested that anxiety and fear associated with COVID-19 were prevalent among patients with ophthalmic disorders, affecting health-seeking behaviour.[8,15] However, there had been limited assessment of patient perspectives during the third national

Table 4. Univariate and multivariate analyses of factors predictive for clinic nonattendance due to COVID-19 anxiety.

Factors	Univariate			Multivariate		
	OR	95% CI	*p* value	OR	95% CI	*p* value
Site (peripheral units)	0.646	0.282–1.482	0.302	NA		
Age	1.063	1.023–1.105	0.002	1.126	1.037–1.222	0.004
Sex (male)	2.363	1.015–5.5	0.046	0.505	0.1–2.559	0.409
BCVA	0.985	0.965–1.005	0.13	1.002	0.968–1.039	0.89
Impaired mobility	0.252	0.104–0.613	0.002	0.987	0.164–5.959	0.989
Living alone	4.346	1.76–10.727	0.001	32.679	4.6–232.153	<0.001
Suffer from significant comorbidities	0.543	0.236–1.25	0.151	2.624	0.513–13.43	0.247
C-19ASS	1.106	1.047–1.17	<0.001	1.117	1.005–1.241	0.041
Vaccinated	1.475	0.437–4.974	0.531	NA		
Level of difficulty caused by visual impairment	1.569	1.159–2.124	0.004	1.489	0.797–2.78	0.211
Concern about contracting COVID-19 during journey to/from hospital	4.346	1.76–10.727	0.001	5.093	1.05–24.703	0.043
Concern about contracting COVID-19 in eye clinic	3.413	1.313–8.876	0.012	0.176	0.025–1.22	0.079
Concern about spreading COVID-19	3.441	1.401–8.448	0.007	4.052	0.836–19.645	0.082
Concern about being seen as breaking lockdown rule	5.741	2.208–14.928	<0.001	2.713	0.466–15.809	0.267
Knowing someone who contracted COVID-19	4.527	1.739–11.782	0.002	0.029	0.003–0.264	0.002

BCVA, best-corrected visual acuity; C-19ASS, COVID-19 Anxiety Syndrome Scale; CI, confidence interval; OR, odds ratio.

lockdown. A year has passed since the initial outbreak, and this study revealed that the fear of contracting COVID-19 is still a crucial factor that could influence patients' willingness to attend hospital appointments.

It was well established that the profound changes to our way of life brought by large-scale disease outbreak could lead to a surge of psychological distress, as observed during the SARS and H1N1 outbreak.[16,17] The COVID-19 pandemic was no exception.[18] Previous studies had proposed that pandemic-related distress could last beyond the course of the pandemic itself,[19,20] and a survey of the UK population after the end of the first lockdown had demonstrated that the anxiety level remained considerably higher than prelockdown.[21] Indeed, 1 year after the initial outbreak, the rate of nonattendance in our MTC remained higher than the prepandemic level. A subset of the population might display features of dysfunctional coping with the pandemic, such as avoidance, threat monitoring and worry.[13] These individuals might struggle to return to their usual societal activities, even after lockdown had ended, as some activities were perceived to associate with a greater risk of infection, such as using public transport or attending hospital appointments.[22] To understand the perception of the patients who missed their scheduled appointments, it is therefore imperative to characterise and quantify features of

dysfunctional psychobehavioural responses to COVID-19 anxiety. C-19ASS was used for this purpose in this study.

We observed that patients with impaired mobility had a higher level of COVID-19 anxiety, and mobility issue was the single significant predictor for C-19ASS score. A recent study conducted on the UK population found that more people with a physical disability affecting their daily activities than those without had clinically significant depression and anxiety associated with COVID-19.[23] Thus far, only scarce evidence of the effect of impaired mobility on mental health during the COVID-19 pandemic is available.[24] Our finding adds to the existing evidence that people with physical disability are particularly at risk of exacerbated COVID-19 anxiety.

Moreover, participants older than 70 years had higher C-19ASS scores. The disparity in COVID-19 anxiety among different age groups is expected as the older population has a predilection for more severe COVID-19 illness. Social isolation imposed by the lockdown rule likely further exacerbated their distress. Paradoxically some studies had suggested that older people had higher resilience to the mental health impact of COVID-19 than younger generations,[25] and younger patients might in fact suffer from more anxiety due to concern over the possible impact of COVID-19 on finance and employment.[26]

It is also noteworthy that respondents with impaired mobility in our cohort were older than those without, consistent with data derived from the general population.[23] The combination of old age and impaired mobility meant this group of patients was particularly vulnerable, and they faced challenges in accessing health care services. Additional shielding and self-isolation imposed by authority likely further heightened their COVID-19 anxiety, which might aggravate their disease-avoiding behaviour, such as choosing not to attend scheduled clinic appointments. We have also found that C-19ASS was higher in female respondents, consistent with previous finding on general populations.[27]

Patients with macular conditions typically require face-to-face, time-dependent interventions like intravitreal injections of anti-VEGF. Around one-third of our respondents in our survey missed their scheduled appointments due to COVID-19 anxiety. Older age and having concern over contracting COVID-19 during the journey to the hospital were revealed as predictive factors of increasing the odds of DNA. Both fears of being infected during the journey to the hospital and at the eye clinic were more common in the older age group (>70 years). Worryingly, around one-fifth of the surveyed patients expressed reluctance to attend scheduled appointments, and this viewpoint was significantly more prevalent among the older patients. This tendency of poor adherence to clinic appointments may be an exaggerated form of disease avoidance behaviour and a manifestation of dysfunctional coping, as discussed above. Mixed messages on shielding likely caused confusion and further contributed to noncompliance with clinic attendance.

It is worth mentioning that vaccination against COVID-19 neither alleviated the anxiety related to infection nor reduced the likelihood of clinic nonattendance in this survey. This may be because the survey was carried out during the early stage of vaccine rollout and its real-world effectiveness and safety were under heavy scrutiny by the media. Bendau *et al.*[28] showed that COVID-19 anxiety positively correlated to the vaccine acceptance rate. However, it has yet to be confirmed whether vaccination can relieve the fear and anxiety induced by the pandemic. The psychosocial influence of having the first dose only *versus* full dose of vaccination on COVID-19 anxiety was not assessed in this study.

Due to the nature of SARS-Cov-2 transmission, it is unlikely we can assure patients there is zero risk of virus exposure in the hospital. However, studies showed that the risk of COVID-19 transmission was low within health care settings, providing adequate infectious control measures were in place.[29] Nonattendance of eye clinic appointments and delayed treatment could lead to irreversible vision loss in patients with macular diseases. For those who missed their appointments, their perceived threat of viral exposure during clinic visit overshadowed the perceived risk of visual loss from missing appointments. Therefore, it is crucial that hospital eye services reach out and reassure patients that precautions recommended by authorities such as the RCOphth have been implemented. Furthermore, ophthalmologists should endeavour to ensure patients understand the sight-threatening nature of macular conditions and the importance of timely regular treatments. The effort on reassuring patients appeared to be successful to some

extent, as we saw most respondents feeling confident in infection prevention measures in this survey. Encouragingly, the perceived risk of coming in contact with COVID-19 during clinic visit was not found to correlate with nonattendance in the third national lockdown, contrary to the survey result reported during the first wave.[8]

Like any other research studies utilising survey questionnaire, this study is limited by the potential of responder bias. It is possible that the nonreachable patients' demographic and clinical information and their perception and attitude on the risk of COVID-19 exposure would provide further insight into factors that correlate to clinic nonattendance. Moreover, selection bias may have occurred as only patients who missed their appointment were recruited. The respondents in this survey may therefore have inherently higher levels of anxiety. As the study was conducted within one eye hospital within the NHS in the UK, other populations, or patients in other countries, might not experience the same kind of COVID-related anxiety (due to different health care system and cultures) or the same level of non-attendance. However, the finding of our study should still provide novel insight on patients' perceptions.

This study demonstrated that COVID-19 anxiety and fear of viral exposure could adversely affect patient adherence to clinic appointments during the national lockdown. Particular attention should be provided to older patients, those who live alone and patients with impaired mobility. These groups were more prone to have higher C-19ASS scores and a greater likelihood of missing appointments. If the issue with poor clinic attendance is not addressed urgently, a sustained high rate of nonattendance will add to the existing health care burden created by reduced clinic capacity during the first lockdown. In a time of uncertainty, strong public health messages should be conveyed to address the unwarranted fear of COVID-19 infection, for example, eye care professionals should ensure patients appreciate that the material risk of irreversible visual impairments needs to be weighed against the risk of COVID-19 transmission. This is particularly relevant as hospital eye services across the country are in the process of restarting.

Author contributions

Siyin Liu: Conceptualisation; Data curation; Formal analysis; Investigation; Methodology; Project administration; Supervision; Validation; Visualisation; Writing – original draft; Writing – review & editing.

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