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Review

Impact of the COVID-19 Pandemic on Ophthalmologists Residents Well-being and Training Programs: A Systematic Review

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Abstract

Background/Aim: The COVID-19 pandemic significantly impacted residents' well-being and training programs, with potentially severe consequences for specialties like ophthalmology, where residents were often reassigned to non-specialty-related units and tasks. This study aimed to systematically review the pandemic's effects on ophthalmology residents' well-being and training.

Patients and Methods: A systematic review of the literature was carried out using MEDLINE, Scopus, and EBSCO databases. After removing duplicates, 173 unique records were identified, and 30 were considered as potentially relevant. Of these, 13 studies met the inclusion and exclusion criteria and were further analyzed.

Results: The reviewed studies revealed a notable decline in both theoretical and practical aspects of residency training during the pandemic. These impacts were supported by both objective data (*e.g.*, the number of surgeries carried out during the training), and residents' self-reported experiences. The pandemic also had a negative impact on residents' mental health, as evidenced by comparative analyses of data collected prior and during the pandemic. The studies highlighted a correlation between the severity of training disruptions and the negative effects on mental health.

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Conclusion: Education programs should be implemented to cover the knowledge gap of those who were residents during the pandemic. Additionally, targeted mental health support initiatives are recommended to mitigate the long-term impacts on residents' psychological well-being.

Keywords: COVID-19, ophthalmology, pandemic, residents, training, well-being, review.

Introduction

Undoubtedly, the COVID-19 pandemic can be regarded as the most serious threat humanity has faced so far in the 21st century (1). Due to the advancements in public health, the major threat was the management the increase in non-communicable diseases, a problem that concerns both the developed and – even to a less extent – the developing world, because it is related to the social determinants of health (SDH), such as socioeconomic conditions and the adoption of unhealthy behaviors (*e.g.*, smoking, alcohol, lack of physical activity) which are responsible for the creation of chronic diseases (2). Yet, the pandemic led to an unexpected crisis were the primary objective of public health became once again the control of infectious diseases (1).

The primary objective of the global community was to control the spread of the disease with measures such as lockdowns till vaccines would become finally available (3). This strategy was somehow the only viable and imperative approach for most countries, ultimately leading to the end of the pandemic in the previous year (4). Today, studying the pandemic is essential not only to increase our historical understanding of this past phenomenon, but also to increase the level of preparedness for future threats (5).

During the pandemic, it was important to utilize as many human resources as possible in order to maximize the efficiency of health systems. Therefore, residents were used as frontline staff, even in countries such as Switzerland, which handled the pandemic quite effectively (6). This approach had two major consequences for residents. First, their mental well-being was significantly strained, with higher levels of anxiety and burnout reported compared to the period before the pandemic (7). Second, concerns were raised with regard to the adverse effects on the quality of their residency, since their focus on COVID patients interfered with their ability to focus on their training, hindered university hospitals' capacity to provide high-quality training (8).

However, this experience proved to be extremely helpful for residents in several disciplines. For example, anesthesiology residents experienced accelerated development of critical care skills during the pandemic, handling a significantly greater number and complexity of cases compared to the pre-pandemic period (9). However, there were specialties, such as ophthalmology, in which the residents did not directly benefit from the experience of the pandemic, since their usual tasks were not related to the profile and needs of patients with COVID (10).

These two points of interest, the impact on well-being and resident training were the focus of a previous narrative review carried out by Dub *et al.* (10). This review was carried out in the early period of the pandemic and included studies published till October 15, 2021. Hence, this could lead to a fragmentary understanding of the impact, particularly since the effects during the early period of the pandemic may have been more intense compared to later stages. Given that the pandemic has ended, this study aimed to examine its impact on ophthalmology residents' well-being and training.

Study Design

This study was based on a systematic review of the literature. This approach is used in order to answer well-formulated research questions (11). In this case, the research questions were the following: 1) What was the impact of the COVID-19 pandemic on ophthalmology residents' well-being? 2) What was the impact of the COVID-19 pandemic on ophthalmology resident training programs?

Literature Search

All authors participated in the literature search process. A search for English-language articles published from database inception until April 4, 2024 was carried out using the following keywords: ophthalmology AND (resident* OR trainee*) AND ("mental health" OR "quality of life" OR well-being OR stress OR distress OR anxiety OR depression OR "training program" OR education*) AND (COVID-19 OR pandemic OR coronavirus OR SARS-CoV-2). This search was carried out using EBSCO, MEDLINE, and Scopus databases. In addition, snowball search was used to include any records not revealed through the original search. Issues of relevant journals and reference lists of related papers were reviewed in an attempt to identify potential studies. The flow of information from record identification until study inclusion was carried out in line with the PRISMA statement (12).

Study Selection

The study selection was carried out using these basic criteria: 1) original articles published in peer-review journals; 2) papers published in the English language. From that point onward, separate criteria were applied to studies investigating the impact on well-being and resident training, as the nature of these studies differed, and the same criteria could not be uniformly applied. For studies on resident well-being, the criteria were as follows: 1) a quantitative design and 2) a comparison of the burden on residents during the period prior to the pandemic or across different phases of the pandemic. Studies that merely assessed the prevalence of supportive needs (*e.g.*, anxiety) were insufficient to draw reliable conclusions about the pandemic's impact, which is the primary focus of this systematic review. To derive meaningful conclusions, it was crucial to utilize data from pre-pandemic periods or different phases of the pandemic, as supportive needs may have been higher during periods of greater strain. This is a major difference between the present systematic review and the study carried out by Dub *et al.* (10), which primarily assessed the general prevalence of supportive needs in an attempt to assess the impact of the pandemic. Regarding the exclusion criteria, analyzing residents alongside fellows was the only criterion applied. This criterion led to the exclusion of several high-quality studies, such as the one conducted by Engin *et al.* (13) in Turkey. However, it was considered essential to apply this criterion, as the focus of the present study was specifically on residents.

For the studies on resident training, the inclusion criteria were as follows: 1) being carried out in a specific country. Some studies were conducted online in several countries, especially during the early phase of the pandemic. Yet, it would not be sensible to draw conclusions from these studies, since the first wave of the pandemic had a different effect in different regions of the world (*e.g.*, a minimum effect in Africa and a very strong effect on Western Europe) making the extraction of overall conclusions risky; 2) inclusion of questions addressing the expected impact. More specifically, some published studies, especially during the outbreak of the crisis, focused on the expected impact. However, this systematic review focuses on the real impact on training programs. For this reason, studies assessing the expected impact were excluded; 3) Studies assessing the impact of training interventions such as webinars, were also excluded, since the aim of the present systematic review was to depict the problem itself rather than explore methods to address it, which, potentially valuable, falls outside the scope of this study.

Results

The flow of information from record identification until study inclusion was conducted based on the PRISMA Statement. As presented in Figure 1, a total of 242 studies were identified in the three separate databases. Five additional records were identified through snowball searching. After removing duplicates, 173 records remained. Of these, 143 records were considered irrelevant upon examination of their titles (*e.g.*, being a narrative review) and were not further accessed. The remaining 30 records were

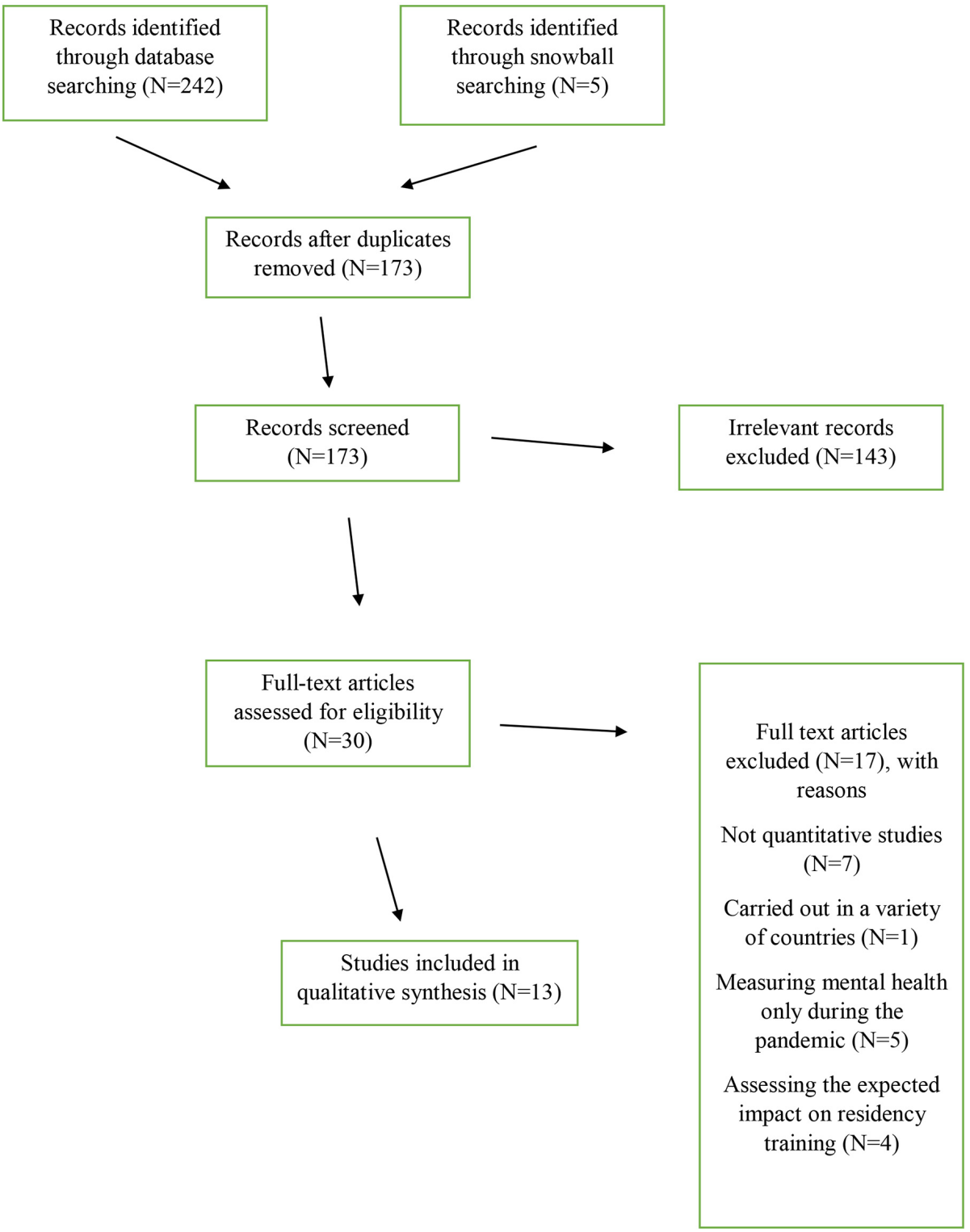

Figure 1. *The flowchart of the study.*

Table I. *The data regarding the impact on residents' well-being.*

Study	Country	Sample	Time period	Studied parameters	Main findings
Szigiato *et al.* (14)	Canada	102 residents	May 6 to June 13, 2020	Anxiety levels	4.9% strongly agreed that they had higher levels of anxiety compared to the previous period, 52% agreed, 7.8% gave a neutral response, 17.6% disagreed and 17.6% strongly disagreed

accessed and 17 of them were excluded because they did not meet the inclusion criteria. Hence, 13 studies met the inclusion criteria and were further analyzed.

Regarding the impact on well-being, only one study was found (Table I). This study was published by Szigiato *et al.* (14). This research was carried out in Canada from May 6 to June 13, 2020. Hence, it was conducted during the latest phase of the first wave of the pandemic. The study sample consisted of 102 residents. The measurements focused, along with several other parameters, on the participants' anxiety levels. A specific question was used to compare anxiety levels from two months prior. As indicated by the analysis, 4.9% of residents strongly agreed that they had higher levels of anxiety compared to the previous period, 52% agreed, 7.8% gave a neutral response, 17.6% disagreed, and 17.6% strongly disagreed. This was also the only study included in the present systematic review solely focusing on well-being.

The first research (Table II) identified regarding the impact on residents' training was the one carried out by Balci *et al.* (15). It was a web-based study involving 37 educators of training programs. The responses were received from 35 different centers, specifically from 17 university hospitals and 18 training and research state hospitals. These educators trained 458 residents working in hospitals, 53.71% of which worked on COVID-related duties. The assessments were carried out at three time points, using a 28-question instrument administered through e-mail. More specifically, data were collected between March 2020 and June 2020, June 2020 and October 2020, and October 2020 and March 2021. In addition, data were collected retrospectively for the period prior to the pandemic. During all three pandemic periods there were significant decreases in the number of patients examined by resident doctors and in theoretical training time compared to the period before the pandemic. Furthermore, there was a significant decrease in the number of surgeries carried out by the participants during the first and the second period compared to the data before the pandemic. Yet, there was no significant difference between the third period and the period prior to the onset of the pandemic. Residents' examination grades were also significantly lower during the pandemic. In addition, a total of 17 residents (N=3.74%) working in these hospitals resigned or transferred to other hospitals during the pandemic. Although the authors did not make a direct comparison with previous evidence, these data raise serious concerns.

An additional study (Table II) conducted in Iran (16), compared the cataract surgery competency of ophthalmology residents. The comparison was carried out using data from the 2018-2019 and 2021-2022 time periods. The data of six and 11 residents were used for the first and second period, respectively. The performances of residents in phacoemulsification were scored by a single faculty assessor using the International Council of Ophthalmology's Ophthalmology Surgical Competency Assessment Rubric for phacoemulsification. Seventy-one surgeries were rated in each group. All task-specific and overall performance scores of the latter group were lower than those of the group before the pandemic. The higher intergroup difference was noted in capsulorrhexis circular completion and tissue handling among task-specific and global scores, respectively. Thus, this study also indicates the aggravating effect of the pandemic on residents' training.

Table II. *Studies regarding the impact on ophthalmology residents' training.*

Study	Country	Sample size	Time period	Studied parameters	Main findings
Balci *et al.* (15)	Turkey	37 educators	Data were collected between March 2020 to June 2020, June 2020 to October 2020 and October 2020 to March 2021. Data before the pandemic were also analyzed	Difference in resident training in different time periods of the pandemic. Examination of difference compared to the pre-pandemic levels	During all three pandemic periods there were significant decreases in the number of patients examined by residents, the theoretical training time, the number of surgeries carried out, and the grades of the participants compared to the period before the pandemic. A total of 17 residents (N=3.74%) working in those hospitals resigned or changed hospital during the pandemic
Ghiasian *et al.* (16)	Iran	17 residents	The comparison was carried out using data of the 2018-2019 and of the 2021-2022 time periods.	Surgeries during residence training	Seventy-one surgeries were rated in each group. All task-specific and overall performance scores of the latter group were lower than those of the group before the pandemic. The higher intergroup difference was noted in capsulorrhexis circular completion and tissue handling among task-specific and global scores, respectively.
Konopinska *et al.* (17)	Poland	126 residents	February 15 and 28, 2021	Impact on residency training	Of the 126 residents, 88.9% (n=112) and 89.7% (n=113) felt that the COVID-19 pandemic had negatively impacted their surgical training and overall training programs, respectively. Approximately 79% (n=99) of the study participants recommended that after the pandemic some of the resident training has still to be carried out online. Yet, only 13.5% (n=17) of residents reported that they would like to undergo training and specialization courses in virtual form after the pandemic is over.
Magalhães *et al.* (18)	Brazil	3,836 surgeries	2019 & 2020	Number of surgeries and related complications	1,275 cataract surgeries were performed by residents in 2020, a number lower by 50.2% compared to the 2,561 surgeries performed during 2019. The incidence of surgical complications did not significantly differ between the two groups (4.2% in 2019 and 2.9% in 2020).

Table II. *Continued*

Table II. *Continued*

Study	Country	Sample size	Time period	Studied parameters	Main findings
Shoji *et al.* (19)	United States	193 residents	22 to 31 August 2020	Impact on residency training	The vast majority of the participants reported overall worsening of their resident training experience due to the pandemic (75.1%), with worsening of surgical training reported by 89.1% of the responders and of clinical training by 72.5% of the respondents. A higher percentage of post-graduate year 3 and 4 residents reported worsened clinical or surgical experience compared with year 2 residents.
Silva *et al.* (20)	Portugal	80 residents	23 to 25 April 2020	Impact on residency training, assessed through a 1-5 Likert type scale	Twenty-seven percent of the participants gave the response 5 and 40% of the participants gave the response 4. In addition, the vast majority of the participants (80%) agreed with the need to further extend their residency training program due to the disruption of the pandemic.
Vongsachang *et al.* (21)	United States	National residency data	Data from 2012 to 2020	Impact on surgical residency training	Across all procedures and roles, average case logs in 2020 were lower than the averages in 2019. Cataract (–22.0%) and keratorefractive (–21.1%) surgery experienced the greatest percent decrease in average primary surgeon cases logged from 2019 to 2020. Average total cases logged as surgical and assistance were increased by 1.2% prior to 2020, but had a reduction by 9.6% from 2019 to 2020.

Another study (Table II) was carried out in Poland by Konopinska *et al.* (17). An internet-based data collection process was conducted between February 15 and 28, 2021. Of the 126 residents, 88.9% (n=112) and 89.7% (n=113) felt that the COVID-19 pandemic had negatively impacted their surgical training and overall training programs, respectively. Approximately 79% (n=99) of the study participants recommended that after the pandemic some of the resident training has still to be carried out online. Yet, only 13.5% (n=17) of residents reported that they would like to undergo training and specialization courses in a virtual format after the pandemic.

Another study (Table II) was carried out in Brazil (18). This study investigated the potential difference in cataract surgeries of trainees between 2019 and 2020 in Altino Ventura Foundation, in Recife. As indicated by the analysis, a total of 1,275 cataract surgeries were performed by residents in 2020, a number much lower compared to the 2,561 surgeries performed during 2019, a reduction of 50.2%. Yet, the incidence of surgical complications did not significantly differ between the two groups (4.2% in 2019 and 2.9% in 2020).

Another study (Table II) was carried out by Shoji *et al.* (19) in the United States. This study surveyed 193 residents

Table III. *The data from the studies evaluating both the impact on resident training and well-being.*

Study	Country	Sample	Time period	Studied parameters	Main findings
Alam *et al.* (22)	Canada	122 residents	15 July and 15 August 2020	Impact on surgical training and on various parameters of mental health	Sixty-eight percent mentioned a worsening in surgical training and 94% preferred person-to-person resident training compared to the online. Overall perceived quality of life worsened in 35%, remained the same in 35%, and improved in 30% of the residents. Even though the majority (62%) had more time for leisure activities, only a small proportion (25%) felt happier. In addition, 41% of the study participants experienced higher levels of anxiety, 34% were equally anxious, and a 25% were less anxious. Sixty-one percent felt lonelier and less connected to their friends, 23% reported no change, and 16% had lower levels of loneliness. There was no difference in sleep for 37% of the study participants, while 26% had worse sleep quality and 37% experienced an improvement.
Alahmadi *et al.* (23)	Saudi Arabia	142 residents	7 July to 14 July 2020	Impact on residency training and on participants' mental health	The resident training education shifted to digital during the pandemic, with 55.4% of the participants reporting that they were satisfied with this method, leading to the conclusion of an average satisfaction. Of the responders, 67% reported satisfaction from the feedback receiving during their web-based training. In addition, 88.3% of the participants reported that their duties were reduced during the pandemic. Seventy-one-point-five percent of the participants reported that the pandemic had a negative impact on their mental health.
Aragão *et al.* (24)	Brazil	171 residents	20 June to 9 July 2020	Association between the impact on residency training and mental health	No association between working hours and stress. Positive association between resident training disruption and stress
Hussain *et al.* (25)	United Kingdom	111 residents	14 May to 21 May 2020	Impact on residency training	Forty-two percent of the participants mentioned a negative effect, 4% a very negative, 7% a positive effect, 1% a very positive effect and 46% said there was no effect.

Table III. *Continued*

Table III. *Continued*

Study	Country	Sample	Time period	Studied parameters	Main findings
Mishra *et al.* (26)	India	716 residents	12 April to 14 April 2020	Impact on residence training and examination of its association with mental health	Of the participants 80.7% reported a negative impact of the lockdown on their surgical training. The majority of the participants (75.7%) found webinars and online classes useful to reduce those negative effects. In addition, 54.8% of the responders indicated that their stress levels increased during the COVID-19 lockdown.

through a questionnaire administrated between August 22 and 31, 2020. The vast majority of the participants reported overall worsening of their resident training experience due to the pandemic (75.1%), with worsening of surgical training reported by 89.1% of the responders and of clinical training by 72.5% of the respondents. A higher percentage of post-graduate year 3 and 4 residents reported worsened clinical or surgical experience compared with year 2 residents. The impact did not differ across the different geographical regions examined.

Another study (Table II) was carried out in Portugal (20). The data collection process was carried out between April 23 and 25, 2020 through a questionnaire administrated to 80 ophthalmology residents. This instrument assessed several parameters, some of which were related to the participants' residency training. More specifically, the impact on residency training was evaluated through a scale with values ranging from 1 (no impact) to 5 (maximum impact). Twenty-seven percent of the participants rated the response as 5, while 40% of the participants rated it as 4. In addition, the vast majority of the participants (80%) agreed on the need to extend their residency training program due to the disruption caused by the pandemic.

An additional retrospective study (Table II) was carried out by Vongsachang *et al.* (21) in the United States. All the data regarding ophthalmology residency graduates from 2012 to 2020 were analyzed to estimate the yearly percent change in the average number of procedures performed. Across all procedures and roles, average case logs in 2020 were lower than those in 2019. The average total cases logged as a primary surgeon had been increasing by 3.2% annually from 2012 to 2019, but the total primary surgeon case logs decreased by 11.2% from 2019 to 2020. Cataract surgery (–22.0%) and keratorefractive surgery (–21.1%) surgery experienced the greatest percent decreases in average primary surgeon cases logged during this period. Average total cases logged as both surgical and assisting roles were increased by 1.2% annually prior to 2020, but had a reduction by 9.6% from 2019 to 2020. Similar trends were observed for the Accreditation Council for Graduate Medical Education minimum requirements. Specifically, the average case logs in Yttrium-Aluminum-Garnet, Selective Laser Trabeculoplasty, filtering (glaucoma), and intravitreal injections had been increasing significantly prior to 2020, but decreased in 2020. Hence, this study also found a negative impact of the pandemic on residents' training.

Finally, there is a category of studies (Table III) investigating the impact of the pandemic both on residency training and well-being. A related study was carried out in Canada (22). The data of this study were collected through a questionnaire administrated to 122 residents between July 15 and August 15, 2020. Sixty-eight percent of the responders mentioned a worsening in their surgical training and 94% of the participants expressed a preference for in-person resident training over online formats. Overall perceived quality of life worsened in 35%

of residents, remained the same in 35%, and improved in 30%. Even though the majority (62%) had more time for leisure activities, only a small proportion (25%) felt happier when compared to the era before the pandemic. In addition, 41% of the study participants reported experiencing a higher level of anxiety, 34% were equally anxious, and 25% were less anxious when their data were compared with the pre-COVID period. Sixty-one percent of the responders felt lonelier and less connected to their friends, 23% reported no change, and 16% had lower levels of loneliness. Sleep quality remained unchanged for 37% of the participants, while 26% reported worse sleep quality, and 37% experienced an improvement. Hence, the participants' training was negatively impacted by the pandemic, whereas there was also a negative impact on their well-being, apart from sleep quality.

An additional study investigating both effects was carried out by Alahmadi *et al.* (23) in Saudi Arabia. This study was carried out between July 7 and July 14, 2020. The data were collected through the administration of an online questionnaire to 142 ophthalmology residents. Resident training shifted to a digital format during the pandemic, with 55.4% of the participants reporting satisfaction with this method, leading to the conclusion of an average level of satisfaction. Of the responders, 67% reported satisfaction with the feedback received during their web-based training. In addition, 88.3% of the participants reported that their duties were reduced during the pandemic, while 71.5% of the participants reported that the pandemic had a negative impact on their mental health.

Another study investigating both the impact on residency training and mental health was carried out by Aragão *et al.* (24) in Brazil and included 171 residents. This study also involved 100 fellows, which were not analyzed in the present systematic review. The assessments were carried out between June 20, 2020 and July 9, 2020. The instrument administrated to the participants, the Perceived Stress Scale, assessed the stress level of the responders. The impact on residency training was also evaluated. The study found no association between the working hours and the stress levels of the participants. However, the study found a positive relationship between resident trainings disruption and stress levels during the pandemic. Hence, the stress experienced during the pandemic could also be attributed to the negative effect on training programs.

Another related study was conducted in the United Kingdom (25) using data collected online between May 14, 2020 and May 21, 2020. The instrument administrated to the participants (n=111) assessed, among other factors, the impact of the pandemic on their mental health due to the disruption of their residency training. Forty-two percent of the participants mentioned a negative effect, 4% a very negative, 7% a positive effect, 1% a very positive effect, and 46% stated that there was no effect.

Another study in India was carried out by Mishra *et al.* (26) on 716 trainees through an online questionnaire. The data collection process took place on April 12-14, 2020. Of all participants, 80.7% reported a negative impact of the lockdown on their surgical training. The majority of the participants (75.7%) found webinars and online classes useful in reducing those negative effects. In addition, 54.8% of the responders indicated that their stress levels increased during the COVID-19 lockdown.

Discussion

In this study, the impact of the past COVID-19 pandemic on the quality of life of ophthalmology residents and their training programs was examined. Six studies focused on issues related to the quality of life of the residents, revealing a clear negative impact. Mental health challenges were closely linked to the detrimental effects on training and education programs. Residents became intensely stressed as they realized they were not gaining the knowledge and skills expected during their specialty programs.

The research highlights a marked reduction in training and educational opportunities for ophthalmology residents during the pandemic compared to the pre-pandemic period. This disruption was especially pronounced during the pandemic's initial waves. Evidence for this impact includes measurable data from health systems, such as a decrease in surgeries performed, and self-reported

feedback from ophthalmology residents. Although this disruption may have diminished over time, its effects were profound during the pandemic's early stages.

The findings extend beyond ophthalmology residents to include residents in various specialties. For example, a study by Failla *et al.* (27), analyzed responses from 443 medical residents across Portugal, Italy, Spain, and France, documenting negative impacts on both mental health and training programs during the pandemic. The study confirmed the intertwined effects of mental health challenges and training disruptions, emphasizing that these findings apply broadly across medical specialties. Notably, some specialties experienced accelerated practical training during the pandemic. For instance, cardiology residents often worked on the front lines of COVID-19 care, gaining practical experience despite a lack of theoretical training (28). Conversely, ophthalmology residents frequently transferred to COVID-19 treatment units, where their specialty-specific learning was minimal, further exacerbating gaps in their education (29).

The inadequate training of ophthalmology residents during the pandemic raises concerns about potential future medical errors. Health systems must adopt strategies to address these deficiencies, emphasizing lifelong learning and the integration of education and practice (30). Programs designed to enhance the knowledge and skills of ophthalmologists, even post-specialty training, are crucial. Lifelong learning models can help offset the training gaps caused by the pandemic.

According to the World Economic Forum, crises like pandemics can serve as catalysts for critical reflection and systemic improvement (1). The training deficits observed during the pandemic present an opportunity to develop lifelong learning programs for ophthalmologists and other medical professionals. However, proactive action by individuals and health systems is essential. Policymakers must prioritize the creation of robust training and education programs to mitigate the long-term impact of the pandemic on medical education.

The psychotraumatic experiences of ophthalmology residents during the pandemic underscore the need for mental health support. Psychological interventions, such as Eye Movement Desensitization and Reprocessing (EMDR) therapy, could address trauma and promote well-being (31). Health systems should ensure access to such services to support residents who faced significant mental health challenges during the pandemic.

This study also emphasizes the importance of preparation for future pandemics. Developing digital tools and resources for continued education and training during crises could mitigate disruptions in ophthalmology and other specialties. These measures would ensure the resilience of medical education systems in the face of similar threats.

Study limitations. The focus on quality-of-life issues was less extensive than the focus on training and education, limiting the ability to draw definitive conclusions. The search criteria excluded studies from Chinese databases, leaving potential gaps in geographic representation. Most studies analyzed the early phases of the pandemic, with limited insights into its later impacts. Non-standardized measurement tools and small sample sizes in the included studies may introduce methodological limitations.

Researchers with relevant data are encouraged to publish their findings to enhance understanding of these issues. Retrospective studies focusing on the experiences of ophthalmology residents during the pandemic could provide a broader perspective. Even though the pandemic has passed, continued research remains valuable for improving training, education, and support systems in the medical field.

Conflicts of Interest

The Authors have no conflicts of interest to declare in relation to this study.

Authors' Contributions

Vasiliki Dimaki and Marilita M. Moschos conceived and designed the presented idea and Vasiliki Dimaki took the lead in writing the manuscript. The collection of data analysis and

interpretation of results were performed by Vasiliki Dimaki, Christos P. Zampetidis, and Efthimios Vasilopoulos. Dimitrios Papakonstantinou, Klio Chatzistefanou, and Marilita M. Moschos critically revised the manuscript. Marilita M. Moschos supervised the project. All Authors reviewed the results and approved the final version of the manuscript.

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References

1 Schwab K, Malleret T: The great reset. World Economic Forum, Geneva, Switzerland, 2020.
2 Wang Y, Wang J: Modelling and prediction of global non-communicable diseases. BMC Public Health 20(1): 822, 2020. DOI: 10.1186/s12889-020-08890-4
3 Misra M, Joshi H, Sarwal R, Rao KD: Exit strategies from lockdowns due to COVID-19: a scoping review. BMC Public Health 22(1): 488, 2022. DOI: 10.1186/s12889-022-12845-2
4 Bond L, McNicholas F: The end of COVID-19: not with a bang but a whimper. Ir J Med Sci 193(1): 335-339, 2024. DOI: 10.1007/s11845-023-03435-1
5 Fauci AS, Folkers GK: Pandemic preparedness and response: lessons from COVID-19. J Infect Dis 228(4): 422-425, 2023. DOI: 10.1093/infdis/jiad095
6 Aebischer O, Weilenmann S, Gachoud D, Méan M, Spiller TR: Physical and psychological health of medical students involved in the COVID-19 response in Switzerland. Swiss Med Wkly 150(4950): w20418, 2020. DOI: 10.4414/smw.2020.20418
7 Blanchard AK, Podczerwinski J, Twiss MF, Norcott C, Lee R, Pincavage AT: Resident well-being before and during the COVID-19 pandemic. J Grad Med Educ 13(6): 858-862, 2021. DOI: 10.4300/JGME-D-21-00325.1
8 Chen SY, Lo HY, Hung SK: What is the impact of the COVID-19 pandemic on residency training: a systematic review and analysis. BMC Med Educ 21(1): 618, 2021. DOI: 10.1186/s12909-021-03041-8
9 Nofi C, Roberts B, Demyan L, Sodhi N, DePeralta D, Zimmern A, Aronsohn J, Molmenti E, Patel V: A survey of the impact of the COVID-19 crisis on skill decay among surgery and anesthesia residents. J Surg Educ 79(2): 330-341, 2022. DOI: 10.1016/j.jsurg.2021.09.005
10 Dub N, Konopińska J, Obuchowska I, Lisowski Ł, Dmuchowska DA, Rękas M: The impact of the COVID-19 pandemic on ophthalmology residents: a narrative review. Int J Environ Res Public Health 18(21): 11567, 2021. DOI: 10.3390/ijerph182111567
11 Rys P, Władysiuk M, Skrzekowska-Baran I, Małecki M: Review articles, systematic reviews and meta-analyses: which can be trusted? Pol Arch Med Wewn 119(3): 148-156, 2009. DOI: 10.20452/pamw.634
12 Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group: Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Int J Surg 8(5): 336-341, 2010. DOI: 10.1016/j.ijsu.2010.02.007
13 Durmaz Engin C, Senel Kara B, Ozturk T, Dadas OF: The impact of COVID-19 pandemic on practice patterns and psychological status of ophthalmologists in Turkey. Cureus 13(7): e16614, 2021. DOI: 10.7759/cureus.16614
14 Szigiato AA, Palakkamanil M, Aubin MJ, Ziai S: Canadian ophthalmology resident experience during the COVID-19 pandemic. Can J Ophthalmol 56(2): e42-e44, 2021. DOI: 10.1016/j.jcjo.2020.10.015
15 Balci AS, Altan C, Taskapili M: The impact of COVID-19 pandemic on ophthalmology residency education. Beyoglu Eye J 7(3): 213-222, 2022. DOI: 10.14744/bej.2022.58234
16 Ghiasian L, Aghili S, Abdolalizadeh P: Impact of COVID-19 on cataract surgical competency of ophthalmology residents. Indian J Ophthalmol 71(12): 3696-3700, 2023. DOI: 10.4103/IJO.IJO_1242_23
17 Konopińska J, Obuchowska I, Lisowski Ł, Dub N, Dmuchowska DA, Rękas M: Impact of the COVID-19 pandemic on ophthalmic specialist training in Poland. PLoS One 16(9): e0257876, 2021. DOI: 10.1371/journal.pone.0257876
18 Magalhães MCO, Sarmento MMG, Sant'anna GH, Soares AKA, Ventura CV, Rocha CS, Ventura BV: Effect of the COVID-19 pandemic on cataract surgery by residents who had routine surgical simulator training during residency. Arq Bras Oftalmol 87(2): e20230038, 2024. DOI: 10.5935/0004-2749.2023-0038
19 Shoji MK, Venincasa MJ, Sridhar J: The impact of the COVID-19 pandemic on ophthalmology resident perceptions of clinical experience, surgical training, and personal life. J Acad Ophthalmol (2017) 13(2): e288-e297, 2021. DOI: 10.1055/s-0041-1740314
20 Silva N, Laiginhas R, Meireles A, Barbosa Breda J: Impact of the COVID-19 pandemic on ophthalmology residency

training in Portugal. Acta Med Port 33(10): 640-648, 2020. DOI: 10.20344/amp.14341
21 Vongsachang H, Fliotsos MJ, Lorch AC, Singman EL, Woreta FA, Justin GA: The impact of COVID-19 on ophthalmology resident surgical experience: a retrospective cross-sectional analysis. BMC Med Educ 22(1): 142, 2022. DOI: 10.1186/s12909-022-03205-0
22 Alam P, Salimi A, ElHawary H, Sioufi K, Papanastasiou C, Thibaudeau S: The effects of COVID-19 on Canadian surgical residents' education and wellness. Can Med Educ J 13(2): 50-56, 2022. DOI: 10.36834/cmej.72160
23 Alahmadi AS, Alhatlan HM, Bin Helayel H, Khandekar R, Al Habash A, Al-Shahwan S: Residents' perceived impact of COVID-19 on Saudi ophthalmology training programs-a survey. Clin Ophthalmol 14: 3755-3761, 2020. DOI: 10.2147/OPTH.S283073
24 Aragão IO, Alencar TGC, Soares AKA, da Rocha CS, Ventura CV: Effects of COVID-19 pandemic on stress level of residents and fellows during ophthalmology training. Indian J Ophthalmol 70(6): 2170-2173, 2022. DOI: 10.4103/ijo.IJO_401_22
25 Hussain R, Singh B, Shah N, Jain S: Impact of COVID-19 on ophthalmic specialist training in the United Kingdom-the trainees' perspective. Eye (Lond) 34(12): 2157-2160, 2020. DOI: 10.1038/s41433-020-1034-6
26 Mishra D, Nair AG, Gandhi RA, Gogate PJ, Mathur S, Bhushan P, Srivastav T, Singh H, Sinha BP, Singh MK: The impact of COVID-19 related lockdown on ophthalmology training programs in India – Outcomes of a survey. Indian J Ophthalmol 68(6): 999-1004, 2020. DOI: 10.4103/ijo.IJO_1067_20
27 Failla G, Caminiti M, Chen-Xu J, Lo Moro G, Berselli N, Cabral Ferreira M, Malcata F, Peyre-Costa D, Croci R, Soldà G, Capodici A, Morcavallo C, Traglia F, Cedrone F, Storti I, Jaquete AA, Antinozzi M, Vasiliu A: Impact of the COVID pandemic on mental health and training opportunities of Public Health Residents from 4 European countries: A cross-sectional study. Front Public Health 11: 1044171, 2023. DOI: 10.3389/fpubh.2023.1044171
28 DeFilippis EM, Stefanescu Schmidt AC, Reza N: Adapting the educational environment for cardiovascular fellows-in-training during the COVID-19 pandemic. J Am Coll Cardiol 75(20): 2630-2634, 2020. DOI: 10.1016/j.jacc.2020.04.013
29 Kumar A, Agarwal D: Commentary: Restructuring residency training in ophthalmology during COVID-19 era: Challenges and opportunities. Indian J Ophthalmol 68(6): 1005-1006, 2020. DOI: 10.4103/ijo.IJO_1462_20
30 Thwe WP, Kálmán A: Lifelong learning in the educational setting: a systematic literature review. Asia-Pacific Edu Res 33(2): 407-417, 2024. DOI: 10.1007/s40299-023-00738-w
31 Poli A, Cappellini F, Sala J, Miccoli M: The integrative process promoted by EMDR in dissociative disorders: neurobiological mechanisms, psychometric tools, and intervention efficacy on the psychological impact of the COVID-19 pandemic. Front Psychol 14: 1164527, 2023. DOI: 10.3389/fpsyg.2023.1164527