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PEDIATRICS

The impact of the first peak of the COVID-19 pandemic on childhood myopia control practice patterns among ophthalmologists—an international pediatric ophthalmology and strabismus council global perspective

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Abstract

Background The prevalence of myopia keeps increasing during the COVID-19 pandemic. We aimed to map the worldwide treatment preferences of ophthalmologists managing myopia control during the first wave of the pandemic.

Methods An online questionnaire inquiring about pharmacological and optical treatment patterns during the first half of 2020 was sent to pediatric ophthalmology as well as general ophthalmology memberships worldwide. The results among pediatric ophthalmologists were compared to a previous study we performed before the pandemic.

Results A total of 2269 respondents from 94 countries were included. Most respondents were pediatric ophthalmologists (64.6%), followed by ophthalmologists from other subspecialties (32.3%). The preferred modality for all geographical regions was a combination therapy of pharmacological and optical treatments. When evaluated independently, the pharmacological treatment was more popular than the optical treatment in most regions other than East Asia ($P < 0.001$). Compared to a pre-pandemic questionnaire, the participation of pediatric ophthalmologists affiliated with non-university hospitals increased. Additionally, the prevalence of respondents utilizing either any type of pharmacological treatment and those that using only evidence-based treatments increased globally. Although a decline in the use of optical treatment was evident worldwide, the use of evidence-based optical treatments increased.

Conclusion Ophthalmologists around the world preferred a combination therapy of pharmacological and optical treatments. More pediatric ophthalmologists treated myopia progression and preferred a better evidence-based approach to control myopia. These trends reflect a positive response and more awareness of the rising prevalence of myopia due to the increased burden of myopia imposed by the COVID-19 pandemic.

Keywords COVID-19 · Myopia · Pharmacologic treatment · Optical treatment

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Key messages

What is known

- The COVID-19 pandemic poses an ongoing challenge for ophthalmologists involved in slowing myopia progression. In addition, the awareness of myopia progression modalities of treatment has increased after many publications and webinars.

What this paper adds

- During the COVID-19 pandemic, a combination of pharmacological and optical treatments was the most common practice to control myopia among ophthalmologists.
- More pediatric ophthalmologists treated myopia progression and preferred a better evidence-based approach to control myopia.
- These trends reflect a positive response and more awareness of the rising prevalence of myopia due to the increased burden of myopia imposed by the COVID-19 pandemic.

Introduction

The COVID-19 outbreak poses a global challenge for professionals who treat myopia, the most common cause of visual impairment. The COVID-19 pandemic forced many countries to take exceptional measures to stop the spread of the COVID-19 virus. While countrywide lockdowns helped to control the spread of the disease, it also decreased the time spent outdoors by children, which is associated with a significant myopic shift [1–3]. Furthermore, the fear of contracting a COVID-19 infection was found to be associated with reduced pediatric clinic and routine eye care visits with roughly a fourfold increase in loss to ophthalmic care follow-up [4–6].

The COVID-19 pandemic poses an ongoing challenge for ophthalmologists involved in slowing myopia progression. In addition, the awareness of myopia progression modalities of treatment has increased after many publications and webinars. By April 2020, over 100 countries around the world had instituted either a full or partial lockdown due to COVID-19 [7]. The resulting home confinement led to a dramatic increase in screen time as well as less outdoor activity [8, 9], hampering previous state-wide initiatives to achieve the opposite effect: increased time spent outdoors and decreased utilization of digital screens and time spent studying [10]. Furthermore, the widespread imposed lockdowns have led to reduced manufacturing as well as delays in international shipments [11]. This consequently caused a reduction in the available supplies, including low-concentration atropine as well as optical corrective spectacle and contact lenses used to impede myopia progression. In addition, treatment became less available due to the limited office hours, secondarily to the fear of care providers, patients, or their parents contracting the disease during their visit to crowded medical facilities [4]. Therapeutic decisions of ophthalmologists treating myopia progression might have been affected by all of the above reasons. Yet, to date, those practice patterns have not been evaluated.

In this study, we aimed to map the practice patterns of healthcare professionals to control myopia progression in different regions of the world during the first surge of the COVID-19 pandemic [12] and assessed the trends in treatment preferences of pediatric ophthalmologists by comparing our results to a previous study [13].

Methods

Study protocol

Responses regarding the approach of the respondent to control myopia progression were collected from eye care providers worldwide who had seen in their practice children with myopia (detailed in supplementary Table 1),using an online survey between January 27, 2020 and June 23, 2020, as outlined previously [14]. The questionnaire included 11 questions related to the participants' characteristics and the choice of treatment modalities to decrease the progression of myopia (online supplementary study questionnaire). The number of participants in the statistical analysis was determined by the number of responses received to a specific question in the questionnaire.

Treatments were deemed either evidence-based or non-evidence-based (online supplementary Table 2) based on a published recommendation [15–18]. Treatments derived from online responses were either pharmacological, optical, or combined. Data regarding behavioral treatments, such as increased time outdoors or less screen time, were not

collected. For every respondent, each treatment group was classified as evidence-based if the respondent employed at least one evidence-based method within that group to reduce myopia progression. We compared the responses of pediatric ophthalmologists between the current study and a previous study we performed before the pandemic.

All authors denied financial conflict of interest. As the information obtained through the questionnaire did not refer to a specific patient but rather to the general clinical treatment patterns of the eye care provider, no consent was required from the participants. This study was performed in accordance with the ethical standards laid down in the Declaration of Helsinki and was approved by the institutional review boards and ethics committees at Sheba Medical Center, Tel-Hashomer, Israel (Reference number 7888–20-SMC).

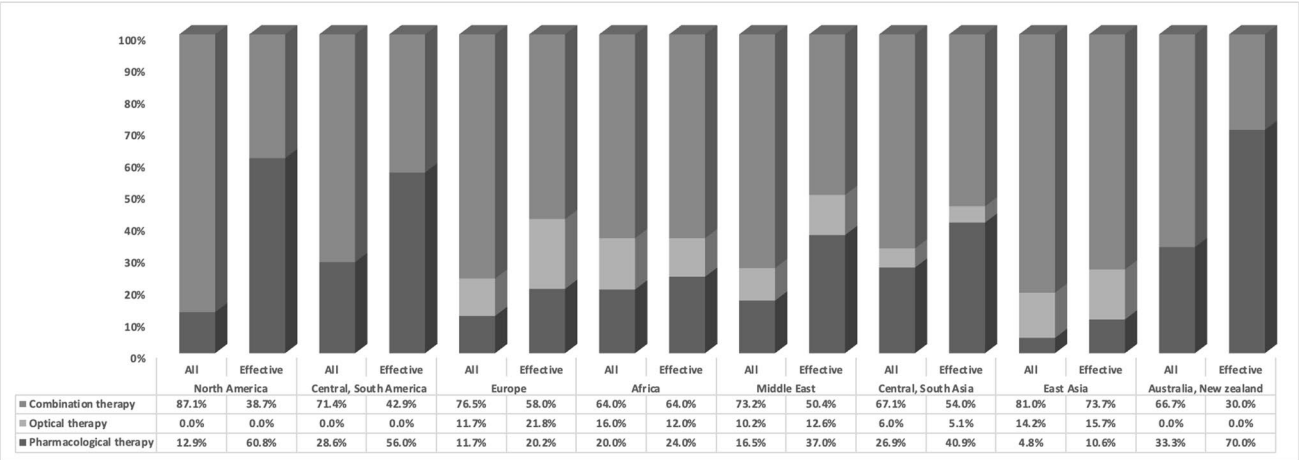
Statistical analysis

Data were analyzed using IBM SPSS for windows, V.25. $p<0.05$ was considered statistically significant. The χ^2 test or Fisher's exact test was utilized to compare the categorical variables. Linear and binary logistic regression analyses were applied as needed to detect interactions between variables and to exclude the confounder effects.

Results

Of the 3207 respondents, 2269 (70.7%) participants who designated themselves as routinely treating myopia responded to all the questions and thus were eligible for the study. In this study, most of the respondents were from East Asia 1026 (45.2%), followed by Europe 426 (18.7%), and North America 194 (8.5%) (online supplementary Table 1). Responses were received from 94 countries (online supplementary Table 3). The leading countries were China 642 (28.9%), India 332 (14.6%), and the USA 188 (8.3%). Overall, as well as in each geographical location, pediatric ophthalmologists were the largest group of respondents 1452 (64.6%), followed by ophthalmologists from other subspecialties 725 (32.2%) (online Supplementary Table 1). The distribution of the various professions and affiliations among geographical regions varied significantly (each $p<0.001$) (online Supplementary Table 1). Respondents were most affiliated with a university hospital, which was in first place in 62.5% of the geographical regions and second place in 25% of them. Respondents were affiliated with other types of hospital clinics equally in first and second places in 37.5% of the geographical locations. North America was the only region where more participants were affiliated with a group practice rather than with any type of hospital.

Treatment preferences during the COVID-19 pandemic are shown in Fig. 1. A combination therapy of pharmacological and optical therapies was the most popular modality for each of the geographical regions. However, an evidence-based combination therapy came first in 62.5% of the regions, followed by pharmacological treatment (37.5%). Pharmacological treatment was statistically more popular than optical treatment in most regions, except East Asia, where optical treatment alone was more popular ($p<0.001$) (online supplementary Table 4). In the American continent as well as in the Australia–New Zealand region, optical treatment was utilized only as part of combination therapy. Data analyzed in all regions combined and by profession revealed that both pediatric ophthalmologists and other ophthalmologists equally utilize pharmacological treatment (all 86.1% vs 86.4% $p=0.889$; evidence-based 81.6% vs 81.4%, $p=0.901$). However, the optical treatment was more common for other ophthalmologists (all 81.4% vs 83.6%, $p=0.249$; evidence-based 66.3% vs 72.5%, $p=0.007$) (online supplementary Tables 5–6).



	All	Effective	All	Effective	All	Effective	All	Effective	All	Effective	All	Effective	All	Effective	All	Effective
	North America		Central, South America		Europe		Africa		Middle East		Central, South Asia		East Asia		Australia, New zealand	
Combination therapy	87.1%	38.7%	71.4%	42.9%	76.5%	58.0%	64.0%	64.0%	73.2%	50.4%	67.1%	54.0%	81.0%	73.7%	66.7%	30.0%
Optical therapy	0.0%	0.0%	0.0%	0.0%	11.7%	21.8%	16.0%	12.0%	10.2%	12.6%	6.0%	5.1%	14.2%	15.7%	0.0%	0.0%
Pharmacological therapy	12.9%	60.8%	28.6%	56.0%	11.7%	20.2%	20.0%	24.0%	16.5%	37.0%	26.9%	40.9%	4.8%	10.6%	33.3%	70.0%

Fig. 1 Treatment* selection of participants in different geographical regions during COVID-19 pandemic. * Treatment refers to all types of treatment both evidence based as well as non-evidence based

Comparisons between the survey that was conducted during the COVID-19 pandemic and the pre-COVID-19 survey are shown in Figs. 2–4. The total number of pediatric ophthalmologists who have responded in the pre-COVID-19 and in COVID-19 studies were 451 and 1443, respectively (Fig. 2). However, the geographical distribution of respondents changed between the two surveys. Although the percentage of respondents from North America was smaller (143, 31.7%, to 186, 12.9%), there was an increase in respondents from Europe (53, 11.8%, 287, 19.9%) and East Asia (107, 23.7%, to 610, 42.3%) during the COVID-19 survey. In addition, fewer respondents were affiliated with a university hospital (188, 41.7% to 401, 27.8%) ($p < 0.001$) (online supplementary Table 7). The prevalence of pediatric ophthalmologists using either a pharmacological treatment (Fig. 3) or an evidence-based pharmacological treatment (Fig. 4) increased during the COVID-19 pandemic in all regions. Although a decline in the utility of the optical modality to reduce myopia progression was observed in all regions, an opposite trend was found for evidence-based optical treatment.

Discussion

Our results show variability in the choice of treatment modalities made by eye care practitioners around the world over the early months of the COVID-19 pandemic. Overall in all geographical regions, combination (pharmacological and optical) therapy was the preferred modality.

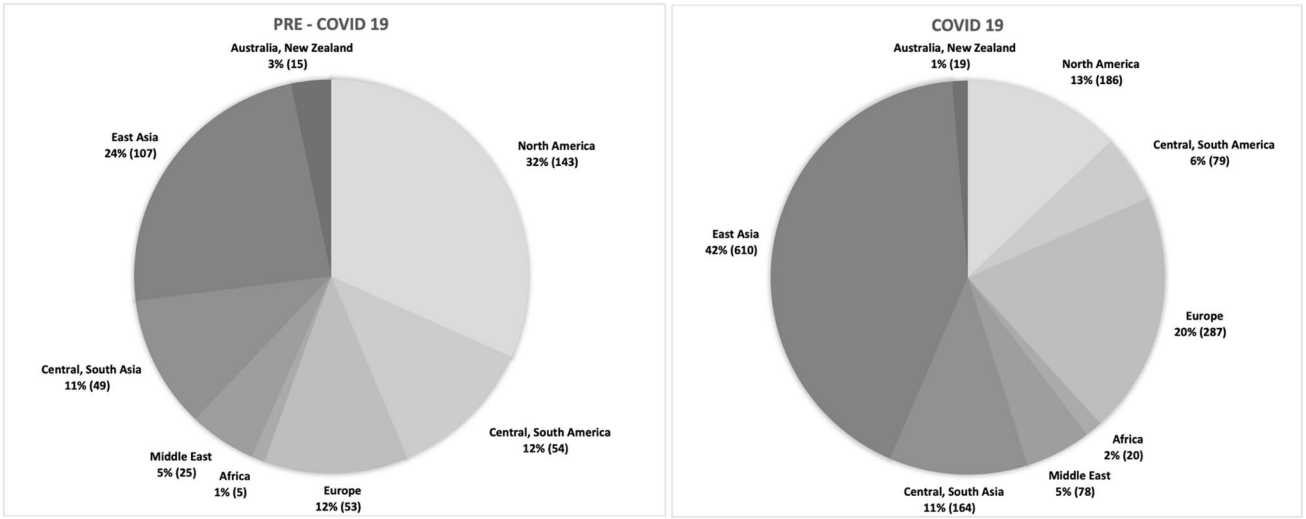


Fig. 2 Distribution of pediatric ophthalmologist respondents by geographical region, pre-COVID 19 and during COVID-19

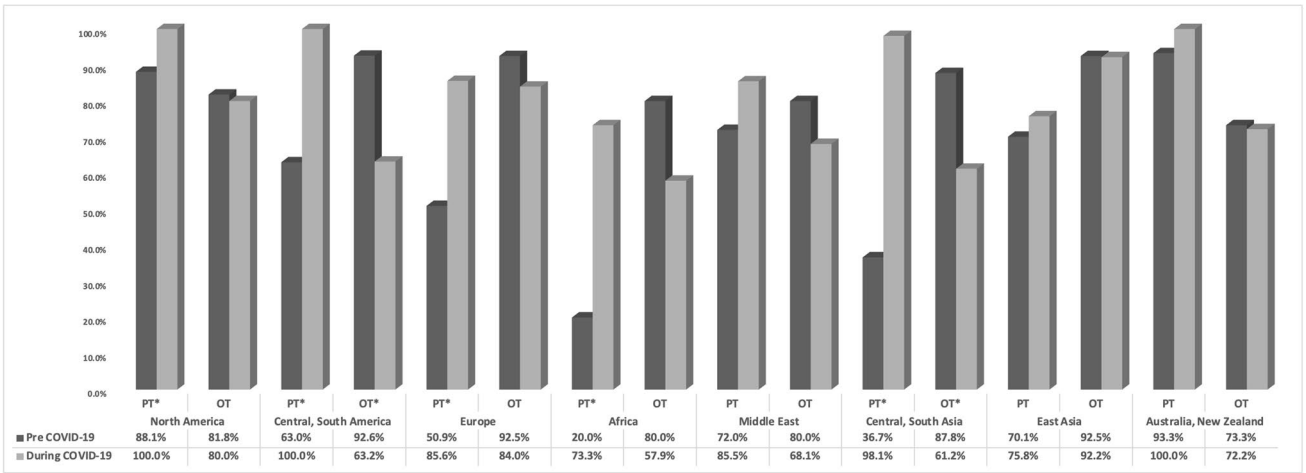


Fig. 3 Comparison between treatment** selection of pediatric ophthalmologists in different geographical regions, pre COVID-19 and during COVID-19 pandemic. Pharmacological treatment (PT), optical treatment (OT). * Statistically significantly different. ** Treatment refers to all types of treatment both evidence based as well as non-evidence based

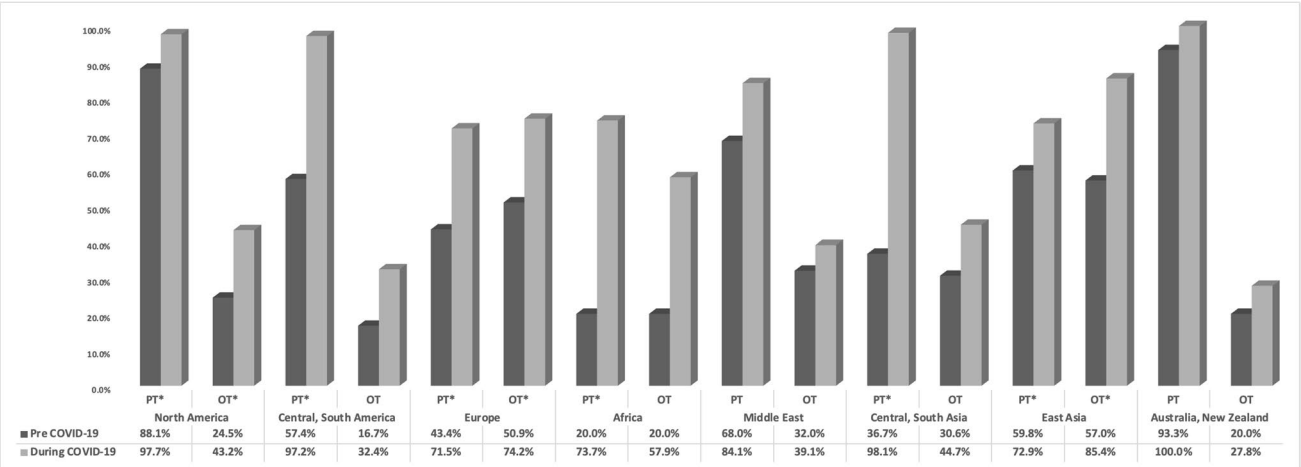


Fig. 4 Comparison between evidence-based treatment selection of pediatric ophthalmologist in different geographical regions, pre COVID-19 and during COVID-19 pandemic. Pharmacological treatment (PT), optical treatment (OT). * Statistically significantly difference

Pharmacologic therapy

In most regions, pharmacologic treatment was prescribed more often during the pandemic, which was characterized by an increase in the utilization of optical treatment, compared with the pre-COVID-19 era. This may be partially explained by the low-concentration atropine that could be prepared locally and domestically by pharmacies without the need for industrial manufacturing. This, in turn, dramatically increased its availability and affordability. The LAMP studies and the few side effects of topical use of eye drops containing low-concentration atropine might have further raised its popularity [19–23].

Optical therapy

The use of optical devices among children may have been hampered for various reasons, one being the mild effect of the progressive addition lenses on myopia progression prevention [14]. Some additional issues may have caused the optical modality to be out of fashion: the prolonged research and development of spectacles and contact lenses with peripheral defocusing, as well as formal statements by the American Academy of Ophthalmology and the American Association of Pediatric Ophthalmology and Strabismus advising against the routine use of contact lenses in general and orthokeratology, in particular, due to the risk of sight-threatening corneal infections [24, 25].

Combination treatment

Combination treatment was found to be more popular than monotherapy with either pharmacological or optical treatments. The choice to utilize a dual treatment might have been driven by the urgency to provide the most effective therapeutic effect because of the massive increase in predisposing factors leading to myopia progression during the COVID-19 pandemic [7, 8]. Another explanation of the choice of dual treatment is the added effect shown, for example, by a contemporary study that revealed a synergistic effect of orthokeratology with low concentration atropine eye drops [26]. This study, in addition to others in recent years, has raised awareness among practitioners of the scope of the disease and the wide range of available treatment modalities [27].

Treatment choices in different geographical regions

Our findings further show that, between the individual modalities, pharmacological treatment was the preferred modality in most regions. This finding is in agreement with previous studies in which muscarinic antagonists, in particular, low-concentration atropine, was the most evidence-based effective intervention in controlling myopia [28, 29]. Moreover, practitioners preferred to minimize physical interaction with patients, when possible, and therefore, optical treatments, such as ortho-k or contact lenses with peripheral defocusing, which require several examinations and measurements, were less preferred. Notably, a contrary trend was evident in East Asia, where optical treatment was more common. This might be due in part to the strengthened state regulation of the production and selling of eyeglasses [30, 31], as well as the wide use of orthokeratology in East Asia.

Increased global awareness among ophthalmologists

Several findings in this study may reflect the increased appreciation of the scope of myopia, and in particular, of the long-term implications of high pathological myopia:

ophthalmologists from 94 countries around the world participated in this study, representing more than a threefold increase in respondents, compared with the previous study [13]. Additionally, a significant rise was noted in the participation of respondents from East Asia, where the prevalence of myopia is the highest in the world, as well as from India and Europe [32]. Furthermore, in comparison to the pre-COVID survey, the rate of participants that have chosen evidence-based optical treatment and an evidence-based pharmacological treatment has increased. Lastly, we found an increase in the percentage of respondents who were not affiliated with a university hospital. This may indicate an improvement in the awareness of community-based physicians, who are usually less involved in research and academic activity. This may be due in part to better dissemination of knowledge and its improved accessibility. This was evident by the abundance and accessible free online educational opportunities such as webinars, which resulted in better utilization of new treatment modalities for ophthalmologists in general, and for pediatric ophthalmologists in particular, to counter the recent steep increase in the prevalence of myopia.

Study limitations

This study has several limitations, including the fact that data collection through surveys may be skewed toward respondents who treat myopia. Additionally, there may be a potential misrepresentation of certain geographical regions such as South America and Africa, since only a minority of the respondents are from these regions. We tried to increase the participation by translating the questionnaire to Spanish and by contacting supra-national as well as national society leaders in South America and Africa. However, we believe this limitation may not be significant, since the rates of myopia in both South America and Africa are known to be the lowest in the world and therefore, myopia does not pose a major health problem in these regions at this time. In addition, behavioral treatments such as outdoor activity and a reduction in digital screen time were not evaluated, even though they are recognized as evidence-based and effective treatments of myopia [11, 33]. Furthermore, the optometrists are underrepresented in the current study, even though they constitute the majority of healthcare professionals who treat myopia progression in various countries, such as Australia and the USA. Future studies will be more comprehensive via the inclusion of optometrists and other pediatric eye care professionals. Another possible limitation is the timing of the data collection. Since this survey took place between January and June 2020, immediately after the outbreak of COVID-19, it is possible that the initial measures and attitudes of the professionals have changed. Another study would be able to clarify this possibility.

Conclusions

This global study surveyed the treatment preferences of healthcare professionals, especially pediatric ophthalmologists, to reduce myopia progression during the first wave of the COVID-19 pandemic (early and mid-2020) and compared it to a previous survey conducted before the pandemic started [13]. It revealed a better evidence-based effective approach to control myopia, consisting of utilizing a combination therapy of pharmacological and optical treatments. Furthermore, it showed a possible increase in awareness of the preferred practice patterns to decrease myopia progression among non-university-affiliated ophthalmologists, perhaps indicating the effectiveness of educational webinars and publications produced by supra-national and national societies such as the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus, the Asia–Pacific Strabismus and Pediatric Ophthalmology Society, and the International Pediatric Ophthalmology and Strabismus Council [34, 35]. It remains to be determined whether these measures would suffice against the significant impact of increasing myopia, resulting from the COVID-19 pandemic and related various causes.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00417-022-05864-7.

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Declarations

Conflict of interest The authors declare no competing interests.

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12 Guru Nanak Eye Centre &, Maulana Azad Medical College, New Delhi, India

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