



Screening of Refractive Disorders and Eye Health Awareness: Knowledge, Attitudes, and Behaviors of Elementary School Children in Semarang



Trilaksana Nugroho¹, Fifin L Rahmi¹, Andhika Guna Dharma¹, Arnila Novitasari Saubig^{1*}

¹Ophthalmology Department of Diponegoro University, Semarang, Indonesia

Keywords:

*Refractive disorders,
Eye Health Awareness,
Elementary school children*

*) Correspondence to:
nila.bramantogdrive@gmail.com

Article history:

Received 14-06-2024
Accepted 30-04-2025
Available online 29-07-2025

ABSTRACT

Background: Refractive disorders are the leading cause of visual impairment. Uncorrected refractive errors in children can significantly impact their development, especially regarding education and psychosocial growth.

Objective: This study aims to determine the prevalence of refractive disorders and to assess the knowledge, attitudes, and behaviors related to eye health among elementary school children at Semarang.

Methods: This is a descriptive study involving 200 students from SDN Wonotingal Semarang as the sample. The study included eye examinations to identify refractive disorders in students and a questionnaire to collect data on their knowledge, attitudes, and behaviors regarding eye health. Data were collected through school-based eye screening and were analyzed using Microsoft Excel and SPSS version 26.

Results: The prevalence of refractive disorders among children at SDN Wonotingal Semarang was 14%, with Astigmatism Myopia Compositus being the most common type of refractive disorder at 67.9%. Among the 28 children with refractive disorders, the majority were 11 years old (75%). Refractive disorders were more prevalent in females (64.29%) than males (35.71%). The questionnaire data revealed that a large number of children had poor knowledge about eye health (97.9%). However, most children exhibited good attitudes (79.5%) and behaviors (66.0%) regarding eye health.

Conclusion: The prevalence of refractive disorders among children at SDN Wonotingal Semarang is 14%, with Astigmatism Myopia Compositus being the most common type. A significant number of children still have poor knowledge about eye health.

DIMJ, 2025, 6(1), 1-6 DOI: <https://doi.org/10.14710/dimj.v6i1.23477>

1. Introduction

Refractive disorders are the main cause of visual impairment.¹ Based on the WHO report (2020), it is known that the most common cause of visual impairment throughout the world is uncorrected refractive error, namely 48.99%.² Research regarding the diagnosis of the most eye diseases at RSUPD Dr. Kariadi Semarang also found that refractive disorders were the most common diagnosis among patients who came to the outpatient clinic.³ Refractive disorders are a condition where the light entering the eye cannot be focused properly, making the image of the object look blurry.⁴ In children, uncorrected refractive errors can have a major impact on both their educational and psychosocial development.⁵

Globally, 19 million children have visual impairment, of which 12 million have correctable refractive error.⁶ Metanalysis research on the global prevalence of refractive disorders shows that the highest prevalence of refractive disorders in children is astigmatism, namely 14.9%.⁷ The risk of amblyopia increases if correction of the refractive error is carried out too late. Undetected refractive errors can

hinder effective learning and are associated with developmental disorders in children. This is because the sense of sight has a major role in absorbing information.^{8,9}

Several factors are known to influence the incidence of refractive disorders in children, such as parents with refractive disorders, prolonged and close viewing activities, using computers, and lack of outdoor activities.¹⁰⁻¹³ Especially during the COVID-19 pandemic, the government implemented "Pembatasan Sosial Berskala Besar" (PSBB) so that many schools carried out learning activities using an online system. This causes an increase in the intensity of using computers or gadgets, resulting in the risk of visual impairment for students.^{14,15} The decrease in visual acuity is often not realized by students because of the student's lack of understanding of their conditions.¹⁶ Therefore, knowledge about eye health as well as children's attitudes and behavior to maintain eye health play an important role in the incidence of refractive disorders in children.^{13,17,18} A screening program for refractive disorders in children is needed for early detection of refractive disorders so that appropriate treatment can be immediately provided. Collecting data regarding the prevalence of

refractive errors is also needed to plan appropriate programs to reduce visual impairment and blindness in children.¹⁹

This study aims to determine the prevalence of refractive disorders in children in one of the elementary schools in Semarang and to find out how their knowledge, attitudes, and behavior are related to eye health.

2. Methods

The research design used is descriptive research. This research was conducted at SDN Wonotingal Semarang through the Community Service Program for Eye Screening Examinations for Elementary School Age children. This research was conducted in November 2023. The population of this research was children in grades 5th and 6th at SDN Wonotingal in Semarang. The sampling technique used was the accidental sampling method. This sampling method depends on the size of the population at the time the research is carried out. The variables of the study include gender, age, type of refractive error (through examination), questionnaire data on knowledge, attitudes, and eye health behavior answered by students independently. The questionnaire consists of 10 questions each regarding knowledge, attitude, and behavior regarding eye health. Students are categorized as good if they answer >60% of the questions correctly, categorized as moderate if they answer 50-60% of the questions correctly, and categorized as poor if they answer <50% of the questions correctly. Before conducting the research, The participant's willingness to be included in the research was carried out in writing (informed consent) through the student's teachers and parents. Before providing informed consent, an explanation is given regarding the aims, benefits, and effects that may occur as a result of the research. Participant data will be kept confidential and not published unless with the participant's permission. The data obtained was then analyzed using Microsoft Excel and SPSS version 26.

3. Result

This research was carried out through an eye examination screening program for children at SDN Wonotingal Semarang. The research was carried out on 200 subjects from 5th and 6th grade elementary school students. The research took the form of collecting student vision data and also collecting questionnaire data regarding eye health knowledge, attitudes and behavior.

Table 1. Age and gender characteristics of all children (200 children)

Age	Number of children	Percentage
10 years	43	21.5 %
11 years old	112	56.0 %
12 years old	43	21.5 %
13 years old	2	1 %
Gender		
Male	85	42.5 %
Female	115	57.5 %
Total	200	100.0 %

Table 1 describes the characteristics of all students who took part in this research. Of the 200 subjects, it was found that the subject's ages ranged from 10 to 13 years old. With the largest number being 11 years old, namely 56%. In this study the subjects consisted of 85 males and 115 females.

Table 2. Refractive disorders suffered by students

Characteristics	Myopia		AMC		AMS		AHC		Mixtus	
	N	%	N	%	N	%	N	%	N	%
Number of eyes	7	12.5%	30	53.6%	10	17.9%	2	3.6%	3	5.4%
Number of children	5	17.9%	19	67.9%	9	32.1%	1	3.6%	3	10.7%
Gender										
Male (children)	2	40.0%	7	36.8%	2	22.2%	1	100.0%	1	33.3%
Female (children)	3	60.0%	12	63.2%	7	77.8%	0	0.0%	2	66.7%
Age										
10 years (children)	2	40.0%	3	15.8%	2	22.2%	0	0.0%	1	33.3%
11 years old (children)	3	60.0%	15	78.9%	6	66.7%	1	100.0%	2	66.7%
12 years (children)	0	0.0%	1	5.3%	1	11.1%	0	0.0%	0	0.0%
13 years old (children)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Table 2 displays the types and characteristics of refractive disorders of students who have refractive disorders. From the eye examination, it was found that 28 children (14%) suffered from refractive disorders. The types of refractive disorders obtained are Myopia, AMC (Astigmatism Myopia Compositus), AMS (Astigmatism Myopia Simplex), AHC (Astigmatism Hyperopia Compositus), and Astigmatism mixtus. The largest number were children with AMC, namely 19 children (67.9%). After that, followed by children with AMS, namely 9 children (32.1%), Myopia 5 children (17.9%), AMS 3 children (10.7%), and the least number of children with AHC, namely only 1 child (3.6%).

Table 3 . Age and gender characteristics of refractive errors (28 children)

Age	Number of children)	Percentage
10 years	6	21.43%
11 years old	21	75%
12 years old	1	3.57%
13 years old	0	0%
Gender		
Man	10	35.71%
Woman	18	64.29%
Total	28	100.0%

Table 3 describes the age and gender characteristics of students who have refractive errors. Of the 28 children with refractive errors, the most common age group was 11 years old. Refractive disorders were more common in females than males in this study.

Table 4. Questionnaire results (200 children)

Questionnaire	Poor		Moderate		Good	
	N	Perce nt	N	Perce nt	N	Perce nt
Knowledge	194	97.0	6	3.0	0	0
Attitude	4	2.0	37	18.5	159	79.5
Behavior	8	4.0	60	30.0	132	66.0

Table 4 describes the results of the knowledge, attitudes and behavior questionnaire regarding eye health answered by the students. There were many children with poor knowledge about eye health, namely 194 children (97.9%). For attitudes and behavior regarding eye health, many children have attitudes and behavior in the good category, namely 159 children (79.5%) for attitudes and 132 children (66.0%) for behavior.

4. Discussion

Uncorrected refractive errors are the main cause of visual impairment globally.^{1,2} Refractive disorders are also a vision problem that many schoolchildren experience.^{13,20} Refractive disorders are often discovered too late and are not treated due to lack of awareness about vision problems and many students are not aware that they have vision problems. Therefore, implementing a school-based eye examination screening program is beneficial in addressing this problem.¹⁹

From this research, it was found that of the 200 students examined, there were 28 children, namely 14% suffering from refractive disorders. Based on the Indonesian Basic Health Research (Riskesdas) report (2013), in Indonesia

around 10 percent of 66 million school-age children (5-19 years), experience eye problems due to refractive errors.²¹ The type of refractive error most often suffered by students in this study was Astigmatism Myopia Compositus, namely 67.9%. This is contrary to several studies which have found that Myopia is the most common refractive disorder.²²⁻²⁴ However, metanalysis research by Hassan H, et al. (2017), taking 163 studies from various countries and various ethnicities, found that astigmatism is the most common refractive disorder experienced by children and adults.²⁵ Research conducted at the Cicendo Eye Hospital, Jakarta by Ginting, et al. (2018) also found that Astigmatism Myopia Compositus is the most common refractive disorder suffered by children.²⁶

In this study, it was found that women (64.29%) were more likely to suffer from refractive disorders than men (35.71%), although in this study more male students were examined. This is in accordance with research conducted at the Cicendo Eye Hospital, Jakarta Ginting, et al. (2018) that female subjects (58.1%) suffered more refractive disorders than males (41.9%). The same thing was also found in research by Hashemi H, et al. (2018) in rural areas of Iran that refractive disorders were more common in women (57.98%) than men (42.02%).²⁵ However, there is no clear theory regarding the relationship between gender and refractive errors. From the results of this study, it was found that the largest age group who experienced refractive disorders was 11 years old (75%). This is because the students most frequently examined are 11 years old. Research by Adeel, et al. (2020), who divided the sample into age categories 4-10 years, 11-20 years, 21-40 years , and ≥ 40 years, found that most refractive disorders were experienced by subjects aged 11-20, namely 39.6%. However, in this study, age did not affect on the incidence of astigmatism.²⁷

Several risk factors have been known to be associated with refractive errors. The results of previous research by Umamaheswari, et al. (2016) found that the duration and distance of watching television, the duration and distance of using computers/gadgets, and the duration of outdoor play had a statistically significant relationship with the prevalence of refractive disorders.¹³ Community-based research by Marshet, et al. (2024) also found that the likelihood of refractive errors in subjects who regularly used electronic devices was 3.64 times higher than in participants who did not regularly use electronic devices.²⁸ Staring at a computer for a long time causes prolonged accommodation and muscle fatigue, which can result in changes in the refractive status of the eye. In addition, staring at a computer for a long time can cause dry eyes, which can affect the refractive power of the cornea.^{29,30}

The Covid-19 pandemic forced the government to create a Large-Scale Social Restrictions (PSBB) policy to minimize the spread of Covid-19. So the Ministry of

Education and Culture made a policy of learning from home through online learning.³¹ This causes children to do a lot of assignments and learn via gadgets or computers and their outdoor activities are decreasing.³² These can certainly affect student's eye health if they do not know how to maintain eye health.³² Several studies have shown an increase in the incidence of myopia in school-aged children by comparing refraction values before and after the pandemic.³²⁻³⁵ This shows the importance of children's knowledge, attitudes, and behaviors regarding eye health to prevent refractive disorders. In this study, there were still many students who did not understand well about general eye health knowledge taken from their questionnaire answers, namely 97% had a poor category on the eye health knowledge questionnaire. Meanwhile, based on the questionnaire, many students already know what good attitudes and behavior are to maintain eye health. The results of the questionnaire regarding attitudes in the good category were 79% and the results of the questionnaire regarding behavior in the good category were 66.0%. However, there are still some students who do not know what good attitudes and behaviors are to maintain eye health.

Given the importance of early detection of refractive errors in children and adolescents, school-based eye health services that are high quality and cost-effective in terms of service provision are of paramount importance.³⁶ Knowledge about eye health and attitudes and behavior to maintain eye health need to be introduced early in school-aged children.³⁷

5. Conclusion

The prevalence of refractive disorders at SDN Wonotingal Semarang was 14% of the total of 200 students examined. This research shows that astigmatism, especially Astigmatism Myopia Compositus, is the most common disorder among students. Even though the number of male students examined is greater, female students more often experience refractive disorders.

The COVID-19 pandemic, with social restrictions and online learning, has changed student learning patterns and activities. More activity in front of computer screens and less time outdoors have been linked to increased cases of refractive errors in school-aged children. Even though the majority of students at SDN Wonotingal Semarang do not fully understand eye health in general, they have demonstrated a good understanding regarding attitudes and behavior to maintain eye health.

Increasing awareness of the importance of early detection and prevention of refractive disorders needs to be done, not only among students but also among parents and teachers. School-based eye health services and high-quality eye health education should be introduced early to children

to reduce the impact of refractive disorders in the future. School-based eye examination screening programs are very important for the early detection of refractive disorders and for preventing serious complications that can disrupt a child's development.

Ethical Approval

None.

Conflicts of Interest

None.

Funding

Funding for this research was obtained from a research grant from the Faculty of Medicine, Diponegoro University.

Author Contributions

Conceptualization, TN, FLR, AGD, and ANS; methodology, TN; software, AGD; validation, TN and FLR; formal analysis, TN and FLR; investigation, TN; resources, FLR; data curation, TN and AGD; writing—original draft preparation, TN, FLR, AGD, and ANS; writing—review and editing, TN, FLR, AGD, and ANS; visualization, AGD and ANS; supervision, TN, FLR, AGD, ANS; project administration, TN.

Acknowledgments

This work was supported by Faculty of Medicine, Diponegoro University.

References

1. Steinmetz JD, Bourne RRA, Briant PS, Flaxman SR, Taylor HRB, Jonas JB, et al. Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence of avoidable blindness in relation to VISION 2020: the Right to Sight: an analysis for the Global Burden of Disease Study. *Lancet Glob Health* [Internet]. 2021 Feb;9(2):e144–60. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S2214109X20304897>
2. World Health Organization. World report on vision Geneva. 2020; Available from: <https://www.who.int/publications/i/item/9789241516570>
3. Rahmi FL, Wildan A, Maharani M, Prihatningtias R, Nugroho T, Rikiandraswida Z. The Characteristics of Eye Diseases at Merpati Eye Clinic Dr Kariadi Hospital Semarang in 2020-2022. *Diponegoro International Medical Journal* [Internet]. 2023 Jul 26;4(1):24–30. Available from: <https://ejournal2.undip.ac.id/index.php/dimj/article/view/17677>

4. Schiefer U, Kraus C, Baumbach P, Ungewiß J, Michels R. Refractive errors. *Dtsch Arztebl Int* [Internet]. 2016 Oct 14; Available from: <https://www.aerzteblatt.de/10.3238/arztebl.2016.0693>
5. Sheeladevi S, Seelam B, Nukella PB, Modi A, Ali R, Keay L. Prevalence of refractive errors in children in India: a systematic review. *Clin Exp Optom* [Internet]. 2018 Jul 1;101(4):495–503. Available from: <https://www.tandfonline.com/doi/full/10.1111/cxo.12689>
6. World Health Organization. Global data on Visual Impairments. Available from: Available at www.who.int/blindness/GLOBALDATAFINALforweb.pdf?ua=1/fs282/en/2010
7. Hashemi H, Fotouhi A, Yekta A, Pakzad R, Ostadimoghaddam H, Khabazkhoob M. Global and regional estimates of prevalence of refractive errors: Systematic review and meta-analysis. *J Curr Ophthalmol* [Internet]. 2018 Mar;30(1):3–22. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S2452232517300227>
8. Kleinsteijn RN, Mutti DO, Sinnott LT, Jones-Jordan LA, Cotter SA, Manny RE, et al. Uncorrected Refractive Error and Distance Visual Acuity in Children Aged 6 to 14 Years. *Optometry and Vision Science* [Internet]. 2021 Jan;98(1):3–12. Available from: <https://journals.lww.com/10.1097/OPX.0000000000001630>
9. Kemenkes RI. Peraturan Menteri Kesehatan Republik Indonesia Nomor 82. *Kaos GL Derg*. 2020;8(75):147–54.
10. Firdawati NMuthia. Literatur Review: Faktor-Faktor Yang Mempengaruhi Kejadian Miopia Pada Anak Usia Sekolah. *Bhakti kencana university*. 2020;
11. Juneti, Juneti, Eka Bebasari and ENukman. Gambaran faktor-faktor yang mempengaruhi gangguan tajam penglihatan pada anak sekolah dasar kelas V dan kelas VI di SDN 017 Bukit Raya Pekanbaru tahun 2014. *Diss Riau University*. 2015;
12. Harb EN, Wildsoet CF. Origins of Refractive Errors: Environmental and Genetic Factors. *Annu Rev Vis Sci* [Internet]. 2019 Sep 15;5(1):47–72. Available from: <https://www.annualreviews.org/doi/10.1146/annurev-vision-091718-015027>
13. Kannan U, Rajendiran A YD, Shanmugavel K, John NA RS. Refractive error and associated risk factors in 6-12 years schoolchildren. *Natl J Physiol Pharm Pharmacol*. 2016;6(6):554–8.
14. Tirayoh NC, Dja'far VH. INCREASED MYOPIA PREVALENCE IN YOUNGSTERS AS A RESULT OF ONLINE LEARNING. *TRANSFORMATIONAL LANGUAGE, LITERATURE, AND TECHNOLOGY OVERVIEW IN LEARNING (TRANSTOOL)* [Internet]. 2021 Nov 25;1(1):39–46. Available from: <https://ojs.transpublika.com/index.php/TRANSTOOL/article/view/106>
15. Detanac D. Digital device overuse during the COVID-19 pandemic and visual impairment among children: Is there a risk for long-term effects? *Sanamed* [Internet]. 2021;16(3):161–6. Available from: <https://scindeks.ceon.rs/Article.aspx?artid=1452-662X2102161D>
16. Saiyang B, Rares LM, Supit WP. Kelainan Refraksi Mata pada Anak. *Medical Scope Journal* [Internet]. 2021 Jan 8;2(2). Available from: <https://ejournal.unsrat.ac.id/index.php/msj/article/view/32115>
17. Dwiana, Agnes, Cici Lestari and LAstuty. “Hubungan pengetahuan siswa tentang kesehatan mata dengan sikap penggunaan gadget yang berlebihan di SD N 13 Engkasan Kalimantan Barat.” *A. vicenna: Journal of Health Research* 41. 2021;
18. Aini, Susmita, Dewi Martha and ARDewi. “PENINGKATAN PENGETAHUAN, SIKAP, DAN PERILAKU PENCEGAHAN KELAINAN REFRAKSI PADA SANTRI DI PONDOK PESANTREN MELALUI VIDEO EDUKASI.” *J. urnal Kedokteran Komunitas (Journal of Community Medicine)* 112. 2023;
19. Basrowi, Ray Wagiu et al. “Key Dimensions of Refractive Errors Screening at School in Indonesia: A Primary Educator’s Perspective.” *National Journal of Community Medicine* 1504. 2024;314–9.
20. Titah A, Mu’awanah M, Purnomo H, Mudhofar MN. DETEKSI DINI PENURUNAN TAJAM PENGLIHATAN PADA ANAK USIA SEKOLAH DASAR. *LINK* [Internet]. 2020 Nov 9;16(2):149–53. Available from: <http://ejournal.poltekkes-smg.ac.id/ojs/index.php/link/article/view/6459>
21. Kementerian Kesehatan RI Pusat Data dan Informasi. Laporan Hasil Riset Kesehatan Dasar (Riskesdas) Indonesia tahun 2013. Jakarta : Badan Penelitian dan Pengembangan Kesehatan Kemenkes RI. 2013;
22. Iqbal F, Khalil I, Zahid M. Prevalence of refractive errors in school going children in district Faisalabad, Pakistan. *Adv Ophthalmol Vis Syst* [Internet]. 2020 Jan 20;10(1):4–6. Available from: <http://medcraveonline.com/AOVS/prevalence-of-refractive-errors-in-school-going-children-in-district-faisalabad-pakistan.html>
23. Gull A, Raza A. Visual Screening and Refractive Errors among school aged children. *J Rawal Med Coll*. 2014;18(1):97–100.
24. Francisc March de Ribot, Ostrow GI, Epley KD, Iribarren R, Nallasamy S. Myopia. *American Academy*

- of Ophthalmology [Internet]. 2023; Available from: <https://eyewiki.aao.org/Myopia>
25. Hashemi H, Fotouhi A, Yekta A, Pakzad R, Ostadimoghaddam H, Khabazkhoob M. Global and regional estimates of prevalence of refractive errors: Systematic review and meta-analysis. *J Curr Ophthalmol* [Internet]. 2018 Mar;30(1):3–22. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S2452232517300227>
 26. Ginting, Dianita Veulina Amiruddin PO. Hubungan usia dan jenis kelamin dengan jenis kelainan refraksi pada anak di Pusat Mata Nasional Rumah Sakit Mata Cicendo. Portal Perpustakaan RSM Cicendo. 2018;
 27. Siddiqui AA, Chaudhary MA, Ullah MZ, Hussain M, Ahmed N, Hanif A. Prevalence of refractive errors by age and gender in patients reporting to ophthalmology department. *The Professional Medical Journal* [Internet]. 2020 Sep 10;27(09):1989–94. Available from: <http://theprofesional.com/index.php/tpmj/article/view/5216>
 28. Abebe MG, Alemayehu AM, Munaw MB, Tilahun MM, Alemayehu HB. Prevalence and associated factors of refractive error among adults in South Ethiopia, a community-based cross-sectional study. Aghayeva F, editor. *PLoS One* [Internet]. 2024 Mar 25;19(3):e0298960. Available from: <https://dx.plos.org/10.1371/journal.pone.0298960>
 29. Alemayehu AM. Pathophysiologic Mechanisms of Computer Vision Syndrome and its Prevention: Review. *World Journal of Ophthalmology & Vision Research* [Internet]. 2019 Nov 12;2(5). Available from: <https://irispublishers.com/wjovr/fulltext/pathophysiologic-mechanisms-of-computer-vision-syndrome-and-its-prevention-review.ID.000547.php>
 30. Kim SH, Suh YW, Choi YM, Han JY, Nam GT, You EJ, et al. Effect of Watching 3-Dimensional Television on Refractive Error in Children. *Korean Journal of Ophthalmology* [Internet]. 2015;29(1):53. Available from: <http://ekjo.org/journal/view.php?doi=10.3341/kjo.2015.29.1.53>
 31. Kemendikbud. Kementerian Pendidikan dan Kebudayaan. Surat Edaran Nomor 15 Tahun 2020 tentang Pedoman Penyelenggaraan Belajar Dari Rumah Dalam Masa Darurat Penyebaran Covid-19. [Internet]. 2020. Available from: kemdikbud.go.id
 32. Li M, Xu L, Tan CS, Lanca C, Foo LL, Sabanayagam C, et al. Systematic Review and Meta-Analysis on the Impact of COVID-19 Pandemic-Related Lifestyle on Myopia. *Asia-Pacific Journal of Ophthalmology* [Internet]. 2022 Sep;11(5):470–80. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S2162098923007429>
 33. Sanz Diez P, Ohlendorf A, Barraza-Bernal MJ, Kratzer T, Wahl S. Evaluating the impact of COVID-19 pandemic-related home confinement on the refractive error of school-aged children in Germany: a cross-sectional study based on data from 414 eye care professional centres. *BMJ Open* [Internet]. 2023 Nov 21;13(11):e071833. Available from: <https://bmjopen.bmj.com/lookup/doi/10.1136/bmjopen-2023-071833>
 34. Sanz Diez P, Ohlendorf A, Barraza-Bernal MJ, Kratzer T, Wahl S. Evaluating the impact of COVID-19 pandemic-related home confinement on the refractive error of school-aged children in Germany: a cross-sectional study based on data from 414 eye care professional centres. *BMJ Open* [Internet]. 2023 Nov 21;13(11):e071833. Available from: <https://bmjopen.bmj.com/lookup/doi/10.1136/bmjopen-2023-071833>
 35. Zhang X, Cheung SSL, Chan HN, Zhang Y, Wang YM, Yip BH, et al. Myopia incidence and lifestyle changes among school children during the COVID-19 pandemic: a population-based prospective study. *British Journal of Ophthalmology* [Internet]. 2022 Dec;106(12):1772–8. Available from: <https://bjo.bmj.com/lookup/doi/10.1136/bjophthalmol-2021-319307>
 36. World Health Organization. “World report on vision.” 2019; Available from: <https://iris.who.int/bitstream/handle/10665/328717/9789240017184-ara.pdf>
 37. Dwiana A, Lestari C, Astuty L. HUBUNGAN PENGETAHUAN SISWA TENTANG KESEHATAN MATA DENGAN SIKAP PENGGUNAAN GADGET YANG BERLEBIHAN DI SD N 13 ENKGASAN KALIMANTAN BARAT. *Avicenna : Journal of Health Research*. 2021;4(1):1–8.