

# The awareness of amblyopia among parents in Saudi Arabia

Ali M. Alsaqr<sup>ID</sup> and Ali M. Masmali

Ther Adv Ophthalmol

2019, Vol. 11: 1–7

DOI: 10.1177/  
2515841419868103

© The Author(s), 2019.  
Article reuse guidelines:  
sagepub.com/journals-  
permissions

## Abstract

**Purpose:** Amblyopia is the most common cause of unilateral visual impairment. This study investigated parents' awareness of amblyopia in different regions of Saudi Arabia.

**Methods:** This was a cross-sectional population study. The survey consisted of two main sections; the first section contained 13 general background questions, and the second section (10 questions) focused on awareness of amblyopia, routine vision checks and how to raise awareness of amblyopia in the community. The survey was distributed to respondents using email and social media.

**Results:** The responses of 1649 families were received. Respondents' age range was from 22–62 years (mean  $\pm$  standard deviation = 33.6  $\pm$  8.7 years). Most respondents had no previous knowledge of amblyopia (1155 participants, 70%), and 313 participants (19%) had no idea if their children had amblyopia. In total, 990 participants (60%) did not visit the eye clinic with their children for a routine eye exam. A total of 495 parents (30%), who were aware of amblyopia, knew of it mainly from eye clinic visits and from Internet websites. A total of 140 respondents reported that their children had amblyopia; 58.3% of those children underwent routine eye examinations once a year, and the rest underwent routine eye examinations twice a year.

**Conclusion:** The results clearly showed a lack of amblyopia awareness among the Saudi community. This lack of awareness can lead to visual impairment among children. More efficient efforts are urgently needed from health professionals, education centres, the media and social organizations to promote awareness of amblyopia.

**Keywords:** amblyopia, refractive errors, Saudi parents, visual impairment

Received: 30 November 2018; revised manuscript accepted: 15 July 2019.

## Introduction

The decline of visual acuity at an early age can be easily treated, but if left untreated, it can lead to an amblyopia. Amblyopia is the reduction of visual acuity at an early age caused by visual abnormalities such as strabismus and anisometropia in the absence of visible damage to the eye or visual system or to ocular pathology.<sup>1,2</sup> It is one of the most common public health problems, affecting up to 5% of the population.<sup>3,4</sup> Unilateral visual impairment is usually caused by amblyopia in both children and adults.<sup>5</sup>

Amblyopia can occur from 4 months until 8 years of age<sup>2</sup>; if not treated before the development of central vision, the efficacy of treatment is poor

after 8 years of age.<sup>6,7</sup> Amblyopia is commonly a monocular condition, but it can also be binocular.<sup>8</sup> The leading causes of monocular amblyopia are deprivation, anisometropia and strabismus.<sup>9</sup> Binocular amblyopia is mainly caused by high uncorrected refractive errors. Although amblyopia is defined as a deficit in visual acuity, it can also occur with visual limitations such as poor accommodation, binocular dysfunction, abnormal contour interactions, positional uncertainty, reduced contrast sensitivity, spatial distortions, abnormal eye movements, suppression and fixation instability.<sup>10–22</sup>

The treatment of amblyopia involves patching, ranging from 1 h to full-time occlusion.<sup>23,24</sup> The

Correspondence to:  
**Ali M. Alsaqr**  
Department of Optometry,  
College of Applied Medical  
Sciences, King Saud  
University, PO Box 10219,  
Riyadh 11433, Saudi  
Arabia.  
[amsaqr@ksu.edu.sa](mailto:amsaqr@ksu.edu.sa)

**Ali M. Masmali**  
Cornea Research Chair,  
Department of Optometry,  
College of Applied Medical  
Sciences, King Saud  
University, Riyadh, Saudi  
Arabia



success rate of patching depends mainly on compliance; the reported rates of compliance range widely from 49% to 87%.<sup>25,26</sup> Furthermore, a randomized controlled study showed that Atropine produced similar improvements in vision to patching in young children.<sup>27</sup> These treatments could be useful in amblyopic children when it is caused by high refractive errors, strabismus or other causes. The treatment of amblyopia involves depriving the vision of the better eye, eliminating suppression of the amblyopic eye and performing visual exercises that promote recovery of the visual acuity of amblyopic eye.<sup>28</sup> Amblyopia can impact quality of life because of its effect on patients' ability to perform sports and physical activities, social activities and their career of choice<sup>29,30</sup>; moreover, it can cause depression or anxiety in amblyopic patients.<sup>10</sup> The amblyopic treatment challenges involve the parents when the parents are uncertain about the benefits of the treatment and are under stress or have relationship pressure.<sup>31</sup> The parents' understanding of amblyopia and its impact on their children's well-being is crucial. Therefore, studies are needed to investigate the level of parents' awareness and how to increase their awareness in the future.<sup>32-35</sup>

The prevalence of amblyopia in preschool children has been previously reported to range from 0.8% to 2.6% in population-based studies conducted in the United States, Australia, Taiwan and Singapore.<sup>36-41</sup> The prevalence of amblyopia in Saudi Arabia varies by region: 2.6% in Riyadh,<sup>42</sup> 3.9% in Qassim province,<sup>43</sup> 1.3% in Jeddah<sup>2</sup> and 1.9% in Abha.<sup>44</sup> These differences in prevalence could be due to variations in the definitions and cutoff points of visual parameters that define amblyopia and the characteristics of the studied patients. To date, there is no study that has investigated awareness of amblyopia among Saudi parents using a population-based design; therefore, this study aimed to investigate parents' awareness of amblyopia in different regions of Saudi Arabia.

## Methods

### *Ethical approval*

The study was approved by the Research Ethics Committee of King Saud University (no. 128649/12/3 on 27 December 2016) and followed the tenets of the Declaration of Helsinki. Informed consent was electronically obtained from all participants, and the aims of the study were fully described to the participants.

### *Study design and sample size*

A cross-sectional study design was used in this study. The target population consisted of parents in different parts of Saudi Arabia. A structured survey was designed, focusing on the parents' background characteristics, including general and ophthalmic histories, and their knowledge of amblyopia. The study was conducted from March 2017 to March 2018.

The sample size was computed using Epi Info, version 7 (Centers for Disease Control, Atlanta, GA, USA; <http://wwwn.cdc.gov/epiinfo/7/>). The inputs were a population size of 30 million, an expected frequency of 50%, a 95% confidence interval, a design effect of 2 and the number of clusters as five (central, northern, western, eastern and southern regions). The estimated overall sample size was recorded ( $n = 770$ ). The investigators aimed to recruit enough participants to account for the variation in population size of the five clusters; however, the sample size calculator (Epi Info) did not have the ability to take this factor into account. Therefore, the investigators promoted the survey for over a year to try and recruit a sufficient number of participants that adequately represented the population in each cluster.

### *Survey structure*

The survey was divided into two main sections involving the parents' demographic characteristics and their awareness of amblyopia. The first section included information about the participants' sex, marital status, current location, age, occupation, general and ocular health (to indicate their health knowledge in general), educational status, number of children and their children's ages.

The second section consisted of questions focusing on previous knowledge of amblyopia and its risk factors. The participants were asked the following questions: How did they know about amblyopia (they could select more than one answer)? Did they have children? Did any of their children have amblyopia? If so, how many and what are their ages? Did their children visit an eye care practitioner? If the response was yes, how many visits were made per year (every 3 months, 6 months or yearly)? And from the parents' point of view, who should promote the awareness of amblyopia? (the choices were: Ministry of Health; the media; health-related associations, including optometrists and ophthalmology societies; schools

and universities; social institutions; nonprofit organizations; eye care practitioners; and others that should be specified). The respondent was given the freedom to choose more than one answer.

The survey was uploaded online and was accessible without any login restrictions; it was promoted using all accessible social media (e.g. Twitter, WhatsApp and Telegram). Many emails were sent to all listed members of the Saudi Optometry Society to promote the survey in their areas and through the social media sites mentioned previously. To avoid duplicate responses, a bold-type note appeared at the beginning of the survey to state that there was no need to answer the survey more than once. Furthermore, before analysing the raw responses, we reviewed the responses for any duplication and excluded 50 responses from the analyses.

## Results

The responses of 1649 families were received, and they comprised 858 mothers (52%) and 791 fathers (48%). Their current marital status was 1419 married (86%), 192 widowed (11.6%) and 38 divorced (2.2%). The age of the parents ranged from 20 to 62 years ( $M \pm SD = 37 \pm 9.25$ ). The respondents reported the age of their children as ranging from 6 months to 40 years. The sample was relatively diverse, with 660 (40%) participants from the central region, 531 (32.20%) participants from the southern region, 190 (11.5%) participants from the western region, 183 (11.10%) participants from the eastern region and 85 (5.20%) participants from the northern region of Saudi Arabia. The parents' level of education differed: 940 (57%) parents had a university degree, 248 (15%) parents had a high school degree or lower, 156 (9.5%) parents had a diploma, 223 (13.5%) parents had a master's degree and 82 (5%) parents had a PhD. Approximately 80% of the parents did not report any general health issue. The most commonly reported general health disorders in the remaining 330 (20%) parents were diabetes, hypertension, high cholesterol and knee osteoarthritis. Of the total respondents, 610 (37%) parents reported that they had some ophthalmic-related problems, including poor vision, dryness, itching, cataract and glaucoma.

A total of 1402 (85%) parents reported that they had children. The number of children they had

ranged from 1 child [297 (18%) respondents] to 10 children [8 (0.50%) respondents]. Only 30% (495) of the participants had previously known the term 'amblyopia' or its meaning. With regard to the source of the respondents' awareness, they were given the option to choose more than one answer. The respondents reported that they were aware of amblyopia from the optometrist (149 participants), ophthalmologist (133 participants), friends and co-workers (96 participants), Internet websites (85 participants), media (40 participants), flyers (40 participants) and lectures (25 participants). The remaining respondents stated that they were familiar with the term 'amblyopia' because their children had the condition or that they heard it spoken of by others or by other means.

The parents were asked whether their child had amblyopia: 1204 respondents (73%) reported no and 305 respondents (19%) were not sure. The remaining 8% (140 parents) reported that their children had amblyopia. Of those parents, 106 respondents (75.70%) reported they had one son or daughter with amblyopia, 29 respondents (20.7%) had two children with amblyopia, and 5 respondents (3.5%) had at least three children with amblyopia. The parents reported that the age of their amblyopic children ranged from 1 to 40 years. The majority of the parents (989 respondents, 60%) reported that they had not visited an ophthalmic clinic for a comprehensive examination. The details of the 660 parents who took their children to an optometrist routinely were the following: 228 respondents (34.50%) reported that they had visited an optometrist once a year, 82 respondents (12.50%) reported visits every 6 months, 23 respondents (3.50%) reported visits every 3 months, 149 respondents (22.50%) reported visits every 2 years, 61 respondents (9.3%) reported visits once in their lifetime, 60 respondents (9%) visited the optometrist whenever needed and the remaining 57 respondents (8.7%) never visited an optometrist. Of the 140 respondents who had children with amblyopia, 58.3% had routine eye examinations for their children once a year, and 41.7% had routine eye examinations for their children every 6 months.

The parents were asked who was responsible for promoting amblyopia awareness (they were free to choose more than one response). Their responses indicated that it was the responsibility of the Ministry of Health [1237 respondents (75%)], and 957 respondents selected the media

(58%), 792 respondents (48%) selected scientific and health-related societies as well as schools and universities, 231 respondents (14%) selected ophthalmic professionals, and 825 respondents (50%) selected other means such as families, teachers, social media and primary health programmes.

The participants' backgrounds were investigated for their relationship with their awareness of amblyopia. There was a significant difference between the father and mother regarding awareness of amblyopia, with more mothers (267, 16.20%) knowing about amblyopia when compared with fathers (228, 13.80%) (Pearson's chi-square test;  $p = 0.0001$ ). Marital status was also found to be associated with awareness of amblyopia (Pearson's chi-square test;  $p = 0.0001$ ), with married respondents (400) more aware of the term amblyopia than those with other marital statuses, including divorced and widowed respondents. The participants' residences (central, southern, northern, western and eastern regions) were found to be associated with amblyopic awareness (Pearson's chi-square test;  $p = 0.0001$ ). Residents of the central region had more awareness of the term amblyopia than residents of the other regions [central region (207), southern region (143), northern region (24), western region (58) and eastern region (63)]. The parents' occupation was found to be associated with amblyopia awareness (Pearson's chi-square test;  $p = 0.0001$ ). Finally, parents of children with amblyopia had more awareness than parents of children without amblyopia (Pearson's chi-square test;  $p = 0.0001$ ). Overall, of the 495 parents who knew the term amblyopia, 394 parents (80%) had children with the disorder.

### Discussion

Amblyopia is a condition that permanently affects the vision of children if not treated early, and it could later impact their health and quality of life. Parents' awareness of amblyopia and its risk factors could play a crucial role in early management of the disease, which requires the involvement of both eye care professionals and the parents of the affected children. This study was conducted to determine the current awareness of parents nationally because of their crucial role in detecting and managing amblyopia.

The public awareness level of amblyopia has been previously investigated in different countries.<sup>32,34,37,38</sup> Two studies from Saudi Arabia

reported that the awareness of amblyopia ranged from 10%<sup>29</sup> to almost 50%.<sup>23</sup> The difference between the two studies could be accounted for by their target populations' characteristics. Aljohani and colleagues<sup>29</sup> conducted their study in a hospital and a mall in Jeddah, while Alzahrani and colleagues<sup>23</sup> conducted their study in a hospital-based setting. It is more likely to have a greater number of parents who are aware of amblyopia and its effects in a clinical setting. In addition, these studies were conducted in the same hospital and city (King AbdulAziz University Hospital in Jeddah). This meant that the results should not be generalized to the awareness of the entire population of Saudi Arabia. To the best of our knowledge, this study is the first national population-based investigation regarding amblyopia in Saudi Arabia.

This study recruited 1649 respondents, with a ratio of males to females of approximately 1:1. The parents' ages, education and children's ages and numbers were relatively diverse. This may indicate that this study reflects the diversity of Saudi society in different regions of the country. The level of amblyopia awareness was 30%, which is greater than the awareness reported in Nigeria (2.9%),<sup>34</sup> India (3%)<sup>32</sup> and Jeddah, Saudi Arabia (10%),<sup>29</sup> but less than the values reported in a study in Jeddah (50%).<sup>23</sup> This suggests that the parents in this study were better informed, but these levels of awareness may not be sufficient because 70% of the respondents had never heard the term amblyopia.

Eye care clinicians were the leading source of information for parents about the term amblyopia and its meaning. This may have been due to the reported amblyopic incidence as well as their efforts in screening their children. In addition, all of those who reported having amblyopic children were also committed to routine eye examinations, either on a yearly basis or every 6 months. Friends and co-workers were also a major source of information for the parents, probably because of social interactions. The Internet and media tools were the third most reported source of information. This result may explain the parents' responses regarding who was responsible for promoting knowledge of amblyopia, in addition to the Ministry of Health and nonprofit organizations.

Based on the parents' responses, the percentage of patients with amblyopia was as high as 7.8% of the population. This percentage is larger than in

previous studies in Saudi Arabia.<sup>23,29</sup> However, we are not confident that this prevalence is accurate because the parents may have confused amblyopia with reduced vision. Notably, 989 parents (60%) reported that they had never visited a clinic for a comprehensive eye examination. In addition, even though many parents took their children to eye examinations, they did not do it on a regular basis. This emphasizes the importance of national-level government efforts to establish a structured vision screening programme.

Awareness of amblyopia was more prevalent in mothers than in fathers because mothers generally monitor their sons' or daughters' health more than fathers. Approximately 85% (421) of those who answered that they knew the term amblyopia were married, which could explain why marital status was associated with awareness of amblyopia. Residents of the central region were more aware of amblyopia than residents of the southern region. This difference may be explained by two factors: the number of participants recruited in this study from these two regions (72% of the respondents) and the greater availability of health care providers (because these two areas are highly populated). Although the parents' education had an impact on amblyopia awareness, their responses were diverse, and no particular occupation was associated with a better knowledge of amblyopia. For example, a large percentage of mothers who did not work (50%) knew the term amblyopia, while most university lecturers were unaware of this term (70%). Furthermore, a mall security official responded that he was familiar with the term amblyopia, while some teachers reported that they had not heard this term. This could confirm the lack of awareness of amblyopia in the Saudi community. Parents who had children were more familiar with amblyopia than those without children, which was expected because people have different interests at each stage of their lives. Therefore, it could be normal that parents with children have more interest in information about their sons' or daughters' health and the disorders that may affect their health.

The limitations of this study include not structurally recruiting a random sample from the entire population of Saudi Arabia. The results of the study would be more representative of the current national awareness level of parents if the respondents were recruited with an equal number of participants from different regions, sexes, occupations and ages. However, this study was necessary to

determine the current awareness level, even though it is an approximation. This study was not designed to accurately determine the national prevalence of amblyopia; therefore, the percentage reported by the parents may not be accurate, so a future national population-based study is needed to determine the prevalence of amblyopia. There is a shortage of national population-based studies because previous studies were conducted in a few cities in Saudi Arabia and not on a national level. Amblyopia is a serious ophthalmic disorder that has a prolonged effect on a person's health and future. Introducing the concept of amblyopia to the general public and assessing their awareness of it is a challenging topic to investigate.

In conclusion, this study showed indications that there is a lack of public knowledge regarding amblyopia. More effort should therefore be directed towards outreach to a larger audience, especially in remote areas. More public campaigns, awareness days and media advertisements are possibilities for improving parents' awareness of this disorder. Eye care professionals should be more involved, and other actions could be directed at the family level to increase the children's treatment compliance. Community-wide education about the benefits of patching and atropine drops is needed. Screening programmes for preschool-aged children to provide early detection and treatment could be conducted. Children with limited access to eye care should have a special programme. Teachers could contribute as well by paying more attention to children struggling academically.

### Acknowledgements

The authors extend their appreciation to the College of Applied Medical Sciences Research Centre and the Deanship of Scientific Research at King Saud University for funding this research.

### Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### Conflict of interest statement

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### ORCID iD


Ali M. Alsaqr  <https://orcid.org/0000-0002-2900-2662>

## References

1. Barrett BT, Bradley A and McGraw PV. Understanding the neural basis of amblyopia. *Neuroscientist* 2004; 10: 106–117.
2. Bardisi WM and BinSadiq BM. Vision screening of preschool children in Jeddah, Saudi Arabia. *Saudi Med J* 2002; 23: 445–449.
3. Al-Yahya A, Al-Odan K, Allam K, *et al.* Compliance to patching in the treatment of amblyopia. *Saudi J Ophthalmol* 2012; 26: 305–307.
4. Carlton J and Kaltenthaler E. Amblyopia and quality of life: a systematic review. *Eye* 2011; 25: 403–413.
5. Robaei D, Rose KA, Ojaimi E, *et al.* Causes and associations of amblyopia in a population-based sample of 6-year-old Australian children. *Arch Ophthalmol* 2006; 124: 878–884.
6. de Zarate BR and Tejedor J. Current concepts in the management of amblyopia. *Clin Ophthalmol* 2007; 1: 403–414.
7. Ehrlich MI, Reinecke RD and Simons K. Preschool vision screening for amblyopia and strabismus: programs, methods, guidelines, 1983. *Surv Ophthalmol* 1983; 28: 145–163.
8. Webber AL and Wood J. Amblyopia: prevalence, natural history, functional effects and treatment. *Clin Exp Optom* 2005; 88: 365–375.
9. Tailor V, Bossi M, Greenwood JA, *et al.* Childhood amblyopia: current management and new trends. *Br Med Bull* 2016; 119: 75–86.
10. McKee SP, Levi DM and Movshon JA. The pattern of visual deficits in amblyopia. *J Vis* 2003; 3: 380–405.
11. Hess RF and Howell ER. The threshold contrast sensitivity function in strabismic amblyopia: evidence for a two type classification. *Vision Res* 1977; 17: 1049–1055.
12. Levi DM and Harwerth RS. Spatio-temporal interactions in anisometric and strabismic amblyopia. *Invest Ophthalmol Vis Sci* 1977; 16: 90–95.
13. Bradley A and Freeman RD. Contrast sensitivity in anisometric amblyopia. *Invest Ophthalmol Vis Sci* 1981; 21: 467–476.
14. Montes-Mico R and Ferrer-Blasco T. Contrast sensitivity function in children: normalized notation for the assessment and diagnosis of diseases. *Doc Ophthalmol* 2001; 103: 175–186.
15. Abrahamsson M and Sjostrand J. Contrast sensitivity and acuity relationship in strabismic and anisometric amblyopia. *Br J Ophthalmol* 1988; 72: 44–49.
16. Campos EC. Amblyopia revisited: evidence for the heterogeneity of the syndrome. *Int Ophthalmol* 1989; 13: 327–330.
17. Birch EE. Amblyopia and binocular vision. *Prog Retin Eye Res* 2013; 33: 67–84.
18. Levi DM. Visual processing in amblyopia: human studies. *Strabismus* 2006; 14: 11–19.
19. Woodruff M. Amblyopia: basic and clinical aspects. *Optom Vis Sci* 1991; 68: 365–396.
20. Agrawal R, Conner IP, Odom JV, *et al.* Relating binocular and monocular vision in strabismic and anisometric amblyopia. *Arch Ophthalmol* 2006; 124: 844–850.
21. Rutstein RP and Corliss D. Relationship between anisometropia, amblyopia, and binocularity. *Optom Vis Sci* 1999; 76: 229–233.
22. Weakley DR Jr. The association between nonstrabismic anisometropia, amblyopia, and subnormal binocularity. *Ophthalmology* 2001; 108: 163–171.
23. Alzahrani N, Alhibshi N, Bukhari DMA, *et al.* Awareness, perceptions and knowledge of amblyopia among pediatrics and ophthalmology clinics attendees in King AbdulAziz University Hospital, Jeddah. *Int J of Adv Res* 2018; 6: 1506–1517.
24. Olson RJ and Scott WE. A practical approach to occlusion therapy for amblyopia. *Semi Ophthalmol* 1997; 12: 161–165.
25. Al-Zuhaibi S, Al-Harthi I, Coymans P, *et al.* Compliance of amblyopic patients with occlusion therapy: a pilot study. *Oman J Ophthalmol* 2009; 2: 67–72.
26. Moseley MJ, Fielder AR, Irwin M, *et al.* Effectiveness of occlusion therapy in ametropic amblyopia: a pilot study. *Br J Ophthalmol* 1997; 81: 956–961.
27. Pediatric Eye Disease Investigator Group. A randomized trial of atropine vs. patching for treatment of moderate amblyopia in children. *Arch Ophthalmol* 2002; 120: 268–278.
28. Lee H-J and Kim SJ. Effectiveness of binocularity-stimulating treatment in children with residual amblyopia following occlusion. *BMC Ophthalmol* 2018; 18: 253.
29. Aljohani M, Alorabi S, Alrajhi Z, *et al.* Awareness, attitudes and practices regarding common eye diseases among general population in Saudi Arabia. *Ann Int Med Den Res* 2018; 4: ME01–ME4.

30. Webber AL. The functional impact of amblyopia. *Clin Exp Optomet* 2018; 101: 443–450.
31. Maconachie GDE and Gottlob I. The challenges of amblyopia treatment. *Biomed J* 2015; 38: 510–516.
32. Senthilkumar D, Balasubramaniam SM, Kumaran SE, *et al.* Parents' awareness and perception of children's eye diseases in Chennai, India. *Optom Vis Sci* 2013; 90: 1462–1466.
33. Singh A, Rana V, Patyal S, *et al.* To assess knowledge and attitude of parents toward children suffering from strabismus in Indian subcontinent. *Indian J Ophthalmol* 2017; 65: 603–606.
34. Ebeigbe JA and Emedike CM. Parents' awareness and perception of children's eye diseases in Nigeria. *J Optom* 2017; 10: 104–110.
35. Newsham D. Parental non-concordance with occlusion therapy. *Brit J Ophthalmol* 2000; 84: 957–962.
36. Chang CH, Tsai RK and Sheu MM. Screening amblyopia of preschool children with uncorrected vision and stereopsis tests in Eastern Taiwan. *Eye* 2006; 21: 1482–1488.
37. Dirani M, Chan YH, Gazzard G, *et al.* Prevalence of refractive error in Singaporean Chinese children: the strabismus, amblyopia, and refractive error in young Singaporean Children (STARS) study. *Invest Ophthalmol Vis Sci* 2010; 51: 1348–1355.
38. Multi-ethnic Pediatric Eye Disease Study Group. Prevalence of amblyopia and strabismus in African American and Hispanic children ages 6 to 72 months the multi-ethnic pediatric eye disease study. *Ophthalmology* 2008; 115: 1229–1236. e1.
39. Friedman DS, Repka MX, Katz J, *et al.* Prevalence of amblyopia and strabismus in white and African American children aged 6 through 71 months the Baltimore pediatric eye disease study. *Ophthalmology* 2009; 116: 2128–234. e1.
40. Pai A, Rose K, Leone J, *et al.* Amblyopia prevalence and risk factors in Australian preschool children. *Ophthalmology* 2012; 119: 138–144.
41. McKean-Cowdin R, Cotter SA, Tarczy-Hornoch K, *et al.* Prevalence of amblyopia or strabismus in asian and non-Hispanic white preschool children: multi-ethnic pediatric eye disease study. *Ophthalmology* 2013; 120: 2117–2124.
42. Al-Assaf A and Fatani R. Vision screening of preschool children in Riyadh. *Saudi J Ophthalmol* 1994; 8: 9–14.
43. Aldebasi YH. Prevalence of amblyopia in primary school children in Qassim province, Kingdom of Saudi Arabia. *Middle East Afr J Ophthalmol* 2015; 22: 86–91.
44. Abolfotouh MA, Badawi I and Faheem Y. Prevalence of amblyopia among schoolboys in Abha city, Asir Region, Saudi Arabia. *J Egypt Public Health Assoc* 1994; 69: 19–30.

Visit SAGE journals online  
journals.sagepub.com/  
home/oed

 SAGE journals