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Current Social Determinants of Health and Social Risk Factors in Conditions of the Cornea: A Scoping Review

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Abstract

Purpose of Review: To achieve health equity in eye health and vision care, social determinants of health (SDoH) and the associated social risk factors must be addressed. To address SDoH and social risk factors in ophthalmology, they must first be identified. The purpose of this review was to determine the SDoH and social risk factors in conditions of the cornea that have most recently been explored.

Recent findings: This review identified social risk factors associated with all five domains of SDoH, as outlined by Health People 2030. The neighborhood and built environment was the domain identified the most for both exploration and observation. The social and community context domain was the least explored, and health care access and quality and social and community context domains were the least observed. The cornea condition explored the most in relation to SDoH was dry eye syndrome.

Summary: The findings from this review can inform clinicians on the social risk factors that could be screened for in eye care facilities, so patients can be connected with services to minimize the impact of social risk factors on cornea conditions. Furthermore, the findings have identified cornea conditions and domains of SDoH that are understudied which can be an area for future studies by vision researchers.

Keywords

Social Determinants of Health; Social Risk Factors; Cornea; Public Health; Health Equity

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Conflicts of Interest

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Introduction

The cornea plays significant roles in both the protection of the eye and refractive functions. The cornea is an important part of eye health and vision. There are several prevalent corneal conditions that threaten vision or eye function including dry eye syndrome (DES), keratoconus, keratitis, corneal dystrophies, and pterygium^[1]. When these conditions go untreated it can lead to vision loss, disability, and blindness. The World Health Organization states that blindness of the cornea is the fourth leading cause of blindness globally, after glaucoma, cataracts, and age-related macular degeneration. An estimated 10 million people globally have bilateral corneal blindness^[2]. Almost 80% of blindness due to the cornea is preventable^[3]. Thus, it is essential to understand the contributing factors to avoidable blindness to implement public health efforts and policy that will have the greatest impact for prevention.

It has been documented that social determinants of health (SDoH) are associated with eye health outcomes for several eye diseases including cataracts^[4], microbial keratitis^[5], and diabetic retinopathy^[6]. The United States (US) Department of Health and Human Services defines SDoH as “the conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks^[7].” Healthy People 2030 outlines five domains of SDoH which include neighborhood and built environment, economic stability, education access and quality, health care access and quality, and social and community context^[8]. Social determinants of health are estimated to account for 80–90% of modifiable health factors, while the medical care a patient receives only accounts for 10–20%^[9]. SDoH contributes to health disparities which are “health differences based on one or more health outcomes that adversely affects defined disadvantaged populations^[10].” Disadvantaged populations may experience more social risk factors, which describe how SDoH affect a patient^[11]. Social risk factors can include lower incomes, decreased educational attainment, poorer housing conditions, food insecurity, fewer support systems, and worse health care coverage^[12].

Thus, it is imperative to understand which SDoH and social risk factors have recently been identified to implement interventions to make eye health a population health imperative^[13]. It is essential to understand the gaps in the literature to understand which areas of SDoH and subsequent social risk factors have been understudied or not studied for diseases and conditions of the cornea. The purpose of this review is to examine SDoH and corresponding social risk factors in cornea conditions that have been studied since 2020. The goal was to determine where researchers should be concentrated to their work in order to deliver equitable care to patients and where clinicians should focus learning about SDoH and social factors that could affect their patient populations.

Methods

Arksey and O’Malley and Levac and colleagues’ proposed search frameworks were utilized for this scoping review which follows the JBI Manual for Evidence Synthesis: Chapter 11 - Scoping Reviews^[14–15]. Search strategy, potential databases, concepts, and search terms to obtain evidence were created with the guidance from an informationist at the

University of Michigan's Taubman Health Sciences Library in August 2022. Two study team members (PMH, MAW) reviewed both search terms and results for the databases and subsequently provided feedback to obtain the final searches for each of the databases which are presented in Appendix 1. Citations were managed with EndNote 20 (Clarivate, London, United Kingdom) and duplicate articles were also removed. The databases used for this review include Ovid MEDLINE, Embase (Elsevier), CINAHLComplete (EBSCO), PsycInfo (EBSCO), SocINDEX with Full Text (EBSCO), ERIC (ProQuest), Scopus (Elsevier), and Web of Science (Clarivate). The scoping review's final search strategy centers around the main concept of identifying SDoH and associated social risk factors related to cornea conditions. The review highlights publications from 2020–2022.

Selection of Evidence and Data Extraction

The process of reviewing citations was conducted in The Rayyan-Intelligent Systematic Review program (Rayyan Systems Inc., Cambridge, MA). Exclusion criteria were as follows: articles that are reviews, articles that studied individuals 17 years and under, case reports, or opinion pieces; articles that are not related to the cornea; studies that include cataracts, glaucoma, or external eye disease were excluded. We exclusively looked at articles written in the English language, as we were not able to provide translation of these articles. At least 2 screeners (PMH and MLA) reviewed sources at each level (title abstract and full-article review) and disagreements were reconciled by consensus or by a third screener (MAW). Scoping review screeners completed an initial training by reviewing the protocol, followed by a pilot test consisting of reviewing 1% of the articles to establish inter-rater reliability. Pilot screening commenced once 75% of agreement was met, and screeners reviewed the remaining articles. When completing the screening, at least 2 screeners reviewed each source at each level (title abstract and full-article review) and disagreements were reconciled by consensus or by a third screener (MAW). Figure 1 provides a flow chart of the reviewing process. In accordance with the PRISMA-ScR statement, a flowchart and narrative description of the evidence selection process was created as presented in Figure 1^[16]. Data extracted from the articles included: year of publication, author(s), country, type of study conducted, cornea condition, study outcomes (e.g., social risk factors identified in association with a specific cornea condition), and data analysis methodology. SDoH domains associated with the social risk factors identified were also determined^[7,11].

Search Results and Studies Included in the Review

A search was conducted in October 2022 in accordance with the search terms presented in Supplemental Figure 1 that was adapted from a validated SDoH search^[17]. The search yielded 10,072 records with 3,877 duplicates. The remaining 6,195 records were screened by title and abstract. A total of 144 articles were included for full text review in which 101 were excluded for various reasons including age requirements (59), publication type (25), publication year (2), did not include cornea condition (11), and article did not explore SDoH (4). A total of 43 articles (5 in the US, 38 international) that were published from February 2020 to October 2022 were included in this review. Both a narrative description and flowchart of the evidence selection process is provided in Figure 1.

The explored and observed social risk factors for cornea conditions in each article are found in Supplemental Table 1. Social risk factors for cornea conditions were organized into the five domains according to the codebook outlined in Supplemental Table 2. All included articles and the identified SDoH in each study are summarized in Table 1. Dry Eye/ Ocular Surface^[18*,19*, 20*, 21*, 22*, 23*, 24*, 25*, 26*, 27*, 28*, 29*, 30*, 31, 32*, 33*, 34*, 35, 36*, 37*, 38*] (21 articles) was the most prevalent cornea condition, followed by pterygium^[39*,40*,41*,42*] (4 articles), keratoplasty^[43**,44,45*,46*] (4 articles), keratoconus^[47*,48,49] (3 articles), cornea donation^[50,51*,52*] (3 articles), cornea thickness^[53*,54*] (2 articles), trachoma^[55*,56] (2 articles), corneal ulcers^[57*,58*] 2 articles, corneal arcus^[59*] (1 article), and corneal opacity^[60*] (1 article). Cornea donation for transplantation was also explored. The SDoH domains included 26 articles identified neighborhood and built environment, 21 articles identified economic stability, 19 articles identified education access and quality, 9 articles identified health care access and quality, and finally 6 articles identified social and community context. Studies explored various SDoH domains but may have only observed specific SDoH in their study. Neighborhood and built environment was the most explored (60.5%) and observed (44.7%) SDoH domain, for both US and international studies. Social and community context was the least explored (14.0%), and both social and community context and health care access and quality (11.6%) were the least observed. (Table 2) Economic stability (48.8%) was the second most explored SDoH domain, followed by education access and quality (44.2%), health care access and quality (20.9%), and social and community context (14.0%). For SDoH observed, education access and quality (18.6%) was the second most observed SDoH followed by economic stability (16.3%). Social and community context (11.6%) and health care access (11.6%) and quality were both the least observed. The US-based studies only explored two domains: neighborhood and built environment (60%) and healthcare access and quality (40%), while internationally all SDoH domains were explored. (Table 2)

Neighborhood and Built Environment

The social risk factors associated with the neighborhood and built environment domain are heavily focused on the physical environment, in this review. The social risk factors that were most commonly mentioned for this domain were air pollution, residing in a rural versus urban environment, and air conditioning and sun exposure. This is most likely due to the high representation of DES studies, and this condition is known to be associated with climate and environmental factors^[61]. Similarly, in all the Pterygium studies (Table 3), neighborhood and built environment was observed, but again only environmental exposures were explored such as sun exposure. Again, this is most likely due to established epidemiological risk factors such as outdoor occupation^[62]. The current research focuses on the physical environment highlighting gaps in research to assess the impact of the neighborhood environment. Specifically, neighborhood environment factors include lack of resources (i.e., access to healthy foods, neighborhood walkability, and community safety) within the community that could impact health and outcomes for various cornea conditions. In addition, future research could assess the impact of the home environment and outcomes for cornea conditions.

Economic Stability

Economic stability was explored in all conditions except keratoconus. This gap is interesting, as previous research has found that keratoconus has a lifetime economic cost to the patient. Rebenitsch and colleagues, in the U.S., found that there is a mean lifetime cost of more than \$25,000 after diagnosis^[63]. Recent research, published after the formal conclusion of the study search but before submission, found economic stability and social risk factors related to keratoconus severity and progression^[64**]. Ahmed and colleagues found in a US-based study that in a univariate analysis that unemployment was associated with worse keratoconus^[64**]. This research is important for examining current economic stability in the space of cornea conditions in the U.S. as no studies in this review examined U.S. economic stability associations. Future research should also expand to other social risk factors associated with this domain including household expenses and debt, as much of the research focused on employment, socioeconomic status, and income. Only one study examined wealth which could be further examined^[55**].

Education Access and Quality

The observed social risk factors for education access and quality was limited to education achieved (educational level and literacy)^[18**,39**]. This domain was explored for all of the cornea conditions. No associations were found for keratoplasty, keratoconus, and corneal arcus. Education access and quality domain was only explored in international studies, and not US-based studies. This was also most recently observed by Ahmed and colleagues, in which an association between limited English proficiency was associated with worse disease in a univariate analysis^[64**]. Future work should look more specifically at mechanisms behind access and quality that could further explain these associations with increased literacy and education.

Health Care Access and Quality

Social risk factors in the domain of health care access and quality explored both access (insurance, distance, and transportation) and quality (satisfaction with care, lack of attention from clinicians, and medical advice) aspects. This domain was not explored for several cornea conditions including pterygium, keratoconus, corneal arcus, and corneal thickness. Due to the eligibility criteria for Medicaid, patients with this insurance tend to have less money and worse health. In a US study conducted by Son et al. Medicaid insurance was a risk factor for repeated keratoplasty^[43**]. It is important to highlight that the previously mentioned study, by Ahmed and colleagues, also found an association between insurance type and severity and need for transplantation in keratoconus patients^[64**]. SDoH is comprised of multifactorial areas within the five domains and highlights the need to go beyond only exploring the medical care an individual receives. The findings from this review are promising that research is moving towards examining the other four domains that have historically been understudied. It is also important to highlight that though health care access and quality may have been more thoroughly examined in the past, it is also still important to continue to study this domain for surveillance over time across conditions of the cornea.

Social and Community Context

Only two social risk factors were identified for the social and community context domain and were only observed in two conditions, DES, and cornea donation for transplantation (Table 3). First, personal stress was observed as an outcome in patients with DES, rather than as a risk factor for the condition. These findings highlight the importance of understanding the social risk factors within SDoH both as a potential causative factor as well as an outcome after a diagnosis. For example, dry eyes may result in personal stress because of decreased quality of life, inability to complete work, and poor sleep quality. Secondly, previous studies have found a connection between organ donation and both religious and cultural aspects that can either hinder or increase a patient's willingness to donate^[51**,52**]. Gesesse and colleagues found that study participants in Ethiopia that identified as Christian were more likely to participate in cornea donation (AOR: 3.229; 95% CI:1.090 – 9.569) as compared to participants that identified as Muslim^[51**]. In a study conducted in Turkey, by Tuncer and colleagues, 40.4% of individuals surveyed stated that “religious and cultural concerns” was a reason for negative attitudes towards cornea donation^[52**]. Future research should explore additional aspects of this domain including support systems (via relationships with friends and family) and social integration within the community and the impacts on conditions of the cornea.

Conclusion

SDoH remains to be an understudied area for cornea conditions, despite recent calls to action in Ophthalmology and Medicine to achieve health equity in eye health and vision care. The most recent literature focuses on DES and the neighborhood and built environment domain of SDoH. There are significant gaps in studying other prevalent corneal conditions including corneal ulcers, keratoconus, and corneal opacity. Eye care clinicians can screen for these social risk factors to aid patients by connecting them with coordinated social services. By address their social needs, there is a potential to improve health to prevent disease and avoid poor eye and vision outcomes. Researchers can explore understudied cornea conditions and domains of SDoH and create interventions to address social risk factors to mitigate poor cornea eye outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key Points

- The Neighborhood and Built Environment was most explored and observed domain of Social Determinants of Health for conditions of the cornea.
- International studies explored all Social Determinants of Health domains, while studies based in the United States only explored neighborhood & built environment and health care access & quality.
- Dry eye syndrome was the condition with the most manuscripts recently published.
- Screening for social risk factors related to Social Determinants of Health domains at appointments can help to connect patients with resources to address their social needs.
- Future research is needed to understand Social Determinants of Health domains that have been understudied in conditions of the cornea.

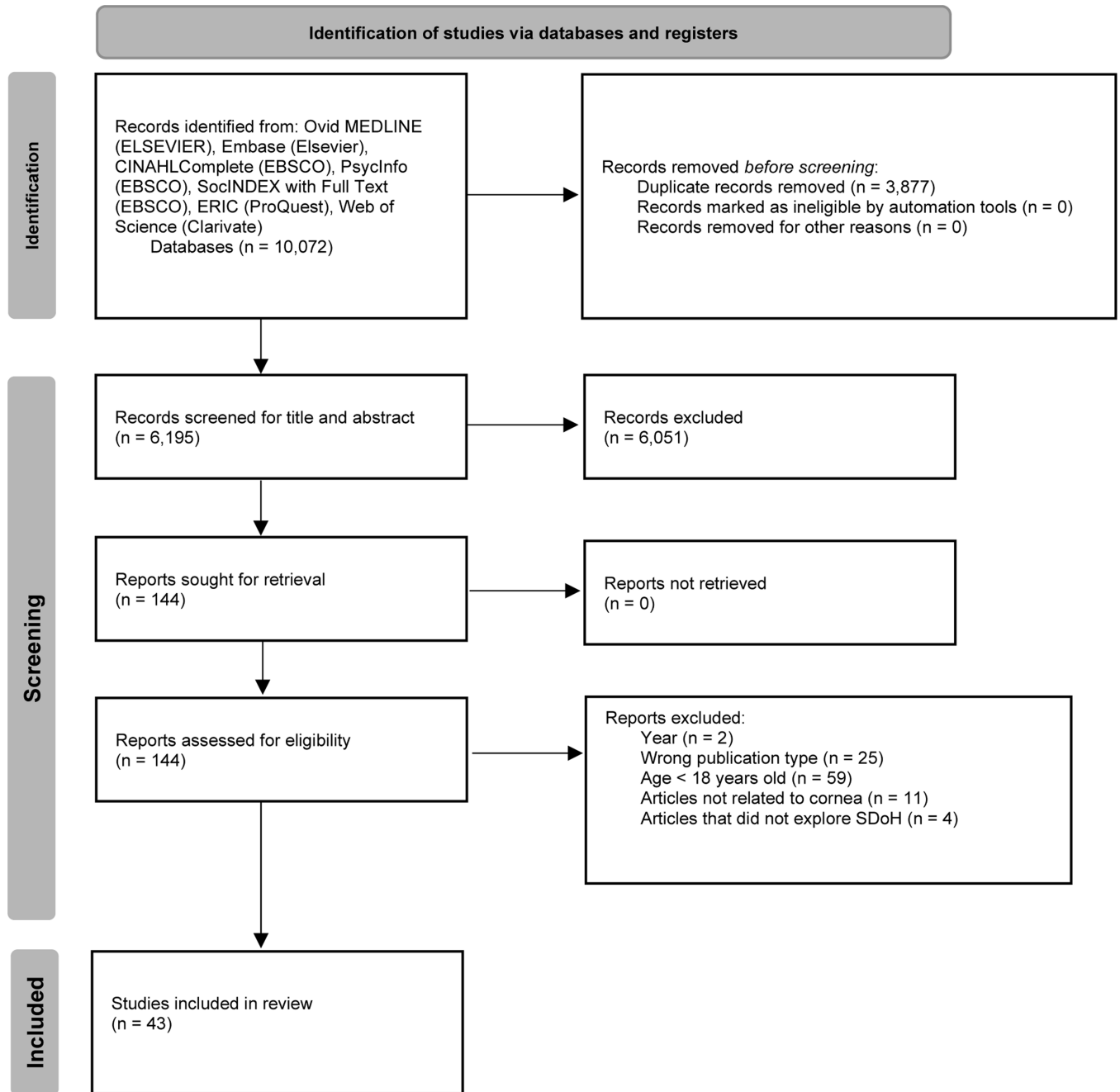


Figure 1.
Scoping Review PRISMA flowchart
PRISMA flowchart and narrative description of the evidence selection process.

Table 1. Explored and Identified Social Determinants of Health Domains for Conditions of the Cornea

Author / Year	Country	Explored Social Determinants of Health					Social Determinants of Health Associations Observed				
		Neighborhood and Built Environment	Economic Stability	Education Access and Quality	Health Care Access and Quality	Social and Community Context	Neighborhood and Built Environment	Economic Stability	Education Access and Quality	Health Care Access and Quality	Social and Community Context
Dry Eye Disease/ Ocular Surface Disease											
Yu et al. 2022	China										
Eijkelenboom et al. 2022	Netherlands										
Hao et al. 2022	China										
Garcia-Marques et al. 2022	Spain										
An and Kim et al. 2022	South Korea										
Gaber et al. 2022	Malaysia										
Tanavuvat et al. 2022	Thailand										
Liou et al. 2022	Taiwan										
Chen et al. 2022	China										
Bikbov et al. 2022	Russia										
Hu et al. 2021	China										
Choi et al. 2021	South Korea										
Ahn et al. 2021	South Korea										
Chung et al. 2021	Taiwan										
Chatterjee et al. 2021	India										
Recchini et al. 2021	United Kingdom										
Idarraga et al. 2020	United States										
Choi et al. 2020	South Korea										
Tandon et al. 2020	India										

Author /Year	Country	Explored Social Determinants of Health				Social Determinants of Health Associations Observed					
		Neighborhood and Built Environment	Economic Stability	Education Access and Quality	Health Care Access and Quality	Social and Community Context	Neighborhood and Built Environment	Economic Stability	Education Access and Quality	Health Care Access and Quality	Social and Community Context
Huang et al. 2020	United States										
Colorado et al. 2020	Australia										
Pterygium											
Tandon et al. 2022	India										
Fang et al. 2021	Singapore										
Fekadu et al. 2020	Ethiopia										
Mushtaq et al. 2020	India										
Keratoplasty											
Son et al. 2022	United States										
Srikumaran et al. 2022	United States										
Hua et al. 2021	China										
Ikpo et al. 2020	Kenya										
Keratoconus											
Munir et al. 2021	United States										
Baenninger et al. 2021	Switzerland										
Al-Amir et al. 2020	Saudi Arabia										
Cornea Thickness											
Bikbov et al. 2022	Russia										
Ma et al. 2022	China										
Trachoma											
Churko et al. 2021	Ethiopia										
Gebretnsae et al. 2020	Ethiopia										
Corneal Ulcer											
Hoffman et al. 2022	Nepal										
Anunga et al. 2021	Uganda										

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Author / Year	Country	Explored Social Determinants of Health				Social Determinants of Health Associations Observed					
		Neighborhood and Built Environment	Economic Stability	Education Access and Quality	Health Care Access and Quality	Social and Community Context	Neighborhood and Built Environment	Economic Stability	Education Access and Quality	Health Care Access and Quality	Social and Community Context
Corneal Arcus											
Hashemi et al. 2022	Iran										
Corneal Opacity											
Hashemi et al. 2022	Iran										
Cornea Donation											
Panigrahi et al. 2022	India										
Gessese et al. 2021	Ethiopia										
Tuncer et al. 2021	Turkey										

Table 2.

Domains of Social Determinants of Health and Percentage by Location

Social Determinants of Health Domains	Explored Social Determinants of Health			Social Determinants of Health Associations Observed		
	Total 43	United States 5	International 38	Total 43	United States 5	International 38
Neighborhood and Built Environment	60.5% (26)	60% (3)	60.5% (23)	46.5% (20)	60% (3)	44.7% (17)
Economic Stability	48.8% (21)	0% (0)	55.3% (21)	16.3% (7)	0% (0)	18.4% (7)
Education Access and Quality	44.2% (19)	0% (0)	50.0% (19)	18.6% (8)	0% (0)	21.1% (8)
Health Care Access and Quality	20.9% (9)	40% (2)	18.4% (7)	11.6% (5)	0% (0)	10.5% (4)
Social and Community Context	14.0% (6)	0% (0)	15.8% (23)	11.6% (5)	0% (0)	13.2% (5)

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Table 3. Domains of Social Determinants of Health and Percentage by Cornea Condition

Condition	Explored Social Determinants of Health						Social Determinants of Health Associations Observed					
	Neighbourhood and Built Environment	Economic Stability	Education Access and Quality	Health Care Access and Quality	Social and Community Context	Neighbourhood and Built Environment	Economic Stability	Education Access and Quality	Health Care Access and Quality	Social and Community Context		
Dry Eye Disease/Ocular Surface Disease (21)	71.4% (15)	33.3% (7)	19.0% (4)	4.8% (1)	19.0% (4)	52.4% (11)	14.3% (3)	9.5% (2)	4.8% (1)	14.3% (3)		
Pterygium (4)	100% (4)	50% (2)	75% (3)	0% (0)	0% (0)	100% (4)	0% (0)	25% (1)	0% (0)	0% (0)		
Keratoplasty (4)	0% (0)	50% (2)	25% (1)	75% (3)	0% (0)	0% (0)	0% (0)	0% (0)	25% (1)	0% (0)		
Keratoconus (3)	33.3% (1)	0% (0)	66.7% (2)	0% (0)	0% (0)	33.3% (1)	0% (0)	0% (0)	0% (0)	0% (0)		
Cornea Thickness (2)	100% (2)	50% (1)	50% (1)	0% (0)	0% (0)	100% (2)	0% (0)	50% (1)	0% (0)	0% (0)		
Trachoma (2)	50% (1)	100% (2)	100% (2)	50% (1)	0% (0)	50% (1)	50% (1)	50% (1)	0% (0)	0% (0)		
Corneal Ulcer (2)	50% (1)	100% (2)	50% (1)	100% (2)	0% (0)	50% (1)	50% (1)	50% (1)	2% (100%)	0% (0)		
Corneal Arcus (1)	0% (0)	100% (1)	100% (1)	0% (0)	0% (0)	0% (0)	100% (1)	0% (0)	0% (0)	0% (0)		
Corneal Opacity (1)	0% (0)	100% (1)	100% (1)	100% (1)	0% (0)	0% (0)	0% (0)	100% (1)	100% (1)	0% (0)		
Cornea Donation (3)	66.7% (2)	100% (3)	100% (3)	33.3% (1)	66.7% (2)	0% (0)	33.3% (1)	33.3% (1)	0% (0)	66.7% (2)		