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REVIEW OPEN

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Prevalence of Visual Impairment and Ocular Pathologies in Nursing Home Residents: A Systematic Review and Meta-analysis

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PURPOSE: Nursing homes play a crucial role in providing care to the ageing population; however, reports suggest nursing home residents experience difficulties accessing specific medical services, particularly eye care. This review aims to use the available data to find the pooled prevalence of visual impairment (VI) and blindness in the residents of nursing homes. This review also aims to propose future strategies to support the eye health of nursing home residents.

METHODS: The systematic review and meta-analysis were conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The online databases of PubMed/ Medline, Embase and Google Scholar were searched systematically for the keywords to identify articles reporting the prevalence of VI and blindness in nursing home residents in different geographical regions. Pooled prevalence of VI and blindness was then calculated using a random-effects model. The heterogeneity was quantified using I-squared statistics.

RESULTS: Eleven studies were selected for the review, of which nine involving 3436 subjects were selected for meta-analysis. The pooled prevalence of VI in the residents of nursing homes, calculated using a random-effects model, was 31% (95% CI: 26%–36%), while the pooled prevalence of blindness, calculated using a random-effects model, was 11% (95% CI 7%–16%). High heterogeneity was observed in the reported prevalence of VI ($I^2 = 89\%$) and blindness ($I^2 = 93.1\%$) across studies.

CONCLUSIONS: The prevalence of VI and blindness among nursing home residents was higher than the global prevalence of VI and blindness in the general population. The high heterogeneity between studies demonstrates the need for more investigations with more consistent visual acuity thresholds. A comprehensive eye examination is recommended for all residents before entering the nursing home and an annual eye examination thereafter to address preventable blindness and vision-related quality of life in nursing home residents.

Keywords: Blindness; Nursing homes; Ocular pathologies; Visual impairment

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INTRODUCTION

Loss of vision among the elderly is a major health care problem. In the global estimates of visual impairment (VI) and blindness 2010, 285 million people out of over 6.5 billion globally were estimated to have VI or blindness, of whom over 218 million people were 50 years and older [1]. There were more than 703 million people worldwide over the age of 65 years, and this number is expected to double to around 1.5 billion by 2050 [2]. Globally, more than 2.2 billion people have near or distance vision impairment. Only 36% of people with a distance vision impairment due to refractive error have received an appropriate pair of spectacles and only 17% of people with VI or blindness due to cataract have received access to quality surgery. Over one billion cases of VI could have been prevented or are yet to be addressed [3, 4].

There is also a regional variation in the prevalence of VI. High-income regions have a four times lower prevalence of distance VI as compared to low-and middle-income regions [3]. Distance and near VI due to uncorrected refractive error are also lower in high-income countries [4]. Globally, the most common causes of distance VI are undercorrected refractive error and/or cataracts, both of which are treatable/correctable conditions. Similarly, the most common cause of near VI is presbyopia. Lack of correction or under-correction of presbyopia has led to a higher rate of near VI [5]. Providing individuals with their correct spectacle prescription or getting cataract surgery could potentially lead to a significant reduction of VI [6–9].

Previous studies have shown that the elderly institutionalised population has higher rates of VI and blindness compared with the population living outside residential care [10–14]. The prevalence of VI and blindness among older institutionalised adults increases with age because of a higher prevalence of irreversible blindness, e.g., retinal diseases, age-related macular degeneration (AMD) and glaucoma, as well as reversible causes such as cataracts [6, 7, 13, 15].

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KEY POINTS

- Prevalence of visual impairment and blindness in nursing home residents is greater than the general population of a similar age group.
- There is a geographical variation in the prevalence of visual impairment and blindness in nursing home residents.
- Provision of regular comprehensive eye examinations for the nursing home residents is needed to reduce preventable blindness in this population.

A better understanding of visual status, eye disease patterns and the quality of life among the elderly residents of nursing homes is a significant step towards introducing strategies that help reduce VI in this population. Data on the prevalence of ocular diseases in nursing home residents is often limited and very few studies have been completed involving these residents. Due to the vulnerability of the resident population, many studies lack quality. This review aims to gather the available data on the prevalence and causes of VI and blindness in the residents of nursing homes worldwide. In addition, future strategies are suggested to reduce preventable blindness or identify and manage chronic illnesses that lead to eye diseases in nursing home residents.

Definitions of VI and blindness

The definition of VI and blindness depends on the regulatory bodies of different countries and the World Health Organization (WHO). The most widely used are the definitions by the WHO and the American Academy of Ophthalmology (AAO). While current definitions also include aspects of visual function, the definitions of VI and blindness from the WHO and AAO based on distance visual acuity (VA) are given in Table 1.

Table 1. Definitions of visual impairment (VI) and blindness.

Visual acuity range	WHO definition	AAO definition
Worse than 6/12–6/18	Mild VI	VI
Worse than 6/18–6/60	Moderate VI	VI
Worse than 6/60–3/60	Severe VI	Blindness
Worse than 3/60	Blindness	

AAO American Academy of Ophthalmology, *WHO* World Health Organization, *VI* visual impairment.

MATERIALS AND METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed for the systematic review [16]. A completed PRISMA 2020 checklist is provided as supplementary material (Additional file 1). The study protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO; registration number: CRD420251136478) and there was no systematic review protocol with similar research questions registered at the time.

Search Strategy

The online databases of PubMed/ Medline, Embase and Google Scholar were explored for keywords "nursing homes" OR "aged care" OR "care homes" OR "residential homes" OR "old age homes" AND "visual impairment" OR "ocular pathologies" OR "blindness" OR "cataract" OR "glaucoma". For the Google Scholar database (google.com), the keyword combination was used to search and manually screen relevant articles. The search was restricted to peer-reviewed original articles from 2000 to 2025. Studies published or translated into the English language involving participants over the age of 50 years were included in the review.

Study Selection

Abstracts of unique articles were reviewed and assessed by the primary author and studies that were not relevant were removed. Filtering included the removal of duplicates; removal based on abstract and removal based on a smaller sample size. All remaining articles were assessed through full text by the primary author. Articles found to report the prevalence of VI and eye diseases in institutionalised residents (nursing homes, care homes, aged care, old-aged homes or assisted living) were approved for data extraction. Only cross-sectional studies that included on-site VA testing to report VI were included in the review. Articles based on data from the existing eye examination records were excluded to maintain robustness in the extracted data. Selected articles were subjected to the Joanna Briggs Institute (JBI) critical appraisal checklist for studies reporting prevalence data [17]. The article selection steps are illustrated in Fig. 1.

Data Collection Process and Data Items

Data extraction was performed by the primary author for all studies included in the review. The following data were extracted: first author and year of publication; the country where the study was conducted; the age group of participants included in the study; the total included sample size; prevalence of VI and blindness as reported by the authors and causes of VI and blindness. This project followed all the ethical standards for research without direct contact with human or animal subjects.

RESULTS

The initial search yielded 314 articles. After an initial screening of the titles, 46 relevant articles that described the prevalence of eye conditions in nursing homes were selected. Abstract screening was carried out on all 46 articles and 21 were selected for full-text reading.

After full-text reading, 14 articles were selected for the review. However, based on the article quality assessment with the JBI critical appraisal checklist, 11 were selected for the review. A study by Marmula et al. [18] was excluded from the review as more recent data from the same region involving a greater sample size by the same author was available. Information extracted from 11 sources provided the data across nine countries and five continents is shown below in Table 2. The sources dated between 2005 and 2022, and five (45%) articles were published after 2015.

Data was gathered from three studies completed across three different countries in Asia and Europe, whereas a single study was considered from a single country for Oceania and Africa. Two studies conducted in different parts of the USA were considered for the American region. Data from other North and South American countries were not available to include in the review. As most studies reported the VI and blindness threshold as VA worse than 6/18 and 6/60, respectively, from the data available, the prevalence percentage reported in the 6/18 VA threshold for VI and 6/60 VA threshold for blindness was gathered to maintain uniformity.

Based on the available data, the prevalence of VI, blindness and ocular pathologies across different geographical regions is shown in Table 3.

Limitations of Previous Studies

While most of the studies (Table 2) have used larger sample sizes, the test parameters are inconsistent between investigations. Many studies failed to include the causes of VI and blindness. Most importantly, many lack data on the prevalence of uncorrected

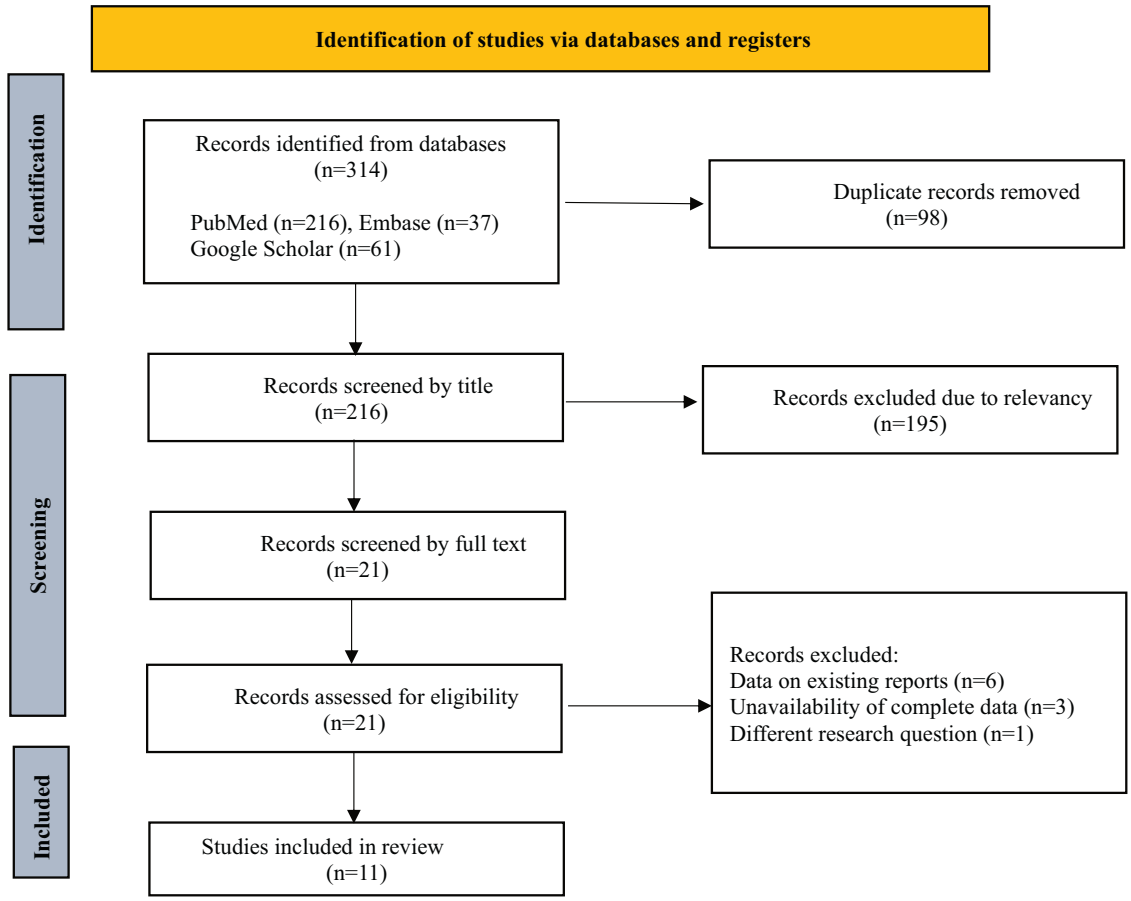


Fig. 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart illustrating the procedure of article selection

Table 2. Prevalence of visual impairment (VI) and blindness in selected studies.

Study	Country[a]	Average age (years)	Sample Size	VA Threshold		VI (%)	Blindness (%)
				VI	Blindness		
Bachmann et al. (2022) [19]	Switzerland	83.9 ± 9.7	540		-	-	-
Thederan et al. (2016) [20]	Germany	82.4 ± 9.2	203	6/18	3/60	37	8
Larsen et al. (2019) [26]	Germany	82.9 ± 9.8	566	6/18	6/60	22.61	7.95
Jee et al. (2005) [27]	Australia	82.4 ± 6.5	96	6/12	6/60	23.95	6.25
Elliott et al. (2013) [28]	USA	84.78 ± 7.81	144	6/18	6/60	34.09	4.55
Owsley et al. (2007) [15]	USA	81.73 ± 7.84	380	6/18	6/60	25.72	6.1
Sainz-Gomez et al. (2010) [29]	Spain	81.7 ± 6.6	288	6/18	6/60	31.94	14.93
Waked et al. (2007) [7]	Lebanon	77.74 ± 12.67	298	6/18	6/60	36.24	22.48
Mashige et al. (2020) [30]	South Africa	73.3 ± 4.6	118	6/18	6/60	46.61	16.94
Marmula et al. (2021) [10]	India	75 ± 8.8	1182	6/18	6/60	23.6	6.51
Dev et al. (2012) [6]	Nepal	74.34 ± 8.19	364	6/18	6/60	39.01	20.05

VA visual acuity.
[a]Studies are ordered based on United Nations Development Programme (UNDP) Human Development Index 2023 [31].

refractive error, which is one of the major causes of preventable blindness worldwide [4]. Due to the variations in the definition of VI and blindness between different governing bodies and the use of different VA charts, some studies failed to provide an accurate prevalence of VI and blindness.

Very few studies reported data on the visual field, yet the definition of VI and blindness can also include impairment in the field of vision. The current authors presume that a threshold visual field was not performed due to possible challenges in collecting reliable data within this population.

Meta-analysis

Overall, nine studies with a total sample size of 3436 participants were included to conduct a meta-analysis to determine the pooled prevalence of VI and blindness. Of the 12 studies selected for review, two were excluded from meta-analysis due to the

Table 3. Prevalence of ocular pathologies in residents of nursing homes in different geographical regions.

		Region										
		USA		**Europe**				**Africa**	**Oceania**	**Asia**		
Condition		Owsley et al. [15]	Elliott et al. [28]	Bachmann et al. [19]	Sainz-Gomez et al. [29]	Thederan et al. [20]	Larsen et al. [26]	Mashige et al. [30]	Jee et al. [27]	Waked et al. [7]	Marmula et al. [10]	Dev *et al.* [6]
Percentage with…	VI	25.72%	34.09%	–	31.94%	37%	22.61%	46.61%	23.95%	36.24%	23.6%	39.01%
	Blindness	6.1%	4.55%	–	14.93%	8%	7.95%	16.94%	6.05%	22.48%	6.51%	20.05%
Reduced VA/ refractive error[a]	Unclassified	–	–	–	–	42.90%	–	–	–	–	–	–
	VI	–	–	–	–	12.00%	25.40%	56.80%	16.70%	–	27%	–
	Blindness	–	–	–	–	23.30%	–	6.80%	–	–	–	–
Corneal issue(s)[b]	Unclassified	–	–	–	–	78.80%	–	20.00%	–	–	–	–
	VI	–	–	–	–	–	–	–	–	–	–	3rd
	Blindness	–	–	–	–	–	–	–	–	–	–	3rd
Cataract[c]	Unclassified	–	–	13.40%		43.30%		54.50%	–	–	–	–
	VI	–	–	-	44.60%	–	46.50%	–	–	–	46.53%	Leading
	Blindness	–	–	–	23.30%	–	38.70%	–		Leading	–	Leading
AMD (any stage)	Unclassified	–	–	26.60%	–	25.90%	–	3.60%	–	–	–	–
	VI	–	–	–	27.20%	–	42.30%	–	–	–	–	2nd
	Blindness	–	–	–	20.90%	–	58.10%	–	–	2nd	–	2nd
Glaucoma	Unclassified	–	–	8.20%	–	–	–	7.30%	–	–	–	–
	VI	–	–	–	–	–	11.30%	–	–	–	–	4th
	Blindness	–	–	–	–	–	16.10%	–	–	3rd	–	4th
Other retinal or optic nerve conditions[d]	Unclassified	–	–	11.00%	–	3.40%		14.65%	–	–	–	–
	VI	–	–	–	12%	–	8.40%	–	–	–	6.55%	5th
	Blindness	–	–	–	23.3%	–	22.60%	–	–	–	–	5th

Unclassified = does not distinguish between VI or Blindness. Often this is the percentage of participants who have a version of the condition. '–' = data not available.
AMD age-related macular degeneration, VA visual acuity, *VI* visual impairment.
[a]Inclusive of Myopia (Thederan et al. [20]) for VI and Blindness.
[b]Inclusive of keratoconjunctivitis sicca (Thederan et al. [20]) and corneal opacity (Mashige et al. [30], Dev et al. [6]).
[c]Thederan et al. [20] also reported that 7.4% had a secondary cataract.
[d]Inclusive of Diabetic Retinopathy (Lai et al. [32], Bachman et al. [19]), Optic Neuropathy (Lai et al. [32]), Epiretinal Gliosis (Thederan et al. [20]) and other retinal or optic nerve conditions (Larsen et al. [26], Mashige et al. [30], Waked et al. [7], Marmula et al. [10] and Dev et al. [6]).

Table 4. Pooled results outcome for visual impairment.

Model	Number of studies	Effect size and 95% Interval			Prediction Interval		Between study		Other heterogeneity statistics	
		Point estimate	Lower limit	Upper limit	Lower limit	Upper limit	Tau	TauSq	*Q*-value	*p*-value
Random effects	9	0.31	0.26	0.36	0.15	0.49	0.08	0.01	72.59	<0.001

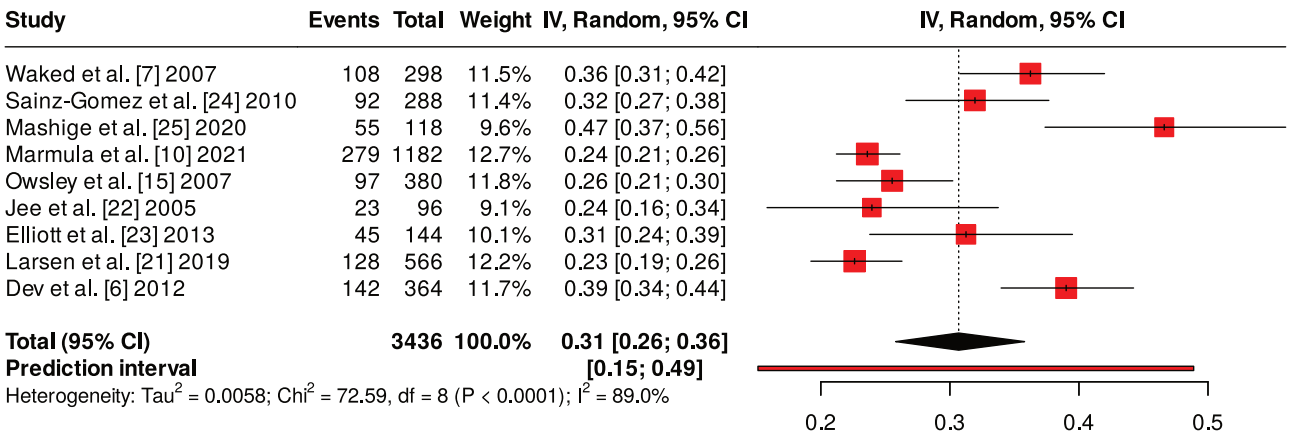


Fig. 2 Forest plot showing pooled prevalence of visual impairment. CI confidence interval, IV inverse variance

Table 5. Pooled results outcome for blindness.

Model	Number of studies	Effect size and 95% interval			Prediction interval		Between study		Other heterogeneity statistics	
		Point estimate	Lower limit	Upper limit	Lower limit	Upper limit	Tau	TauSq	*Q*-value	*p*-value
Random effects	9	0.11	0.07	0.16	0.01	0.30	0.10	0.01	115.33	<0.001

unavailability of data. Bachmann et al. [19] did not present adequate data on VI and blindness and Thederan et al. [20] reported no data for the required VA range.

Pooled Prevalence of VI

A total of nine studies quantified the prevalence of VI in nursing home residents. Using a random effects model with the inverse variance method and Freeman–Turkey Double arcsine transformation, the prevalence rates of VI ranged from 28% to 41%, reflecting the variation in geographic regions, diagnostic criteria and availability of eye care services.

The pooled prevalence of VI, calculated using a random-effects model, was 31% (95% CI: 26%–36%), which is higher than the global prevalence of VI of 3.44% in the general population [21]. As shown in Table 4, the *Q*-test for heterogeneity highlighted (*Q*-value of 72.59 with 8 degrees of freedom and $p < 0.001$) significant variation among the studies. I^2 was 89%, indicating that large variations among the studies are due to heterogeneity rather than sampling error. These variations could be due to the availability of eye care services in different geographical regions, as well as the inclusion of low and high-income nursing homes in the reported studies. The subgroup analysis by country and low/high income nursing homes could potentially clarify these variations, as pooled estimates may be misleading averages of fundamentally different populations.

The Forest plot (Fig. 2) describes the pooled prevalence with the heterogeneity observed between studies. The black diamond-shaped symbol indicates the pooled prevalence with upper and lower limits. The red plots represent the individual studies, with the horizontal straight line showing the range. The heterogeneity between studies can be observed from the position of red plots as seen from the dotted vertical line.

Pooled Prevalence of Blindness

Using a random effects model with the inverse variance method and Freeman-Turkey Double arcsine transformation, the prevalence rates of blindness ranged from 7% to 16%. The overall pooled prevalence of blindness calculated using a random-effects model was 11% (95% CI 7%–16%). As shown in Table 5, the pooled prevalence is higher than the global estimate of blindness of 0.49% [21]. The *Q*-test for heterogeneity showed a *Q*-value of 115.33 with 8 degrees of freedom and $p < 0.001$, indicating the large variability between the studies. I^2 was 93.1%, again, indicating variability due to heterogeneity between the studies rather than random chance.

The Forest plot (Fig. 3) describes a random effects model, including the effect size, within-study variance and the mean effect size.

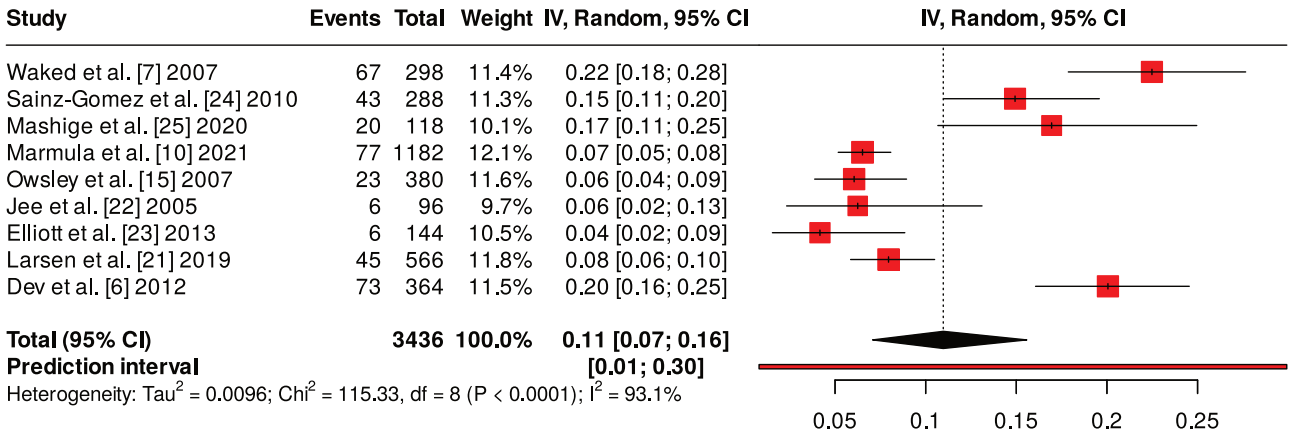


Fig. 3 Forest plot showing pooled prevalence of blindness. CI confidence interval, IV inverse variance

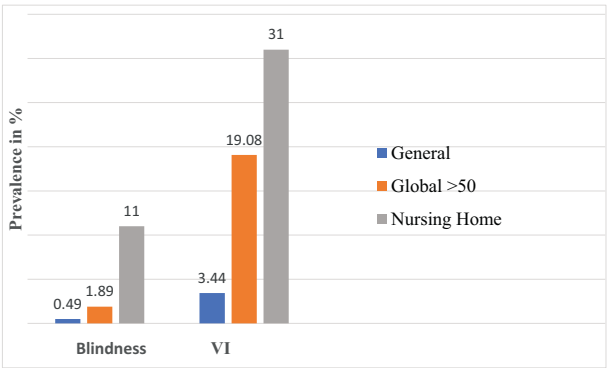


Fig. 4 A bar graph showing the comparison of visual impairment (VI) and blindness prevalence in the general and over 50 years of age groups with that of nursing home populations.

Global Comparison

The pooled estimate calculated in this study was compared with the global prevalence of VI and blindness in the general population, and specifically in the population above the age of 50 years, as reported by Bourne et al. [22]. Figure 4 represents the difference in prevalence across groups, with a significant gap among variables.

DISCUSSION

The prevalence of VI in the included studies from the USA was comparatively higher than the historic Baltimore Eye Study [9], which reported 18.8% VI (95% CI 15.4%–22.3%). However, the prevalence of blindness was much lower than reported in the Baltimore study, which observed 17% blindness (95% CI 13.7%–20.3%).

The prevalence of VI was relatively higher in the studies with samples from low-income residential care centres. In the study by Dev et al. [6] in the low-income nursing home in Nepal, the prevalence of VI was 49.10%. Similarly, for the study conducted by Marmula et al. [10] in low-income nursing homes in Hyderabad, India, the prevalence of VI was 26.8%. There can be many reasons for such a difference, including, but not limited to, access to eye care services.

It should also be noted that many cross-sectional studies exclude individuals over the age of 80 years due to frailty, which might lead to inaccuracy in the research reports [23, 24]. Most studies reported significant improvements in VA following refractive correction. In addition, cataract was the leading cause of preventable VI and blindness in all regions, while AMD was the second-leading cause of blindness in the Asian and European regions. Correction of refractive errors, as well as timely cataract surgery, could improve vision and vision-related quality of life in nursing home residents. In addition, early diagnosis of certain ocular pathologies, such as glaucoma, may allow nursing home residents to receive early treatment and could potentially slow down the progression of vision-threatening conditions.

The pooled prevalence of VI and blindness from the present study was significantly higher than the global prevalence of VI and blindness for all age groups. The estimate is also higher than the age-standardised prevalence for the group aged 50 years and older [4]. This difference can be strong evidence to support further provision of quality eye care services to the residents of nursing homes.

Current American Optometric Association guidelines recommend that adults from 40 to 64 years of age have a comprehensive eye evaluation at least every 2 years, whereas individuals 65 years and older should undergo eye examination annually, even if asymptomatic [25]. There are no specific guidelines for nursing home residents regarding eye examination. Considering the greater prevalence of VI and blindness among nursing home residents, we recommend a comprehensive eye examination involving at least ocular and family history, VA, preliminary tests of visual function, refractive status, intraocular pressure, eye teaming and eye health examination before entering the nursing home. Furthermore, we also recommend a comprehensive eye examination annually after entering the nursing home. Many regulatory bodies around the world have a minimum dataset of health parameters before and after entering a nursing home. We propose that a comprehensive eye examination be included in the minimum dataset of health parameters to reduce preventable blindness.

The overall prevalence of VI and blindness in nursing home residents was found to be higher than the global prevalence of VI and blindness. This gap addresses the need for a plan to ensure the eye health of nursing home residents. Uncorrected refractive errors, cataracts and macular degeneration are still among the major causes of VI and blindness in nursing home residents. Providing facilities such as routine eye examinations, free/subsidised glasses, access to cataract surgery and nutritional interventions would not only reduce the prevalence percentage but also improve the vision-related quality of life among nursing home residents.

Limitations

While this study estimates the prevalence of VI and blindness in nursing home residents worldwide, it does have several limitations. Many records related to public health issues are not published/publicly available and only published records were

used in this analysis. This creates a selection bias in the review and questions the generalisation of all nursing home residents. Also, due to the uneven reporting of VI and blindness due to variations in reporting thresholds in several studies, there can be slight under/overestimation of the actual prevailing condition. Although the selection process and data extraction were supervised by an expert, the abstracts were screened by a single reviewer, which may also contribute to selection bias. Additionally, analysing studies from over a decade ago might no longer be current due to changes in the availability of eye care facilities in different geographical regions.

CONCLUSION

This review highlighted the higher prevalence of VI and blindness amongst residents of nursing homes across different geographical regions. It is important to develop a standard and uniform diagnostic criterion for reporting the prevalence of VI and blindness. We recommend the availability of adequate eye care services to the residents of nursing homes worldwide. We also recommend a comprehensive eye examination before individuals enter the nursing home and annually thereafter, or as per the eye care practitioner's recommendation, for the residents of nursing homes.

DATA AVAILABILITY

No additional datasets were generated or analysed during the current study.

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AUTHOR CONTRIBUTIONS

KA, FH and JN did the conceptualisation. KA wrote the manuscript and prepared the tables. FH, GC, WR and JN reviewed, corrected and approved the manuscript. All

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