

GLOBAL EPIDEMIOLOGY, HUMANISTIC, AND ECONOMIC BURDEN OF ASTIGMATISM: A SYSTEMATIC LITERATURE REVIEW

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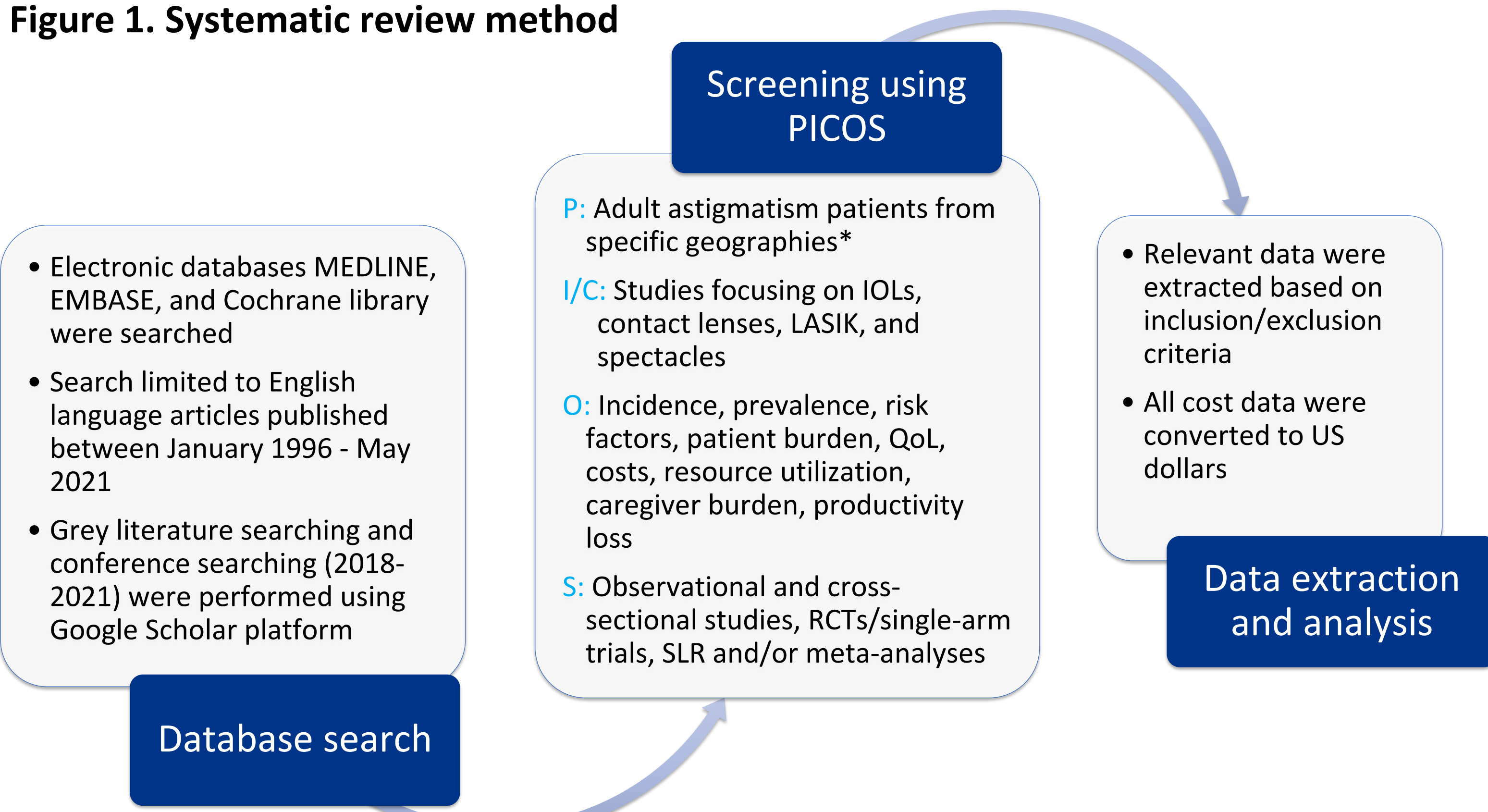
PURPOSE

- Astigmatism is a common refractive error caused by a meridional asymmetry in the curvature of the eye's cornea or lens, leading to a corresponding asymmetric refraction of light rays.¹ Astigmatism affects all age groups.^{2,3}
- The objective of this study was to identify published literature on epidemiology, patient and economic burden of astigmatism through a systematic literature review.
- The unmet needs of astigmatic patients with co-existing ocular conditions (such as cataract, glaucoma, dry eye, presbyopia, or macular degeneration) and the risks associated with untreated astigmatism were also reviewed.

METHODS

- A systematic literature review on astigmatism was conducted (Figure 1).

Figure 1. Systematic review method



IOLs: Intraocular lenses; LASIK: Laser in-situ keratomileusis; QoL: Quality of life; RCTs: Randomized clinical trial; SLR: Systematic literature review; UK: United Kingdom; US: United States.

*US, Canada, Brazil, China, Japan, South Korea, Australia, Europe (UK, Germany, France, Spain, Italy, Netherlands, Sweden)

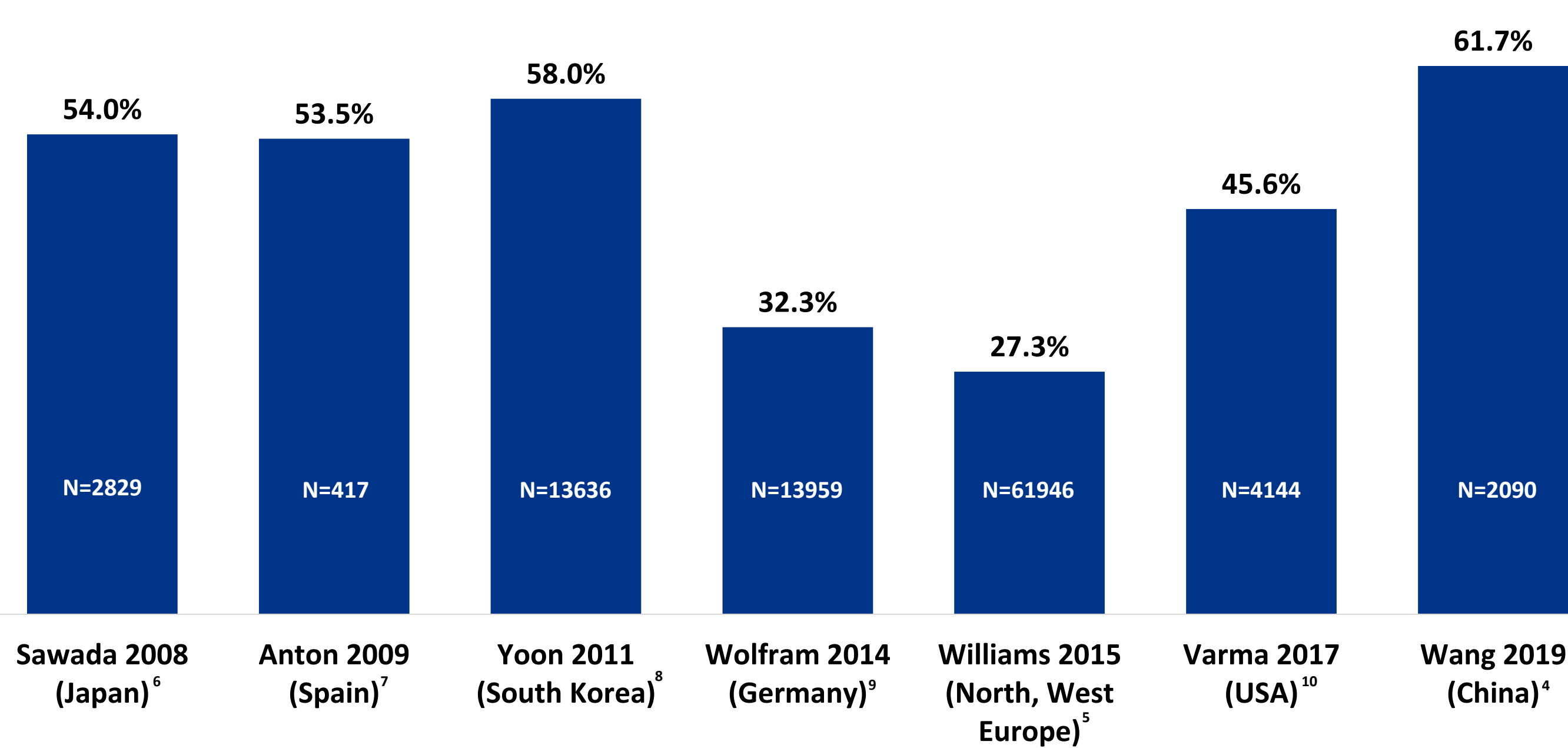
RESULTS

- The literature search yielded 6,804 citations, of which 125 met the inclusion criteria (Epidemiology: 68; Humanistic/Patient burden: 60; Economic burden: 6) and were included for evidence synthesis. Some of the included studies evaluated multiple relevant outcomes, and hence there was overlap among the studies' results.

EPIDEMIOLOGY

- Astigmatism was identified as the most common refractive error [estimated pool prevalence in adults: 40.4% (95% CI: 34.3%-46.6%)] across the WHO regions (Africa, Americas, South-east Asia, Europe, Eastern Mediterranean, and West Pacific).³
- Among various countries/regions, highest astigmatism prevalence was reported in a Chinese study (61.7%),⁴ while the lowest was reported in Northern and Western Europe (27.3%) (Figure 2).⁵

Figure 2. Astigmatism prevalence in the general population*



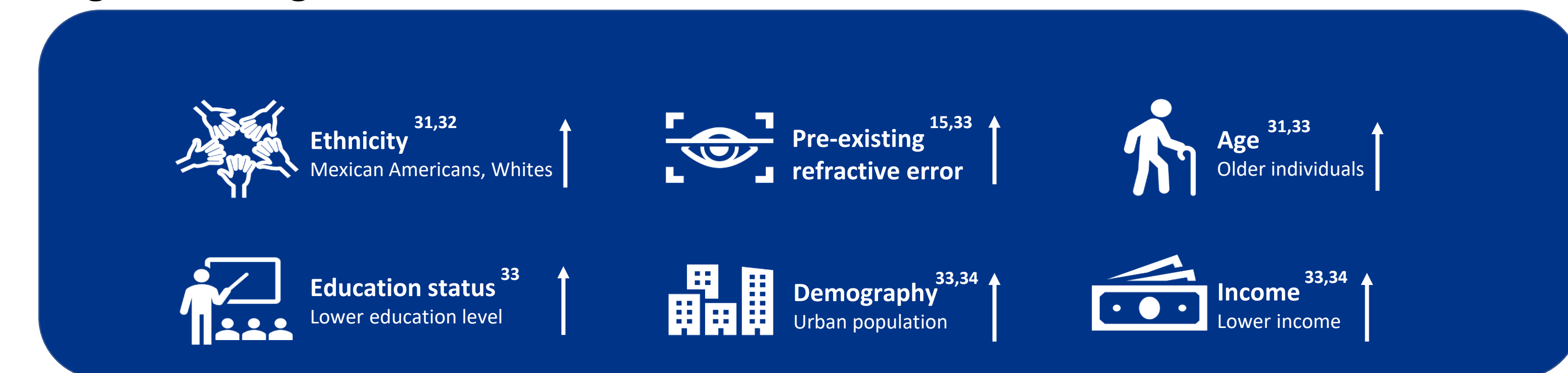
*Variation in prevalence rates could be attributed to different age groups evaluated in studies, differences in examination techniques, different sample sizes, residential area (urban vs rural) and response rates.

- With-the-rule (WTR) astigmatism was found to be more common in young individuals (≤ 40 years).⁷ In contrast, against-the-rule (ATR) and oblique astigmatism were more common in the aged population.⁷ ATR astigmatism was more common in males, and WTR astigmatism was common in females.^{11,12}
- When classified according to severity, the distribution of mild astigmatism (< 1.5 D) in the included studies ranged from 32.7%¹³ to 82.4%.¹⁴ In comparison, distribution rates as high as 39.1%¹⁵ and 34.2%¹³ were recorded for moderate (≥ 1.5 D to ≤ 2.5 D) and significant astigmatism (> 2.5 D), respectively.
- Factors associated with increased risk of astigmatism are reported in Figure 3.

PATIENT BURDEN DUE TO UNCORRECTED ASTIGMATISM

- Astigmatism is associated with a significant impact on patients' spectacle independence, vision-related QoL and overall well-being.¹⁶⁻¹⁹
- Higher spectacle burden (44.8%-85.0%),^{20,21} which persists even after conventional IOL implantation in patients with pre-existing astigmatism (PEA).^{16,22,23}
- Patients with uncorrected astigmatism suffered from increased rates of glare (52.9%-77.0%),^{16,24} halos (28.1%-80.0%),^{25,26} night-time driving difficulties (66.0%),²⁵ and risk of falls (particularly with oblique astigmatism), all leading to decreased QoL.²⁷
- Astigmatism correction with toric contact lenses provided better QoL vs spherical contact lenses,²⁸ while toric IOL implantation led to better QoL scores vs spherical IOL.²⁹
- Astigmatic patients performed vision-related tasks slower (-1 D: 8.9% slower, -2 D: 28.7% slower) and made more errors (-1 D: 38.1% more errors, -2 D: 370.0% more errors) compared to fully corrected astigmatic patients.³⁰

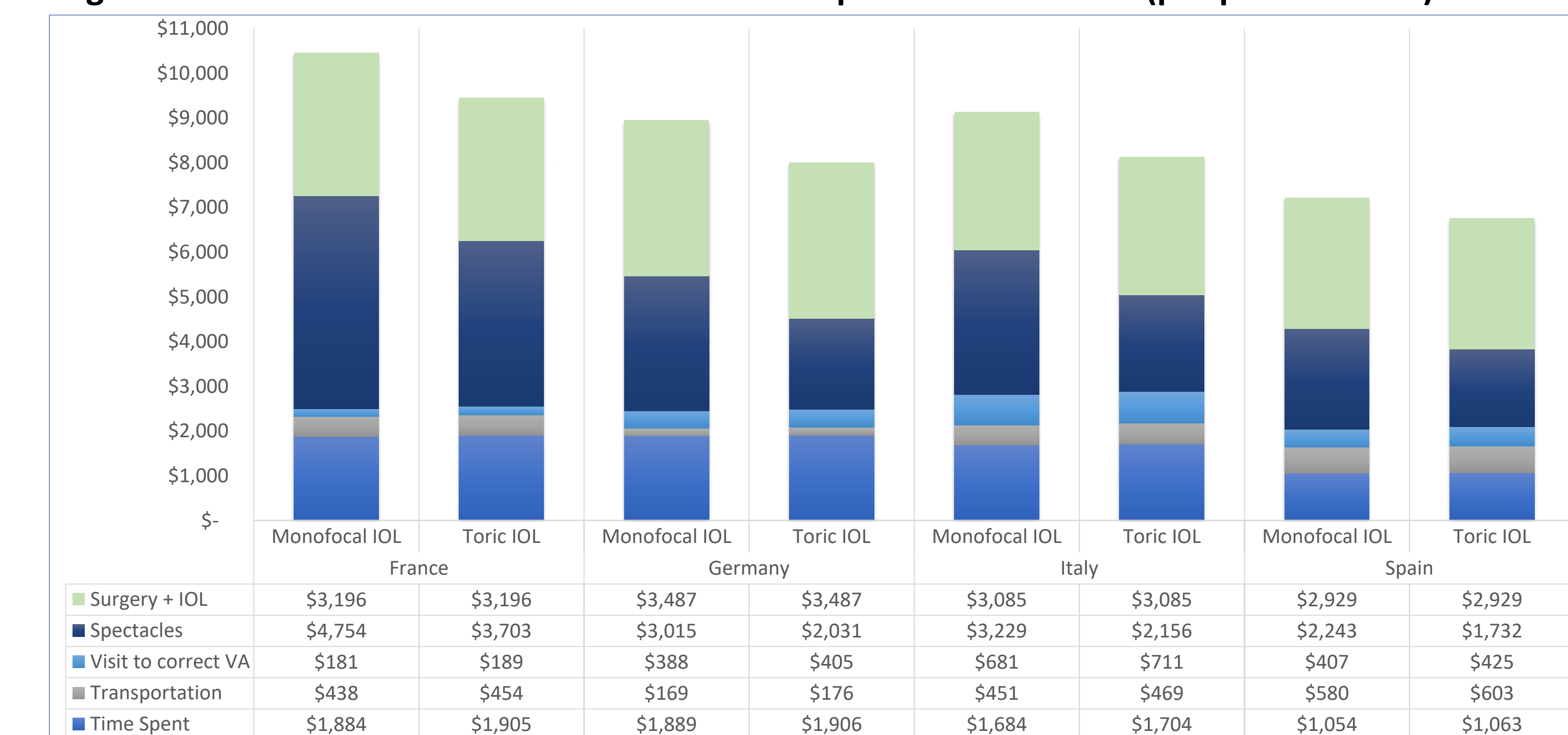
Figure 3. Astigmatism risk factors



ECONOMIC BURDEN

- Limited studies (n=6) evaluated astigmatism's direct/indirect economic impact on patients.^{30, 35-39}
- In cataract patients with pre-existing astigmatism who underwent surgery, post-operative spectacle cost, optometrist/ophthalmologist visits, transportation costs, and time spent to care for visual acuity contributed to the overall economic burden.^{35,37,38} The annual mean per patient productivity costs ranged from \$71-\$108 and mean informal care cost ranged from \$39-\$71 with a mean of 2.3-4.1 hours spent on informal care.³⁵
- For cataract patients with PEA who had undergone surgery, post-operative spectacle costs, optometrist/ophthalmologist visits, transportation costs, and time spent to care for visual acuity contribute to the overall economic burden (Figure 4).^{35,37,38}

Figure 4. Lifetime costs of treatment for cataract patients with PEA* (per patient costs)³⁷



IOL: Intraocular lens; PEA: Pre-existing astigmatism; US: United States; VA: Visual acuity; \$: US Dollars

*Based on a cost-consequence model developed from the societal perspective

CONCLUSIONS

- With the increase in global population and changing demographics, timely screening and correction of astigmatism are necessary to improve vision-related quality of life, and productivity among working-age adults, which imposes an economic burden on patients and their families.

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