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# Association between health insurance membership and cataract surgery utilization: A systematic review and meta-analysis

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## Abstract

**Purpose:** The purpose of this study is to determine the association between health insurance and the use of cataract surgical services.

**Methods:** We conducted a systematic review and meta-analysis according to preferred reporting items for systematic review and meta-analysis guidelines. A literature search was performed on PubMed and ProQuest databases, screening all related articles in the past 10 years (2012–2022). Data were analyzed using RevMan 5.3 software, with pooled effect estimates reported as an odds ratio (OR) with a 95% confidence interval (CI).

**Results:** A total of seven observational studies with a total of 27,054 patients with cataracts were identified and included in the meta-analysis. The pooling results of these studies suggest that there is a statistically significant association between health insurance membership and cataract surgery utilization. Those who have health insurance are 1.28 times more likely to use cataract surgical services (OR 1.28, 95% CI 1.18–1.39,  $P < 0.00001$ ).

**Conclusion:** There is an association between health insurance membership and cataract surgery utilization. These results can guide focused interventions aimed at enhancing cataract surgery coverage.

**Keywords:** Cataract; cataract surgery; health insurance; systematic review.

At least 2.2 billion people worldwide suffer from near- or distance-vision impairment. Nearly half of these instances – at least 1 billion – had vision impairment that might have been prevented or is still unaddressed, with cataract accounting for the majority of these cases.<sup>[1]</sup> Cataracts are

the primary cause of blindness, accounting for 15.2 million cases of blindness globally and remaining the second-largest cause of moderate-to-severe vision impairment for 78.8 million people over the age of 50.<sup>[2]</sup> A cataract is a pathologic condition where the opacification of the eye's



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lens, results in altered vision and even blindness. The most common cause is a senile cataract which is caused by aging.<sup>[3]</sup> The number of adults over 50 who are blind or have moderate-to-severe visual impairment has steadily increased since 1990, with refractive disorders and cataracts showing the greatest increases in prevalence and projected to keep rising in the future.<sup>[2,4]</sup> Surgical intervention is currently the only method for treating cataracts.<sup>[5]</sup>

The recommended feasible global target for effective coverage of cataract surgery by 2030 is a 30% point increase in effective coverage of cataract surgery.<sup>[6]</sup> Cataract surgical coverage is still inadequate in many places, especially in low-middle-income countries. There are still barriers that keep patients from utilizing the services. The expense of accessing eye care services is a substantial barrier and can severely limit the well-being and life opportunities for individuals, and their families. Many people are unable to get crucial eye health services due to the high expense of healthcare.<sup>[7]</sup> The cost was known most commonly reported barrier increasing usage of cataract surgery.<sup>[8]</sup>

To eliminate financial barriers, eye care must be financed through the general health system. Health insurance pool risk mechanisms are strongly desired to provide access for the whole population and reduce eye care costs.<sup>[9]</sup> Healthcare is funded by a range of sources, including government budgets, social health insurance agencies, and households. In high-income countries, the median out-of-pocket health expenditures amount to <20% of overall health expenditures, whereas in low-income nations, it exceeds 40%. Out-of-pocket expenses are a major financial burden on those who utilize the health services including cataract surgery services and a barrier to receiving health services, particularly for the poor.<sup>[7,10]</sup>

Despite the global importance of addressing cataract-related vision impairment, there is limited research concerning the association between health insurance membership and cataract surgery utilization. Filling this gap is essential to comprehend the role of health insurance in improving access to cataract surgery and reducing the burden of cataract-induced blindness. Understanding this relationship is also crucial for identifying barriers and informing policymakers to promote universal access to eye care services and contribute to the achievement of the 2030 global target for effective cataract surgical coverage.

## Materials and Methods

This systematic review employed a search strategy on PubMed and ProQuest databases to identify articles pub-

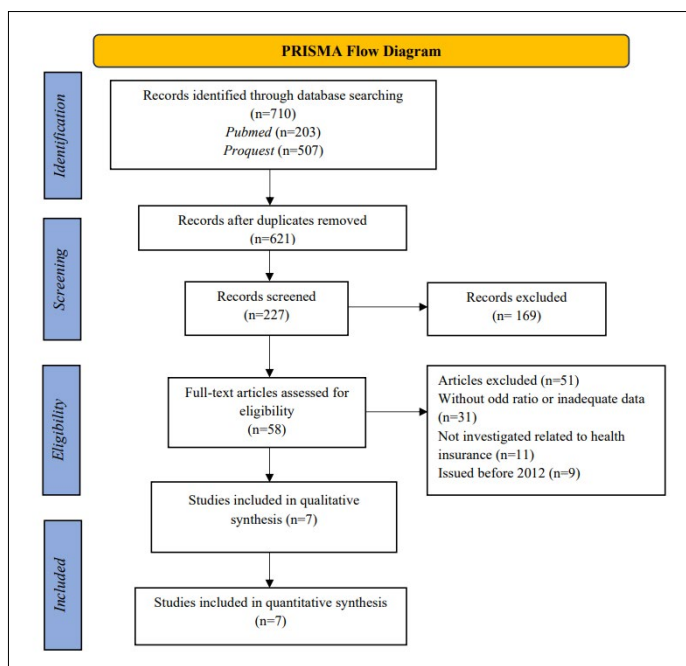
lished between January 2012 and December 2022. The objective was to explore the association between health insurance and cataract surgery. Specific keywords were used during the search process, including “cataract surgery,” “cataract surgical coverage,” “cataract surgical service,” and “cataract surgical uptake.” In addition, the search incorporated terms related to health insurance, namely, “health insurance,” and “insurance”. The study adhered to the preferred reporting items for systematic review and meta-analysis (PRISMA) guidelines. The methodology encompassed systematic search, article identification, screening, and feasibility analysis by following PRISMA guidelines.

This study encompassed a review of English literature published from January 2012 to December 2022, employing specific inclusion criteria. The inclusion criteria consisted of studies conducted in the general adult population, which reported either the odds ratio (OR) or the number of cataract surgeries performed with health insurance financing. Articles investigated the relationship between cataract surgeries and insurance financing membership; we included all types of health insurance including social health insurance, tax-based health insurance, and private insurance. Excluded from the study were letters, editorials, abstracts, and studies with insufficient data. For each study meeting the inclusion criteria, relevant information was collected, including the first author's name, country, year of publication, study design, sample size, P-value, and OR.

The assessment tool employed in this study was the Joanna Briggs Institute Instrument, consisting of eight items on a scale.<sup>[11]</sup> Only articles with a low risk of bias were included in the meta-analysis. The OR values from each study were extracted and entered into the RevMan 5.3 software. Statistical tests were utilized to evaluate heterogeneity between studies, and if the heterogeneity was found to be significant and/or high ( $P < 0.10$  and/or  $I^2 \geq 50\%$ ), the random effects model was utilized. Conversely, the fixed effects model was employed when the heterogeneity was not significant and/or low ( $P > 0.10$  and/or  $I^2 < 50\%$ ). To assess publication bias, a funnel plot was utilized as a visual tool.

## Results

Figure 1 shows the PRISMA flow diagram illustrating the process of the study selection. A systematic search was conducted on two databases, PubMed (203 articles) and ProQuest (507 articles), resulting in a total of 710 articles. After removing duplicates, a total of 621 articles were screened for titles and abstracts. We identified 227 articles that appeared potentially relevant to our study. After as-



**Fig. 1.** Preferred reporting items for systematic review and meta-analysis (PRISMA) flow diagram. n: number of articles.

sessing the eligibility, 58 articles underwent full-text review. Fifty-one articles were excluded due to: (1) Inadequate data or not reporting either the OR or the number of cataract surgery performed/number requiring cataract surgery (for manual OR calculation), (2) not specific for health insurance membership, and (3) published before 2012. Finally, seven articles were included in the meta-analysis.<sup>[12-18]</sup>

Table 1 provides an overview of the characteristics of the studies included in this systematic review, such as the first author’s name, country, published year, study design, sample size, P-value, and OR. A total of seven articles were identified from several countries including Ghana, Australia, China, Germany, India, and England. It has been documented in two out of seven articles that having health insurance and having cataract surgery are significantly related. All of the studies included in quantitative synthesis were classified as having a low risk of bias (Table 2).

A meta-analysis of seven observational studies (three cross-sectional studies and three cohort studies) with a total of 27,054 patients with cataracts was conducted to de-

**Table 1.** Characteristics of studies

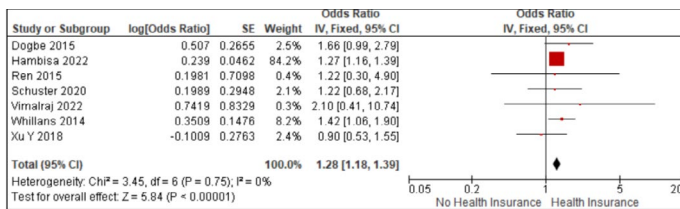
First Author	Country	Published year	Study design	Sample size	P-value	Odd ratio (CI)
Dogbe et al.	Ghana	2015	Cross-sectional	5571	P=0.055	1.66 (0.98–2.79)
Hambisa et al.	Australia	2022	Cohort	6229	P=0.0086	1.27 (1.16–1.39)
Ren et al.	China	2015	Cross-sectional	116	P=0.782	1.22 (0.30–4.90)
Schuster et al.	Germany	2020	Cohort	10,544	P=0.50	1.22 (0.69–2.15)
Vimalraj et al.	India	2022	Cross-sectional	161	P=0.363	2.10 (0.41–10.7)
Whillans and Nazroo	England	2014	Cohort	2091	P=0.01	1.42 (1.06–1.89)
Xu et al.	China	2018	Cross-sectional	2342	P=0.71	0.90 (0.52–1.55)

CI: Confidence interval.

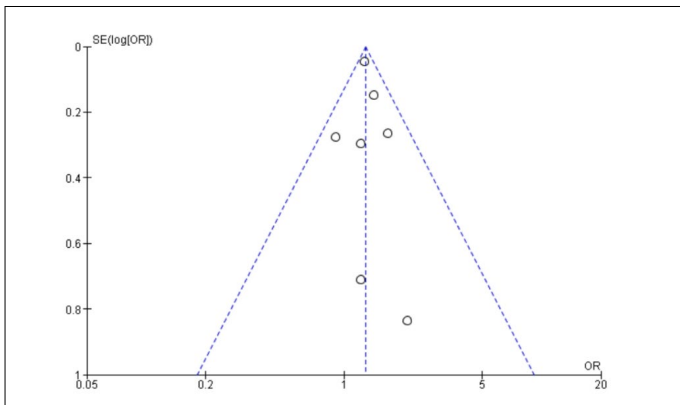
**Table 2.** Risk of bias of individual studies

First author (published year)	1	2	3	4	5	6	7	8	Summary item (%)	Interpretation
Ren et al.	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75	Low risk of bias
Xu et al.	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75	Low risk of bias
Hambisa et al.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	Low risk of bias
Whillans and Nazroo	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	Low risk of bias
Vimalraj et al.	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75	Low risk of bias
Schuster et al.	Yes	Yes	Yes	Yes	No	No	Yes	Yes	75	Low risk of bias
Dogbe et al.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	Low risk of bias

Eight question scale items for risk of bias. 1 = were the criteria for inclusion in the sample clearly defined? 2 = were the study subjects and the setting described in detail? 3 = was the exposure measured in a valid and reliable way? 4 = were objective, standard criteria used for measurement of the condition? 5 = were confounding factors identified? 6 = were strategies to deal with confounding factors stated? 7 = were the outcomes measured in a valid and reliable way? 8 = was appropriate statistical analysis used?



**Fig. 2.** Forest plot of odd ratio for cataract surgery utilization by health insurance membership. A black rectangle represents a pooled Odd Ratio of 1.28 (95% CI, 1.18-1.39) with P value<0.00001 from all studies (red squares). SE: Standard error; IV: Inverse variance; CI: Confidence interval; df: Degree of freedom.



**Fig. 3.** Funnel plot of odd ratio for cataract surgery utilization by health insurance membership. SE: Standard error; OR: Odd ratio.

termine the pooled effect estimates reported as OR with a 95% confidence interval (CI). Meta-analysis of cataract surgery utilization with health insurance membership showed pooled OR of 1.28 (95% CI 1.18–1.39) with P < 0.00001 which health insurance increases the likelihood of using cataract surgical services (Fig. 2). The heterogeneity was not significant (P = 0.75 and I<sup>2</sup> 0%) and a fixed effect model was adopted. Asymmetrical patterns on the funnel plot indicate a propensity of publication bias (Fig. 3).

## Discussion

The present study found a significant association between health insurance membership and cataract surgery utilization. Specifically, those who have health insurance are 1.28 times more likely to use cataract surgical services compared to those who do not have health insurance ownership.

The primary barrier impeding the utilization of cataract surgery services predominantly lies in the financial aspect, as revealed by 52.0% of individuals afflicted with cataract-induced blindness who cited their incapacity to finance the surgical procedure as the decisive factor for not undergoing cataract surgery.<sup>[19]</sup> A study by Broman et al.(2005) identified key predictors for the attainment of cataract surgery within the population, emphasizing the significance of ac-

cessible medical care: Individuals with regular health-care services or possessing health insurance exhibited notably elevated rates of cataract surgery coverage.<sup>[20]</sup> Affordabilities of eye care services are influenced by the cost of treatment, income level, indirect costs such as the loss of productivity and foregone earnings, and health insurance status. The main obstacles to receiving care, particularly in low- and middle-income nations, have been identified as direct costs, involved in accessing eye care, transportation, and associated pharmaceutical interventions.<sup>[21,22]</sup>

Several studies reveal that people without health insurance use eye care services at significantly lower rates than people with health insurance, which provides further evidence of the impact of direct costs for eye care.<sup>[23-25]</sup> This becomes a greater problem when services in the public sector are constrained by a lack of human resources and when the majority of individuals either lack the necessary health insurance coverage or cannot afford treatment in the private-for-profit sector.<sup>[7]</sup> Uninsured participants exhibit a higher propensity for unmet cataract surgery needs to be compared to their insured counterparts, necessitating a comprehensive expansion of health insurance coverage. The integration of insurance coverage serves as a vital strategy for policymakers, as it holds the potential to substantially mitigate unaddressed cataract surgery requirements.<sup>[26]</sup> Insurance coverage exhibits a strong correlation with enhanced health-care accessibility and superior health outcomes, enabling individuals with private health insurance to access the services of their preferred surgeons and expedite the surgical process.<sup>[13]</sup>

A study conducted by Xu et al. (2018) reported that financial impediments encompass more than mere health insurance aspects, encompassing transportation expenses and government policies about health insurance reimbursement for cataract surgery. These multifaceted factors exert a pronounced influence on the augmentation of cataract surgery rates.<sup>[18]</sup> The elimination of financial barriers through the elimination of cataract surgery costs emerges as a pivotal facilitator, fostering the utilization of treatment and health-care services.<sup>[17]</sup> According to the systematic review study of Erlangga et al. (2019), which compiles information on the benefits of health insurance on using health-care services, utilizing curative care generally revealed a favorable effect, with the majority of research showing a statistically significant positive effect. The impact on overall utilization is not affected by the type of insurance, with the majority of the research pointing to an increase in overall utilization by the insured.<sup>[27]</sup>

The treatment of other eye disorders and cataract surgery are already covered through social health insurance programs in some low- and middle-income nations. However, several nations have put restrictions on the total number of surgical procedures that can be claimed per accredited surgeon due to significant increases in the cost of cataract surgery and the accompanying expenses to health insurance carriers.<sup>[7]</sup> The utilization of cataract surgical services is significantly influenced by factors related to health insurance. The progressive escalation of total cataract surgery volumes annually corresponds to the expansion of health insurance coverage within the community, underscoring the substantial impact of insurance availability on cataract surgery rates.<sup>[28]</sup> Notably, cost represents a specific determinant linked to cataract surgery utilization, as surgical expenses significantly fluctuate while additional factors such as transportation costs to hospitals assume critical importance. Remarkably, the Indian context shows the transforming impact of cost-reduction initiatives and the availability of patient transportation, effectively enhancing coverage for cataract surgery.<sup>[29]</sup>

To enhance access to financial risk protection, countries should transition from relying on out-of-pocket payments to implementing compulsory prepayment systems with pooled funds. Although this shift may pose challenges for certain countries, priority should always be given to essential services and marginalized populations, particularly those living in poverty. When implementing insurance or other mandatory prepayment schemes, countries should ensure that the inability to pay does not hinder individuals from obtaining coverage.<sup>[30]</sup>

### Conclusion

Health insurance membership is an influencing factor in the usage of cataract surgical services to overcome the cost barrier related to cataract surgery. Those who have health insurance are more likely to use cataract surgical services. These results can guide focused interventions aimed at enhancing cataract surgery coverage.

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and/or Processing: F.S.F.; Analysis and/or Interpretation: F.S.F., S.A., T.A.W.; Literature Search: F.S.F., T.A.W.; Writing: F.S.F., T.A.W.; Critical Reviews: F.S.F., T.A.W.

**Conflict of Interest:** None declared.

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### References

1. World Health Organization (WHO). Blindness and Visual Impairment; 2022. Available from: <https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment>. Accessed May 05, 2023.
2. GBD 2019 Blindness and Vision Impairment Collaborators, Vision Loss Expert Group of the Global Burden of Disease Study. 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* 2021;9:e144–60.
3. Institute for Quality and Efficiency in Health Care (IQWiG). Cataracts: Overview. In: *InformedHealth.org*. Germany: IQWiG; 2019. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK390302>. Accessed Mar 17, 2023.
4. World Health Organization (WHO). Priority Eye Diseases; 2018. Available from: [www.who.int/blindness/causes/priority/en/index1.html](http://www.who.int/blindness/causes/priority/en/index1.html). Accessed May 05, 2023.
5. Moshirfar M, Milner D, Bhupendra CP. Cataract surgery. In: *StatPearls*. Treasure Island, FL: StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK559253>. Accessed May 05, 2023.
6. World Health Organization (WHO). Integrated People-Centered Eye Care, Including Preventable Vision Impairment and Blindness; 2021. Available from: [https://apps.who.int/gb/ebwha/pdf\\_files/WHA74/A74\(12\)-en.pdf](https://apps.who.int/gb/ebwha/pdf_files/WHA74/A74(12)-en.pdf). Accessed May 02, 2023.
7. World Health Organization (WHO). World Report on Vision; 2019. Available from: <https://www.who.int/publications/i/item/9789241516570>. Accessed May 02, 2023.
8. Aboobaker S, Courtright P. Barriers to cataract surgery in Africa: A systematic review. *Middle East Afr J Ophthalmol* 2016;23:145–9. [\[CrossRef\]](#)
9. Burton MJ, Ramke J, Marques AP, Bourne RR, Congdon N, Jones I, et al. The lancet global health commission on global eye health: Vision beyond 2020. *Lancet Glob Health* 2021;9:e489–551. [\[CrossRef\]](#)
10. Xu K, Soucat A, Kutzin J, Brindley C, Vande Maele N, Touré H, et al. Public Spending on Health: A Closer Look at Global Trends. Geneva: World Health Organization (WHO); 2018. Available from: <https://www.who.int/publications/i/item/WHO-HIS-HGF-hfworkingpaper-18.3>. Accessed May 06, 2023.
11. Moola S, Munn Z, Tufanaru C, Aromantaris EC, Sears K, Sfect R, et al. Systematic review of etiology and risk In: *JBIM Manual for Evidence Synthesis*. Ch. 7. Adelaide: Joanna Briggs Institute;

2020. Available from: <https://synthesismanual.jbi.global>. Accessed May 05, 2023. [CrossRef]
12. Ackuaku-Dogbe EM, Yawson AE, Biritwum RB. Cataract surgical uptake among older adults in Ghana. *Ghana Med J* 2015;49:84–9. [CrossRef]
  13. Hambisa MT, Dolja-Gore X, Byles J. Application of Andersen-Newman model to assess cataract surgery uptake among older Australian women: Findings from the Australian longitudinal study on women's health (ALSWH). *Aging Clin Exp Res* 2022;34:1673–85. [CrossRef]
  14. Ren X, Snellingen T, Gu H, Assanangkornchai S, Zou YH, Chongsuvivatwong V, et al. Use of cataract surgery in urban Beijing: A post screening follow-up of the elderly with visual impairment due to age-related cataract. *Chin Med Sci J* 2015;30:1–6. [CrossRef]
  15. Schuster AK, Nickels S, Pfeiffer N, Schmidtman I, Wild PS, Münzel T, et al. Frequency of cataract surgery and its impact on visual function—results from the German Gutenberg health study. *Graefes Arch Clin Exp Ophthalmol* 2020;258:2223–31.
  16. Vimalraj AN, Anitha A, Amal AV. Prevalence, barriers and gender inequalities in cataract surgical coverage in a rural village in South India. *Eur J Mol Clin Med* 2022;9:3123–32.
  17. Whillans J, Nazroo J. Equal access, (Un) equal uptake: A longitudinal study of cataract surgery uptake in older people in England. *BMC Health Serv Res* 2014;14:447. [CrossRef]
  18. Xu Y, He J, Lin S, Zhang B, Zhu J, Resnikoff S, et al. General analysis of factors influencing cataract surgery practice in Shanghai residents. *BMC Ophthalmol* 2018;18:102. [CrossRef]
  19. Olokoba L, Mahmoud O, Adepoju, F, Olokoba A, Durowade K. Evaluation of the community cataract surgical services of a university teaching hospital using cataract surgical coverage in Nigeria. *Ethiop J Health Sci* 2016;26:109–16. [CrossRef]
  20. Broman AT, Hafiz G, Muñoz B, Rodriguez J, Snyder R, Klein R, et al. Cataract and barriers to cataract surgery in a US Hispanic population: Proyecto VER. *Arch Ophthalmol* 2005;123:1231–6.
  21. Ramke J, Petkovic J, Welch V, Blignault I, Gilbert C, Blanchet K, et al. Interventions to improve access to cataract surgical services and their impact on equity in low-and middle-income countries. *Cochrane Database Syst Rev* 2017;11:CD011307.
  22. Mtuya C, Cleland CR, Philippin H, Paulo K, Njau B, Makupa WU, et al. Reasons for poor follow-up of diabetic retinopathy patients after screening in Tanzania: A cross-sectional study. *BMC Ophthalmol* 2016;16:115. [CrossRef]
  23. Morales LS, Varma R, Paz SH, Lai MY, Mazhar K, Andersen RM, et al. Self-reported use of eye care among Latinos: The Los Angeles Latino eye study. *Ophthalmology* 2010;117:207–15.e1.
  24. Center for Disease Control and Prevention (CDC). Eye-care utilization among women aged > or =40 years with eye diseases--19 states, 2006-2008. *MMWR Morb Mortal Wkly Rep* 2010;59:588–91.
  25. Zhang X, Lee PP, Thompson TJ, Sharma S, Barker L, Geiss LS, et al. Health insurance coverage and use of eye care services. *Arch Ophthalmol* 2008;126:1121–6. [CrossRef]
  26. Richter GM, Chung J, Azen SP, Varma R, Los Angeles Latino Eye Study Group. Prevalence of visually significant cataract and factors associated with unmet need for cataract surgery: Los Angeles Latino eye study. *Ophthalmology* 2009;116:2327–35.
  27. Erlangga D, Suhrcke M, Ali S, Bloor K. The impact of public health insurance on health care utilisation, financial protection and health status in low-and middle-income countries: A systematic review. *PLoS One* 2019;14:e0219731. [CrossRef]
  28. Chen X, Chen C, Zhang, Y, Yuan R, Ye J. The effect of health insurance reform on the number of cataract surgeries in Chongqing, China. *BMC Health Serv Res* 2011;11:67. [CrossRef]
  29. Lewallen S, Courtright P. Recognising and reducing barriers to cataract surgery. *Community Eye Health* 2000;13:20–1.
  30. Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S, et al. High-quality health systems in the sustainable development goals era: Time for a revolution. *Lancet Glob Health* 2018;6:e1196–252. [CrossRef]