



Trend in Cataract Surgical Rate in Iran Provinces

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Abstract

Background: The aim of this study was to determine the trend of changes in Cataract Surgical Rate (CSR) in the provinces of Iran during 2006 to 2010 and identify high risk areas.

Methods: This report is part of the national Iranian CSR Study. The percentage change in CSR in 2010 compared to 2006 was conducted in each province, retrospectively. One hundred and ten centers were chosen from all provinces, to determine CSR in each, the weight of major (>3,000 annual surgeries) and minor (3,000 annual surgeries or less) centers was calculated based on the number of selected centers, and multiplied by the number of surgeries in each province.

Results: In eight provinces, CSR was decreased by 1-60%. One province (Booshehr) showed no change. Eighteen provinces had 2-79% increase. No 2006 data was available in three provinces. North Khorasan had the most decrease while Kerman had the most increase in CSR. Six of these 8 provinces had CSR>3,000 despite a decrease in 2010, but North Khorasan had CSR<3,000 over the whole 5 year period. In 4 provinces, CSR had a gap from 3,000 despite an ascending trend, and in two, the gap was quite considerable.

Conclusion: Although CSR has an improving trend in most provinces in Iran, it is decreasing in some provinces, and despite an already low CSR, the exacerbation continues. The growing population of over 50 year olds calls for prompt measures in such provinces. Even in improving provinces, some lag behind the minimum recommended by WHO, and the growth rate of the over 50 population reveals the necessity of immediate planning.

Keywords: Cataract Surgical Rate, Epidemiology, Iran

Introduction

Vision 2020: the Right to Sight is the joint program of the WHO and the International Agency for the Prevention of Blindness (IAPB) for elimination of avoidable blindness. Since cataract is the leading cause of blindness throughout the world (1), the goals of this program include increasing the number of cataract surgeries and enhancing their quality to achieve satisfactory visual acuity

and vision related quality of life in affected patients (2).

Cataract surgical rate (CSR) or the number of cataract surgeries per million per year, is one of the WHO indicators for quantifying cataract surgical services (3). It is affected by the age structure of the population, the incidence and prevalence of cataract, and the visual impairment threshold for

cataract surgery (4). WHO recommends a CSR of 3,000 as the minimum necessary (3), and the global target is 2,000-5,000 (5).

According to an Iranian national survey, the CSR in 2005 was 1,331 (6), and lagged far behind the recommended minimum or even the minimum global target. In light of improved facilities and surgical equipment in recent years, it was expected this rate to have improved as well. Thus, the survey was repeated for the 2006-2010 period to determine the percentage improvement and the percentage increase required to close the gap. Knowledge of this trend is an essential element for health planning and policy making.

Since overall CSR changes did not reflect non-homogenous changes throughout the country, the aim of this report was to describe five year CSR changes on a provincial level which is the first level of subdivisions, and examine the rate of CSR increase or decrease in 2010 compared to 2006 in each province.

Materials and Methods

Study design

In Iran, provinces are the first level of national subdivisions. Each province is further subdivided into counties which are comprised of districts, and each district has one or more cities and/or one or more rural agglomerations. Every province has a capital city which is known as the focal political, economic, cultural, geographic, and social center of the province.

In this retrospective study, which is part of the cross-sectional 2011 CSR survey in Iran, sampling was done from the capitals of all 30 provinces as

well as other cities that had cataract surgical centers. The samplings team was trained by an ophthalmologist to familiarize them with surgical records and data extraction before commencing the study. First, a list of all cataract surgical centers by province was obtained from the Ministry of Health, Treatment, and Medical Education. Sampling was done after identifying all surgical centers capable of accommodating eye surgeries, and 110 centers were selected in the study. Inclusion criteria were cataract surgery being recorded in the patient charts and the charts being complete.

Sampling and Statistical analysis

To calculate the 2006 and 2010 CSR in the selected surgical centers, a random week was picked in each season for each surgical center after excluding the first two weeks of the year which are a national holiday, and all records of surgeries performed during these weeks were reviewed. The total number of surgeries done in these 4 weeks was multiplied by 50/4 (12.5) to represent the total annual number of surgeries in a given center. Coefficients for major (>3,000 annual surgeries) and minor centers (<3,000 annual surgeries) were computed separately for each province based on the number of centers randomly selected for the study from each province. The 2006 and 2010 CSRs were then determined based on the 2006 and 2010 populations of each province which were obtained from the Statistics Center of Iran. Data extraction was conducted by a team of 10 trained staff under supervision of an ophthalmologist.

The following equation was used to compute CSR in each province:

$$CSR = \frac{[\text{Number of cataract surgeries at major centers} \times 12.5 \times \text{weight of major centers of the province}] + [\text{Number of cataract surgeries at minor centers} \times 12.5 \times \text{weight of minor centers of the province}]}{\text{Population of the province in the given year}}$$

After determining 2006 and 2010 CSRs, we used their differences and percentage of change to demonstrate the trend of CSR changes in each province. Data were analyzed by g Microsoft Excel.

Ethical notes

This study was done retrospectively using data in patient charts. Extracted data did not include personal identifiers; they were coded and confidentiality was observed. All study stages were in accordance with the Declaration of Helsinki.

Results

Table 1 contains provincial CSR information. For three provinces - Zanjan, Kohgiluyeh and Boyer-Ahmad, and Ilam – 2006 data were not available. Of the 27 provinces entered in the analyses, 8 provinces (29.6%) showed a CSR decrease of 1-60%. One province (Booshehr) showed no

change, and in 18 provinces (66.7%), CSR increased by 2-79%. The greatest decrease was observed in data from North Khorasan Province and the greatest CSR increase occurred in Kerman Province. This is while the over 50 population grew by 31% in North Khorasan Province and 39% in Kerman Province.

Table 1: Five year changes in cataract surgical rate (CSR) by province from 2006 to 2010

Province	Increase in over 50 population (%)	Number of cataract surgeries in 2006	Number of cataract surgeries in 2010	CSR-2006 (CI 95%)	CSR-2010 (CI 95%)	Five year change in CSR (%)	Five year change in cataract surgery (%)
North Khorasan*	31	1663	1113	2048 (1950-2147)	1282 (1207-1357)	-60	-33
Sistan and Baluchestan*	25	10050	8250	4178 (4096-4259)	3255 (3185-3325)	-28	-18
Qazvin*	33	7288	6045	6375 (6229-6521)	5031 (4904-5157)	-27	-17
Semnan*	38	2665	2406	4515 (4344-4686)	3812 (3660-3964)	-16	-10
Ardabil	27	6775	5963	5516 (5385-5647)	4776 (4655-4897)	-15	-12
Khuzestan*	34	18885	17548	4418 (4355-4481)	3872 (3815-3929)	-14	-7
Kermanshah	33	12625	12500	6718 (6601-6834)	6426 (6314-6538)	-5	-1
Kordestan*	30	4275	4375	2968 (2880-3057)	2929 (2842-3016)	-1	+2
Booshehr*	37	7250	8450	8180 (7993-8368)	8180 (8007-8354)	0	+17
Hamadan	31	10800	11425	6341 (6222-6460)	6498 (6379-6617)	+2	+6
Qom	39	6213	7363	5935 (5788-6082)	6393 (6247-6538)	+7	+19
East Azerbaijan	30	28852	32861	8007 (7915-8099)	8823 (8728-8918)	+9	+14
Mazandaran*	36	15331	18488	5246 (5162-5323)	6014 (5928-6101)	+13	+21
West Azerbaijan	34	9006	11188	3134 (3070-3199)	3632 (3564-3699)	+14	+24
Yazd*	37	3100	4000	3129 (3019-3239)	3723 (3608-3838)	+16	+29
Tehran (including Alborz)	42	139385	151871	10385 (10330-10439)	12465 (12403-12528)	+17	+9
Razavi Khorasan	35	25575	33838	4573 (4517-4629)	5645 (5585-5705)	+19	+32
Fars	39	41275	54847	9517 (9426-9609)	11932 (11833-12031)	+20	+33
Golestan*	36	1813	2563	1121 (1069-1172)	1442 (1386-1498)	+22	+41
Markazi	34	3775	5163	2794 (2705-2883)	3651 (3552-3751)	+23	+37
Hormozgan*	40	2925	4575	2084 (2008-2159)	2899 (2815-2983)	+28	+56
Chahar Mahal and Bakhtiari*	33	313	525	364 (324-405)	586 (536-637)	+38	+68
South Khorasan*	25	263	488	412 (363-462)	736 (671-801)	+44	+86
Gilan	31	8106	16576	3371 (3298-3444)	6682 (6580-6783)	+50	+104
Lorestan*	35	7433	15660	4330 (4232-4429)	8927 (8788-9066)	+51	+111
Isfahan	37	20588	47889	4516 (4454-4577)	9815 (9727-9902)	+54	+133
Kerman	39	3125	16525	1178 (1137-1219)	5623 (5537-5708)	+79	+429

2006 data was not available for Zanjan, Kohgiluyeh and Boyer-Ahmad, and Ilam provinces.

* These provinces had no major center (more than 3,000 surgeries annually).

CSR decrease was more than 10% in 6 provinces (22.2%) and less than 10% in 2 provinces (7.4%). CSR increase was more than 10% in 3 provinces (11.1%) and less than 10% in 15 provinces (55.5%). In two provinces - Booshehr and Kurdistan – CSR showed no change despite an increase in the number of cataract surgeries.

Discussion

The objective of this study was to show the trend of change in each province and identify high risk zones.

Globally, cataract is responsible for 51% of all cases of blindness around the world, and 49% in the eastern Mediterranean Region (7). Factors affecting this variation include the incidence and prevalence of cataract, the CSR, the cataract surgical coverage, and visual outcome of cataract surgery (8). Studies in various populations have reported decreased vision related quality of life (VRQoL) among cataract patients (9-11), and in developing countries, cataract is responsible for disability adjusted life years (DALYs) of over 90% (12). This is while cataract surgery can improve VRQoL quite tangibly (13-15). In developed countries, the onset of cataract is after the age of 50 years, but in developing countries, the onset may be two decades sooner (16). These facts, along with the rapid aging and increased life expectancy in the Iranian population necessitate more effective preventive strategies.

CSR is an indicator to quantify provision and uptake of eye care services which depends on the supply and demand system and shows a matrix of these two indices (17). In Iran, the reported incidence of cataract was 19.1% in 2006 (18), and the CSR was 1,331 (6); although it had increased by more than 153% compared to year 2000, it greatly lagged behind the 3,000 minimum recommended by the WHO (19). It is revealed that CSR had significantly increased by 2010, but the trend has not been consistent, and in some areas, there is evidence of decreased CSR. This is while life expectancy has increased by one year, median year has increased by 3.5 years, and the over 50 population

has increased by over 2.6 million over the same period (20). There was $\pm 10\%$ change in 6 provinces which is probably the result of sampling variance. Six provinces showed a descending CSR trend. Among these, 5 provinces (Sistan and Baluchestan, Qazvin, Ardabil, Khuzestan, and Kermanshah) had 3,000+ CSR despite a decrease. In North Khorasan, CSR was less than 3,000 in 2006, and after a 60% decrease, it has reached an even worse level in 2010. On the other hand, 4 of the provinces that showed increased CSR (Golestan, Hormozgan, Chaharmahal and Bakhtiari, and South Khorasan) lagged behind 3,000 despite the improvement. Barriers to cataract surgery include high surgery costs and unaffordability (21, 22), old age and inability to tolerate surgery, surgery waiting time (23), adjusting to low vision and unwillingness to improve it (24), unawareness, fear of surgery, comorbidities that contraindicate surgery (25), also lack of a companion (26).

A population-based study in Iran has shown that the most important barriers to surgery are unawareness of treatment followed by misperceptions about the proper time for surgery and sufficiency of monocular surgery (27). These barriers are all simply categorized as availability, affordability, accessibility, and acceptability (28). Since the barriers to cataract surgery have not been studied locally in the abovementioned provinces, we cannot comment on the reasons for decreased CSR in these provinces. There is at least one university and one private cataract surgical center. Possible explanations include an insufficient number of phaco machines which is the most popular surgical method, performing old methods of cataract surgery such as extracapsular and intracapsular cataract extraction which are more time consuming compared to phaco, an insufficient ophthalmologist/patient ratio, long waiting times and seeking care in other provinces, and the increase population of the elderly (25-34%) over this five year period. In 2010, we had 1,750 ophthalmologists for our total population of 75 million and over 50 population of 12.4 million; i.e. one ophthalmologist per 7,085 individuals over 50 years of age (20). In 2006, we had 615 ophthalmologists for our total population of 71 million

and over 50 population of 10 million; i.e. one ophthalmologist per 15,877 individuals over 50 years of age (20). Thus, despite the considerable increase in the number of ophthalmologists during this period, accessibility is still an issue. Besides, ophthalmologists need to be distributed more evenly throughout the nation, and their concentration in some provinces should be reduced, because irregular outreach is one of the causes of CSR inequality in different areas.

In terms of affordability, although the total health expenditure has had 72.4% increase during this 5 year period, the increase was 60.8% in the public sector and 81.5% in the private sector; the greater proportion in the private sector was out of pocket expenditure which had increased by 98.9% (29). Unfortunately, we do not have expenditure data exclusive to vision health, but the overall changes suggest that the public sector, including the Ministry of Health and the Social Security Organization, needs to play a bolder role. Provinces facing decreased CSR have university hospitals affiliated with the Ministry of Health, but the problem in service delivery may be due to insufficient numbers of ophthalmologists and phaco machines. Surgical centers affiliated with the Social Security Organization are either non-existent in these provinces, or there are very few of them. This is while basic health insurances form the principal health insurance coverall throughout the nation, and the coverage provided by private companies and non-profit institutions serving households is limited.

Another suggestion is to involve ophthalmology residents in cataract operating rooms from their first year of their residency. According to the current curriculum, residents in Iran begin their surgical training in the second year (30). In the United States, 75% of first year residents attend the operating room as assistants, and 40% of them have the opportunity to perform a primary surgery in the same year; only 38% of residents do their first surgery in their second year of residency (31). To our knowledge, acceptability and its determinants have not been studied in Iran, but factors such as ignorance about the visual outcome of surgery, adjusting to reduced vision, unawareness of the

complications of untreated cataract, lack of companion, presence of comorbidities, and poverty can reduce acceptability. However understanding barriers and their negative impact on CSR in these provinces requires regional studies.

Bias in this descriptive study would be selection bias which is minimized and close to zero owing to the distribution throughout the country and random selection of the weeks. As stated, underestimation is likely, but since we're studying the trend, that should not be a serious issue.

Conclusion

29.6% of our provinces show a descending trend in CSR, and they require timely planning and measures to improve the situation and reach the minimum recommended by the WHO. A trend towards improvement was observed in 66.7% of provinces, however, health managers need to consider that the increase needs to be proportionate to the percentage increase in the over 50 population, just as we found no change in CSR despite higher numbers of cataract surgery.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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References

1. The International Agency for the Prevention of Blindness (IAPB). WHO Facts, Blindness and Visual Impairment: Global Facts. Available

- from <http://www.iapb.org/vision-2020/global-facts> (accessed Feb 03, 2014).
2. International Agency for the Prevention of Blindness (IAPB). VISION 2020. Available from <http://www.iapb.org/vision-2020> (accessed Feb 3, 2014).
 3. World Health Organization. Prevention of blindness and deafness. Global initiative for the elimination of avoidable blindness. Geneva: WHO; 2000. WHO document WHO/PBL/97.61 Rev2.
 4. Taylor HR (2000). Cataract: how much surgery do we have to do? *Br J Ophthalmol*, 84(1): 1-2.
 5. Lewallen S, Roberts H, Hall A, Onyange R, Temba M, Banzi J, Courtright P (2005). *Br J Ophthalmol*, 89(10): 1237-40.
 6. Hashemi H, Alipour F, Mehravaran S, Rezvan F, Fotouhi A, Alaedini F (2009). Five year cataract surgical rate in Iran. *Optom Vis Sci*, 86(7): 890-4.
 7. World Health Organization (2007). VISION 2020: The Right to Sight. Available from www.who.int/blindness/Vision2020_report.pdf (accessed 01-15-2014).
 8. Foster A (2001). Cataract and "Vision 2020-the right to sight" initiative. *Br J Ophthalmol*, 85(6): 635-7.
 9. Obstbaum SA (2006). Utilization, appropriate care, and quality of life for patients with cataracts: American Academy of Ophthalmology, American Society of Cataract and Refractive Surgery, and European Society of Cataract and Refractive Surgeons. *Ophthalmology*, 113(10): 1878-82.
 10. Pham TQ, Cugati S, Rochtchina E, Mitchell P, Maloof A, Wang JJ (2007). Age-related maculopathy and cataract surgery outcomes: visual acuity and health-related quality of life. *Eye (Lond)*, 21(3): 324-30.
 11. Asgari S, Hashemi H, Nedjat S, Shahnazi H, Fotouhi A (2012). (Quality of life in the group of patients with chronic eye disease). *Iran J Epidemiol*, 7(4): 43-48.
 12. Ono K, Hiratsuka Y, Murakami A (2010). Global inequality in eye health: country-level analysis from the Global Burden of Disease Study. *Am J Public Health*, 100(9): 1784-8.
 13. Asgari S, Hashemi H, Nedjat S, Shahnazi H, Fotouhi A (2011). Persian Version of the 25-item National Eye Institute Visual Functioning Questionnaire (NEI-VFQ 39): A Validation Study. *Iran J Ophthalmol*, 23(3): 5-14.
 14. Owsley C, McGwin G, Jr., Scilley K, Meek GC, Seker D, Dyer A (2007). Impact of cataract surgery on health-related quality of life in nursing home residents. *Br J Ophthalmol*, 91(10): 1359-63.
 15. Pesudovs K, Weisinger HS, Coster DJ (2003). Cataract surgery and changes in quality of life measures. *Clin Exp Optom*, 86(1): 34-41.
 16. Clyton R, Cuthbert J, Seth J, Phillips CI, Bartholomew RS, Reid JM (2009). Epidemiological and other studies in the assessment of factors contributing to cataractogenesis In: Nugent J, EWhelan J, editors. Ciba fundation symposium 106, Human cataract formation. UK: Ciba foundation. p. 18-47.
 17. Lansingh VC, Resnikoff S, Tingley-Kelley K, Nano ME, Martens M, Silva JC, Duerksen R, Carter MJ (2010). Cataract surgery rates in latin america: a four-year longitudinal study of 19 countries. *Ophthalmic Epidemiol*, 17(2): 75-81.
 18. Hashemi H, Hatef E, Fotouhi A, Feizzadeh A, Mohammad K (2009). The prevalence of lens opacities in Tehran: the Tehran Eye Study. *Ophthalmic Epidemiol*, 16(3): 187-92.
 19. World Health Organization. Prevention of Blindness and Visual Impairment 2014. Available from <http://www.who.int/blindness/causes/priority/en/index1.html> (accessed 01-15-2014).
 20. Statistical center of Iran. Iran Statistical Year Book. Iran: Statistical center of Iran; 2011.
 21. Kessy JP, Lewallen S (2007). Poverty as a barrier to accessing cataract surgery: a study from Tanzania. *Br J Ophthalmol*, 91(9): 1114-6.
 22. Dean WH, Patel D, Sherwin JC, Metcalfe NH (2011). Follow-up survey of cataract surgical coverage and barriers to cataract surgery at Nkhoma, Malawi. *Ophthalmic Epidemiol*, 18(4): 171-8.
 23. Rabi MM, Muhammed N (2008). Rapid assessment of cataract surgical services in Birnin-Kebbi local government area of Kebbi State, Nigeria. *Ophthalmic Epidemiol*, 15(6): 359-65.
 24. Athanasiov PA, Edussuriya K, Senaratne T, Sennanayake S, Selva D, Casson RJ (2009). Cataract in central Sri Lanka: cataract surgical coverage and self-reported barriers to cataract

- surgery. *Clin Experiment Ophthalmol*, 37(8): 780-4.
25. Limburg H, Silva JC, Foster A (2009). Cataract in Latin America: findings from nine recent surveys. *Rev Panam Salud Publica*, 25(5): 449-55.
 26. Sapkota YD, Sunuwar M, Naito T, Akura J, Adhikari HK (2010). The prevalence of blindness and cataract surgery in rautahat district, Nepal. *Ophthalmic Epidemiol*, 17(2): 82-9.
 27. Katibeh M, Ziaei H, Rajavi Z, Hosseini S, Javadi MA (2014). Profile of cataract surgery in Varamin Iran: a population-based study. *Clin Experiment Ophthalmol*, 42(4):354-9.
 28. Khanna RC, Garudadri C (2010). Incidence of post-cataract endophthalmitis at Aravind Eye Hospital. *Indian J Ophthalmol*, 58(6): 562.
 29. World Health Organization. Global Health Expenditure Database, Iran (Islamic Republic of) - National Expenditure on Health (Iranian Rial). Geneva: WHO. Available from http://apps.who.int/nha/database/StandardReport.aspx?ID=REP_WEB_MINI_TEMPLATE_WEB_VERSION&COUNTRYKEY=84605.
 30. Educational curriculum for ophthalmic residency (2011). Tehran: Iranian Council for Graduate Medical Education. Iranian Ministry of health and medical education. p. 1-46.
 31. Rowden A, Krishna R (2002). Resident cataract surgical training in United States residency programs. *J Cataract Refract Surg*, 28(12): 2202-5.