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Public Health

journal homepage: www.elsevier.com/puhe

Original Research

Cost-effectiveness and cost utility of community screening for glaucoma in urban India

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ARTICLE INFO

Article history:
Received 3 November 2016
Received in revised form
22 February 2017
Accepted 24 February 2017
Available online 6 April 2017

Keywords:
Primary open-angle glaucoma
Angle-closure disease
Cost-effectiveness
Cost utility
Urban
India

ABSTRACT

Objectives: Population-based screening for glaucoma has been demonstrated to be cost-effective if targeted at high-risk groups such as older adults and those with a family history of glaucoma, and through use of a technician for conducting initial assessment rather than a medical specialist. This study attempts to investigate the cost-effectiveness of a hypothetical community screening and subsequent treatment programme for glaucoma in comparison with current practice (i.e. with no screening programme but with some opportunistic case finding) in the urban areas of India.

Study design: A hypothetical screening programme for both primary open-angle glaucoma and angle-closure disease was built for a population aged between 40 and 69 years in the urban areas of India.

Methods: Screening and treatment costs were obtained from an administrator of a tertiary eye hospital in India. The probabilities for the screening pathway were derived from published literature and expert opinion. The glaucoma prevalence rates for urban areas were adapted from the Chennai Glaucoma Study findings. A decision-analytical model using TreeAge Pro 2015 was built to model events, costs and treatment pathways. One-way sensitivity analyses were conducted.

Results: The introduction of a community screening programme for glaucoma is likely to be cost-effective, the estimated incremental cost-effectiveness ratio (ICER) values being ₹10,668.68 when compared with no screening programme and would treat an additional 4443 cases and prevent 1790 person-years of blindness over a 10-year period in the urban areas of India. Sensitivity analyses revealed that glaucoma prevalence rates across various age groups, screening uptake rate, follow-up compliance after screening, treatment costs and utility values of health states associated with medical and surgical treatment of glaucoma had an impact on the ICER values of the screening programme.

Conclusions: In comparison with current practice (i.e. without a screening programme but with some opportunistic case finding), the introduction of a community screening programme for glaucoma for the 40–69 years age group is likely to be relatively cost-effective if implemented in the urban areas of India.

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http://dx.doi.org/10.1016/j.puhe.2017.02.016
0033-3506/

Objectives

Glaucoma contributes to 0.6 million disability-adjusted life years (DALYs) or 1.96% of the overall burden of diseases in India.[1] A recent population-based study using modern techniques for detecting glaucoma suggested 11.2 million persons aged 40 years and older are affected due to glaucoma in India; primary open-angle glaucoma (POAG) affecting 6.48 million persons and primary angle-closure glaucoma (PACG) affecting 2.54 million persons.[2] Around 27.6 million persons were estimated to have some form of primary angle-closure disease. Blindness among PACG patients affects twice the number than those with POAG.[2] It is estimated that every eighth individual aged 40 years and above to be affected due to glaucoma or is at risk in the country.[2]

Although opportunistic case finding in hospitals and clinics is the major method for glaucoma detection, a majority of the patients presenting themselves to a medical practitioner remain undiagnosed for glaucoma. Studies have shown that between 92.6% and 94.1% of POAG cases, and between 85.3% and 97.6% of PACG cases in the urban areas remain undiagnosed.[3–7] Such poor case-detection rates are further affected due to poor glaucoma awareness and underutilisation of ophthalmic services in the country.[8,9]

Given the existence of underdiagnosis, underutilisation and poor awareness of the disease, population-based screening and subsequent treatment could be suggested as a method for improving case detection and minimising glaucoma-related blindness in the long run. In the case of India, currently no organised community screening programme specifically for glaucoma detection exists. Using glaucoma prevalence estimates from India, studies have shown an effective 'population attributable risk percentage', for primary angle-closure suspect (PACS), primary angle closure (PAC) and POAG to be 56.4%, 65% and 16%, respectively, for developing countries.[10,11] These figures suggest that these conditions are high enough to be considered a public health problem. These large population attributable risk percentage values will also increase the prior probability of the disease on a population basis, thus improving the predictive values of any screening test (as per Bayes' Theorem).

We conducted an unstructured database search and identified eight published studies on cost-effectiveness analysis of glaucoma screening. Most of these studies have been conducted in high-income countries (UK,[12–14] USA[15] Canada,[16] Finland[17] and Barbados[18]) with only two studies being done in middle-income countries (Ghana[18] and China[19]). Only one study focused on PACG,[19] while the rest focused on POAG.

One of the meeting decisions at a consensus meeting of the World Glaucoma Association in 2008 has been that the decision for conducting glaucoma screening should be based on resources and costs available towards justifying such an intervention in the developing countries.[20] Cost-effectiveness analysis is based on the premise that it is the wider community interest which is paramount; therefore, additional eyes saved from blindness through use of a screening programme have to be balanced against the extra costs involved in doing so. The question of whether an intervention is cost-effective depends on whether the relevant decision maker is willing and able to pay the additional costs to achieve the additional benefits that can be achieved by introducing the alternative programme, in this case glaucoma screening.

The objective of this study is to investigate the cost-effectiveness of the introduction of a hypothetical community screening programme for glaucoma in urban areas in comparison with the current alternative (i.e. without screening programme but with some opportunistic case finding) in India, using a decision-analytic model. It is hypothesised that, based on an efficient and cost-effective screening programme, the overall incidence of glaucoma-related blindness will decrease in the country.

Study design

Screening programme

A hypothetical screening intervention programme (Fig. 1) was designed for glaucoma detection after discussions with a glaucoma specialist and ophthalmic epidemiologist. The screening protocol has been described in detail elsewhere.[21] It is to be noted that, due to the higher proportion of cases in the population, only POAG and angle-closure disease were the focus for the screening programme; secondary and other forms of glaucoma were not to be considered.

Table 1 provides the summary of the diagnostic tests, sensitivity and specificity values and data sources of screening tests conducted by an ophthalmic assistant. The choice of the various diagnostic tests is made with the assumption that, glaucoma being a low-prevalence disease, the screening tests should have high specificities. Since the main aim of conducting the glaucoma screening at community level is to filter the candidates with probable glaucoma, subsequent detailed ophthalmic examination by ophthalmologists at examination clinics in the hospital can be utilised to further validate the high number of 'false positive' cases. One or more of the following criteria were used for the diagnosis of a 'glaucoma suspect' as per the International Society of Geographical and Epidemiologic Ophthalmology (ISGEO):[22]

a) Intraocular pressure (IOP) > 97.5th percentile, i.e. > 21 mm Hg.
b) Presence of occludable angle as demonstrated by Van Herick and modified Van Herick methods.
c) Optic disc margin haemorrhages.
d) Visual field abnormalities—considered abnormal if one point was abnormal on frequency doubling technology (FDT) perimetry (C 20-1 programme).

All 'glaucoma suspect' patients identified at screening clinics will be counselled for attending the examination clinic at the hospital (see Fig. 2).

Examination clinic

On visiting the examination clinic at the hospital, the patient undergoes a detailed ophthalmic examination (including diagnostic tests) under an ophthalmologist. The treatment