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Cost-effectiveness of community screening for glaucoma in rural India: a decision analytical model

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ABSTRACT

Objectives: Studies in several countries have demonstrated the cost-effectiveness of population-based screening for glaucoma when targeted at high-risk groups such as older adults and with familial history of disease. This study conducts a cost-effective analysis of a hypothetical community screening and subsequent treatment programme in comparison to opportunistic case finding for glaucoma in rural 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 rural areas of India.

Methods: A decision analytical model was built to model events, costs and treatment pathways with and without a hypothetical screening programme for glaucoma for a rural-based population aged between 40 and 69 years in India. The treatment pathway included both primary open-angle glaucoma and angle-closure disease. The data on costs of screening and treatment were provided by an administrator of a tertiary eye hospital in Eastern India. The probabilities for the screening and treatment pathway were derived from published literature and a glaucoma specialist. The glaucoma prevalence rates were adapted from the Chennai Glaucoma Study findings.

Results: An incremental cost-effectiveness ratio value of ₹7292.30 per quality-adjusted life-year was calculated for a community-screening programme for glaucoma in rural India. The community screening for glaucoma would treat an additional 2872 cases and prevent 2190 person-years of blindness over a 10-year period.

Conclusions: Community screening for glaucoma in rural India appears to be cost-effective when judged by a ratio of willingness-to-pay thresholds as per WHO-CHOICE guidelines. For community screening to be cost-effective, adequate resources, such as trained medical personnel and equipment would need to be made available.

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Introduction

In India, there are estimates that every eighth individual over the age of 40 years is affected by glaucoma or is at risk.[1] This converts to 11.2 million persons aged 40 years and older—primary open-angle glaucoma (POAG) affecting 6.48 million persons and primary angle-closure glaucoma (PACG) affecting 2.54 million persons. The fact that 27.6 million people in India have some form of primary angle-closure disease should be a cause of concern, as glaucoma-related blindness affects twice the number of PACG patients than those with POAG. The 'population attributable risk percentage' figures for primary angle-closure suspect (PACS), primary angle closure (PAC) and POAG at 56.4%, 65% and 16% respectively for developing countries suggest that glaucoma prevalence in India is a high public health issue.[2,3]

Studies have shown that between 93% and 98.5% of POAG cases and 100% of PACG cases remain undiagnosed in rural areas of India.[4–9] Only 0.32% people had an awareness of glaucoma in rural Andhra Pradesh.[10] As per a population-based survey, only 50% of the population with glaucoma ever visited an ophthalmologist.[7]

Given the existence of under-diagnosis, under-utilisation 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. Currently, no organised community-screening programme for glaucoma detection exists in India. However, before setting up such an intervention, it is important to determine the cost-effectiveness of community-based screening in India.

This study used a decision analytic model to investigate the epidemiological and economic impact of the introduction of a hypothetical community-screening programme for glaucoma in rural areas of India in comparison to opportunistic case finding in India. There is very little evidence of cost-effective studies of community screening for glaucoma in developing countries, and same is the case in India. The answers from this study may also add to a wider body of knowledge around epidemiological and economic impact of community screening for glaucoma.

Methods

We examined the impact of community screening for glaucoma based on a screening and treatment protocol described in detail elsewhere.[11,12] The treatment pathway included both POAG and angle-closure disease. The main measures of impact were (a) total cost of each strategy (i.e. costs of screening minus costs of case finding), (b) additional cases treated in the screening arm, (c) cost per quality-adjusted life-year (QALY) gained by screening, and (d) number of years of blindness avoided.

The analysis was applied to a hypothetical population cohort of one million people aged 40–69 years in rural areas of India, over a duration of 10 years. Cost-effectiveness was analysed from a societal perspective, which includes both the direct medical care costs (which includes the direct charges of examination, medications and surgery), direct non-medical care costs incurred (such as travel) and indirect costs (such as wage loss).

All costs are in 2016 rupees. The cost of screening invitation (posters, banners, monitoring etc) for a subset of population (i.e. 10,000 people) was calculated. The screening costs per person (for 10,000 populations) for rural areas were utilized to calculate the screening cost per person (1,000,000 populations) at ₹78. A screening time of 20 min per patient was considered after discussion with a glaucoma specialist. Assuming two ophthalmic assistants work 8 h per day for 26 days per month, 1248 patients could be screened per month. The diagnostic equipment with a usage life of more than a year was considered as capital equipment, and depreciation costs were incorporated. All patients who were found as glaucoma suspects during screening were transported on a fixed day by the implementation organisation to the base healthcare facility for further examination and any medical or surgical treatment. For POAG, an average length of stay for trabeculectomy surgery was assumed to be 3 days per eye (only one eye is operated at one time). Here it was assumed that the surgery was conducted the next day to the examination day. The surgical costs which included the cost of surgery, hospitalisation costs, and dietary costs of patient and relative, were considered ₹9000 (for both eyes) or ₹4500 per eye. The wage loss of ₹100 per day for 3 days was added to this amount. Thus, the total trabeculectomy surgery cost (including wage loss) was ₹9600 (for both eyes) or ₹4800 (for one eye).

For PAC and PACG, all patients were considered for iridotomy the next day. The cost of iridotomy was estimated to be ₹500 per eye or ₹1000 for both eyes. After addition of wage loss of 1 day, the total cost of iridotomy was ₹600 per eye or ₹1200 for both eyes. Here it was assumed that for both eyes the average length of stay would be 2 days as only one eye would undergo iridotomy at one time. Based on discussions with a glaucoma specialist, it was assumed that all patients would be prescribed timolol 0.5% and Prostaglandin analogue 0.005% for medical treatment post-trabeculectomy (for POAG cases), and postiridotomy (for PAC and PACG cases). The cost per bottle was taken from[c] available literature for Timolol 0.5% and prostaglandin analogue 0.005% as ₹35 and ₹1437 respectively (Sharma et al., 2004).[13] Table 1 provides a summary of screening and treatment costs.

Decision analysis model

Based on screening protocol and treatment pathway described in detail elsewhere, a decision analytical model was developed using TreeAge Pro (version 2011, MA, USA; Fig. 1).[11,12] The sensitivity and specificity values of screening tests in the screening protocol is mentioned in Table 2.

Various studies conducted in India, and use of local or national sources were used to derive the probabilities of each pathway. Where information was not available from India, such as screening data, probabilities were drawn from the international literature from other developing countries in Asia and Africa. Where relevant information was not

[c] Dr R Parikh, personal communication, October 18, 2014.