

The KIDROP Experience in India

Tackling ROP in Middle-Income Countries with Cost-Effective Tele-Ophthalmology

BANGALORE – The need for telemedicine in Retinopathy of Prematurity (ROP) in middle-income countries like India is born out of the skewed demand and supply problem plaguing ROP management, the largest cause of infant blindness worldwide.

Of the 27 million live births annually in India, about 8.8% are born below 2000 grams and are at risk of ROP. However, a majority of these infants are born in rural areas and remain unscreened. With less than 400 retinal surgeons and around 15 ROP specialists, there is a huge unmet need for ROP management in India.

Asia's First Tele-ROP Screening Programme

In 2008 we started Asia's first

hardware platform, which allowed images to be viewed on the smart phone or the PC using the lossless

Automated Binary Optimization (ABO) compression technology (patented). Images were also graded by these technicians and validated against binocular indirect ophthalmoscopy by the ROP expert.

The KIDROP programme currently serves 51 neonatal intensive care units (NICU) in rural and semi-urban regions and runs on a

non-profit grant by the Institute. 18 of these centers are in a remote zone 500 kilometers away and are co-managed in a public private partnership (PPP) with the State Government. In this PPP the Government has granted USD 0.52 million (2009-2012) to set up two zones that cover six districts each. Our contribution will include free training,



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Figure 1: Technicians imaging as project manager uploads.

tele-ROP screening programme in Southern India to cover unscreened rural neonatal care centers in the state of Karnataka. Under this KIDROP (Karnataka Internet Assisted Diagnosis of ROP) programme, technicians were trained to image, interpret, store and upload images taken on a mobile wide-field digital retinal camera, the Retcam Shuttle (Clarity MSI, Pleasanton, CA, USA) on to a secure server for experts to review remotely. Together with our technology partners we developed a comprehensive software-

image reading and treatment. The government will provide for the equipment, its maintenance and financial compensation of the technicians in the outreach.

Thus far, we have completed over 25,000 imaging sessions and recruited over 6500 infants into the ROP screening programme in more than twelve districts of Karnataka state covering two zones, each having a radius of care of around 400 kilometers. In this study, we present a cost-utility evaluation of the KIDROP programme. We

used the financial audited data in our study to complete an economic evaluation that employs Analytic Hierarchy Processing (AHP), a multi criteria decision model for comparing the KIDROP strategy (which uses a single Retcam shuttle for 6 districts) to three alternate strategies of ROP screening.

Alternate Strategies

The three alternate strategies were hypothetical and were:

1) Parents in the rural outreach are educated, sensitized and urged to travel with their infants to the city for screening at designated sites.

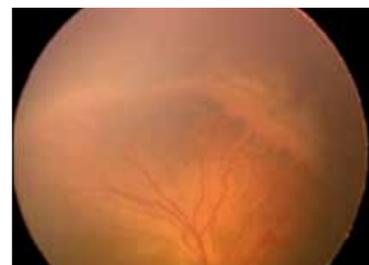


Figure 2: A PRO in a rural infant.

2) Rural infants are to be screened at their respective district hospitals by trained experts using indirect ophthalmoscopy one day a week who travel from their city based practices.

3) Screening is performed by trained non-physicians using Retcams at each district headquarters. The last

with that of the Priority Weights matrix. These ranks measured the "best methodology" between these strategies. Sensitivity analysis and the analysis of uncertainty were also performed to evaluate the maximum and minimum budgetary requirements in each strategy. 'Best case', 'worst case' and 'balanced scenarios' were computed against each strategy and intervention to determine the best strategy in these situations.

When the maximum patient coverage was considered as the goal ("the best case scenario") (which should be the aim of any screening intervention in the community), the best ROP screening strategy for all three scenarios i.e. the provider's perspective (funding organization), the patient's perspective and a 'balanced scenario' was the KIDROP model. In the poorest coverage ('worst case'), best ROP screening strategy for the funding organization was the KIDROP model, but from the patient's perspective and for the balanced scenario it was the multiple Retcam model.

Best Screening Strategy in Four out of Six Situations

Hence, the KIDROP model ranked as the 'best screening strategy' in four out of six situations. In all situations tele-ROP ranked higher than the other interventions where the specialist or



Figure 3: Infants sharing incubator in rural NICU.

strategy is similar to KIDROP but needs to have several Retcams servicing each district.

Criteria for Cost-Effectiveness

Cost-effectiveness in all four strategies was computed using three criteria:

1) Organizational costs: costs incurred by the 'provider' (who could be a private or a public enterprise or a public-private partnership)

2) Burden weight: burden to the parents or guardians of the child including direct and indirect costs

3) Disease coverage: number of 'disease susceptible' as a proportion covered under the strategy.

Using AHP, the overall ranks comparing these strategies were then calculated by the matrix multiplication of the AHP Modified Weights matrix

the patient had to travel for screening. The lowest rank in all six situations was the strategy where mothers had to travel to the city with their infants for ROP screening. This was the strategy that had the lowest cost but produced the poorest coverage, since most parents in rural areas were daily wage workers and belonged to the lower economic strata making travel costs with the family a heavy burden on their resources. The fact that repeated visits are needed before discharge from the screening programme, further adds to problem of travelling which compounds the costs for the family. Poor compliance to complete the screening meant higher risk of blindness. The multiple Retcam strategy had the best coverage but caused a larger financial burden on the organizations that fund and manage

the programme. In a public private joint enterprise, it was more likely that funds would be limited and needed prioritization. In our own setting, we were able to convince the Government to fund only one Retcam per zone.

Economic Impact

The economic impact of the KIDROP programme can be indirectly measured by evaluating the blindness quotient in financial equivalents. Thus far 512 children have received vision restoring laser treatment. The return on investment in the national perspective may be calculated as follows: Each of these 512 infants will survive to an average of 65 years (average life expectancy) and earn approximately USD 900 per annum (per capita income). This is a federal saving of over USD 25 million! All this for an investment of less than USD 250,000! The social returns are, of course, priceless.

As we previously reported, barriers of cost and infrastructure must be met. The cost of the camera alone is currently approximately USD135,000 in India. The greatest barriers, however, are the "mental barrier" of the care-givers created by a mixture of poor awareness, inadequately trained personnel and unwillingness to adapt to innovation. However, there is hope that with time, patience and passion, these barriers can be overcome.

A Viable Model

In conclusion, tele-ROP is a viable model in middle-income countries. The cost utility analysis comparing the KIDROP model with other alternate strategies indicates that the KIDROP model, which uses a single Retcam shuttle to service a zone of roughly 300-400 kilometers radius in six districts using non-physicians (trained technicians) is the most cost-effective method of providing the standard of care in ROP screening in centers which are rural or peripheral with limited access to health care given the current scenario of limited experts and funds. Each country with similar demographic and financial milieu as India must explore tele-ROP as a viable financial model and customize it to suit their local needs. ■

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