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Rapid Assessment of Avoidable Blindness: looking back, looking forward

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Received 31 January 2019
Revised 8 May 2019
Accepted 8 June 2019
Published Online First 2 July 2019

To cite: Mactaggart I, Limburg H, Bastawrous A, *et al. Br J Ophthalmol* 2019;**103**:1549–1552.

ABSTRACT

The Rapid Assessment of Avoidable Blindness, or RAAB, is a relatively simple and low-cost survey methodology to provide data on the prevalence and causes of visual loss. The aim of this article is to reflect on the achievements and challenges of RAAB, and to describe the future developments that are needed to ensure that it remains a relevant and widely used tool. To date, at least 331 RAABs have been undertaken in 79 countries, and these surveys provide an important source of information on visual loss at both the local and global level. A RAAB repository has been developed which includes the site and date of RAABs undertaken, and, where authors have agreed, the core indicators, reports or even raw data from the survey. This dataset has already been used for meta-analyses, and there are further opportunities for its use. Despite these achievements, there are core areas in which RAAB needs to be strengthened so that the full benefits of undertaking the survey can be reaped. Key developments of RAAB are underway, and will include greater use of mobile technologies using a cloud-based platform to enable both digital data collection, real-time survey reviews, reporting and analysis, and a greater emphasis on using the data for planning.

INTRODUCTION

The Rapid Assessment of Avoidable Blindness (RAAB) is a survey methodology that aims to provide data on the prevalence and causes of visual loss (box 1).[1] The RAAB approach is relatively simple and low-cost as it focuses mainly on assessing avoidable causes of visual loss, such as cataract, refractive error and corneal scarring. This approach is in keeping with the aim of the International Agency for Prevention of Blindness (IAPB) VISION 2020: The Right to Sight programme to eliminate 80% of avoidable blindness by 2020. The intention is that the RAAB data are used to plan eye care services, so that they can target the most important local priorities, such as increasing the number of cataract surgeries, improving surgical quality or providing more spectacles. RAAB can also be used to monitor whether there have been changes in the prevalence and causes of eye conditions, when repeated RAABs are conducted in the same area. RAAB was developed by Hans Limburg working with the International Centre for Eye Health, first as the Rapid Assessment of Cataract Surgical Services in 1997, and then updated and modified to create RAAB in 2004.[1–4]

Recently, RAAB has been updated as it moved to a mobile data collection form, through the development of 'mobile RAAB' (mRAAB). Currently, a new version of RAAB is under development, described in detail below, which will facilitate greater use of mobile technologies and a greater emphasis on using the data for planning. At the same time, a new strategic focus on universal eye health coverage through health system strengthening will require key indicators to be collected on coverage, and an increasing focus of posterior segment disorders is needed as these conditions are gaining importance. We are, therefore, at a critical juncture with RAAB. The aim of this article is to reflect on the achievements and challenges of RAAB to date, and to describe the future developments that are needed to ensure that it remains a relevant and widely used tool.

WHAT IS RAAB?

More detail on the exact methodology of RAAB is available from other sources.[1 5] In brief, within any survey, including RAAB, there are two critical stages. The first is the selection of the sample of the population. The second is the examination of selected participants to assess whether or not the participant screened has the condition of interest. For RAAB, these procedures are undertaken as follows:

- Sampling: A district, province or country for the RAAB survey is identified by key stakeholders. Within this particular area, a population-based sample of around 2500–5000 residents aged 50 years and above is selected, through sampling 50–100 clusters of 50 people. The clusters are systematically sampled using probably proportional to size from a sampling frame consisting of all census enumeration areas in the survey. Within a cluster, the 50 participants are selected through a procedure called compact segment sampling. Typically, 3–5 survey teams conduct the fieldwork, each consisting of one ophthalmic clinician (eg, an ophthalmologist), one person capable of undertaking visual acuity assessment (eg, optometrist or ophthalmic assistant and refractionist) and a village guide. The participants are examined in their household, and the teams move door-to-door, to maximise response rate. One cluster of 50 residents aged 50 years or older is completed per team per day.
- Examination: The key measure of interest in the RAAB is visual impairment. Each eligible person selected for the RAAB is invited to undergo visual acuity screening, using a tumbling E chart. He/she is also assessed for the presence of cataract using a torch and a direct ophthalmoscope, and in some settings, a portable slitlamp (optional). People with visual acuity

Box 1 Summary of Rapid Assessment of Avoidable Blindness (RAAB)

The main aims of RAAB are:

- To estimate the prevalence and causes of blindness and visual impairment in people aged 50 years and above.
- To assess cataract surgical coverage.
- To identify the main barriers to uptake of cataract surgery.
- To measure outcome after cataract surgery.
- To provide baseline data for planning of eye care services and to monitor and evaluate ongoing programmes.

Why carry out a RAAB survey?

- To help eye health managers to develop programmes for control of visual impairment based on a community's needs.
- To help to monitor existing eye health programmes and to adjust these programmes as and when required.

What RAAB is not:

- RAAB is not a case-finding exercise: it will not provide a list of names and addresses of all people who are blind due to (for example) cataract in an area.
- RAAB is not a detailed blindness survey: it provides a reasonably accurate estimate of the prevalence of blindness, and the proportion that is avoidable in a geographic area. RAAB is not designed to give accurate estimates of the prevalence of specific causes of blindness and does not measure posterior segment disease in detail.
- RAAB focuses on people aged 50 years and above and so it does not give an estimate of prevalence in children or people younger than 50 years.

below <6/12 have pinhole vision taken, and are examined by the ophthalmologist to ascertain the main cause of visual loss. Dilatation drops are administered to aid examination, in the event that the cause of visual loss is not identified as refractive error, cataract or other anterior segment causes (eg, corneal opacity). Steps are taken to improve standardisation of disease classification, including during training and by data entry prompts (eg, if there is an improvement in vision to 6/12 after pinhole then it is flagged that the cause should be registered as refractive error). However, it is not possible to diagnose the presence of specific posterior segment diseases with accuracy, given that the examination relies on direct ophthalmoscopy, without slit lamps (usually) or the ability to measure intraocular pressure or visual fields. The exception is when a specific diabetic retinopathy (DR) protocol is added to RAAB, as discussed below. If posterior segment disease assessment is the main priority of the study then a more detailed examination protocol is needed.[6]

- Resources: Key resources are available to support these two steps. A RAAB software package is available, which supports sample size estimation, selection of clusters, data entry and data analysis. In addition, a standardised training package has been developed (including a manual and PowerPoint slides) to ensure that the training of RAAB staff is undertaken consistently, and to a high standard.

Each RAAB takes approximately 1–6 months to complete, including 1 week of training (depending on the sample size, the number of teams, transport and time). RAAB was developed for use in low-income and middle-income countries (LMICs), and few RAABs have been completed in high-resource settings.

The RAAB method is 'rapid' for three reasons. First, only people aged 50 years and above are included. The prevalence of visual impairment is highest in this age group and therefore, the required sample size is lower. For instance, estimates from the Gambia show that only 9% of the population was aged 50 years or more, yet they accounted for 84% of the cases of blindness.[7] Consequently, restricting the survey to this age group reduces the required sample size and costs substantially, while the causes of blindness in this sample have been shown to be reflective of the causes in the total population. People of this age are more likely to be at home giving a high response rate. Second, relatively quick and simple eye examinations are undertaken relying on direct ophthalmoscopy. This examination approach is appropriate for identifying an uncorrected refractive error or anterior segment causes of visual loss (eg, cataract and corneal opacity), which remain the leading causes of blindness and visual loss in most LMICs.[8] Third, the RAAB software programme includes a predesigned data-entry form, and allows automated data analysis. This step is helpful as it removes the time required for statistical analysis as well as the need for specialist statisticians. It also ensures that data analyses are comparable across all RAABs.

An additional DR module has been developed to be incorporated in areas where the prevalence of diabetes is high (although a specific threshold has not been established), such as in the Middle East, Latin America or other middle-income or urban settings.[9 10] Here, all participants undergo random blood sugar (RBS) testing, and those who are known diabetics or have an RBS of 200 mg/dL or 11.1 mmol/L have a dilated retinal examination or images taken for DR screening. This component allows planning of DR services, but it will increase the cost of the RAAB and adds to its complexity, and so is not recommended for all circumstances. Furthermore, the prevalence of DR is often around 20%–40% among diabetics, and so can be estimated if the prevalence of diabetes is known.[9–12]

There are also further adaptations of the standard RAAB protocol. As an example, RAAB has been expanded to include children in some settings, as in Vietnam, where a series of 16 RAABs were conducted and these included sampling of children <15 years to allow estimation of the prevalence and causes of blindness in children.[13] The Rapid Assessment of Visual Impairment expands the RAAB protocol to people aged 40 years and above and includes assessment of near vision, but only defines causes in terms of cataract, refractive error or other causes.[14] The Rapid Assessment of Refractive Error includes a sample of people aged 15–50 years, and focusses on the assessment of uncorrected refractive error and presbyopia.[15]

WHAT ARE THE ACHIEVEMENTS OF RAAB?

To date, at least 331 RAABs have been undertaken in 79 countries.[16] To put these figures into context, this is substantially more data than is available for most other impairment types, where standardised rapid assessment survey methods are currently lacking. As examples, a recent review identified only 42 studies from 29 countries that showed the prevalence of hearing loss,[17] and another review identifed only 36 studies since 2000 that estimate the prevalence of autism and other pervasive developmental disorders, the vast majority of which were from high-income settings.[18] Within Africa, specifically, at least 64 RAABs have been undertaken, and by contrast, a recent review identified only eight population-based surveys of hearing impairment.[19] The RAABs have also made an important contribution to the global data on blindness. The latest Global Burden of Disease report included data from 124 RAABs (personal communication).

Box 2 Systems to maintain quality of Rapid Assessment of Avoidable Blindness (RAAB) data collected

- Certified RAAB trainers are available in all continents to maintain the standards for planning, training and data collection in RAABs.
- Data entry system of RAAB uses a wide range of validation rules to ensure complete and valid data.
- RAAB software provides detailed standardised and automatic data analysis. This ensures uniformity in data analysis and makes results comparable between RAABs.
- Before RAAB data are included in the repository, the webmaster (Hans Limburg) checks quality parameters (eg, response rate), violations of the validity rules, cluster size, non-compliance, design effect, and so on, to ascertain whether the data are of a sufficient standard.
- Ideally, journals would consider the publication of RAAB reports only after inclusion of these reports in the repository, as these have used the RAAB protocol and data analysis, and have passed through quality control. Several studies were published in the scientific literature as 'RAAB', while these did not follow the RAAB protocol or used custom data analysis.

A RAAB repository has been developed to store RAAB data and allow comparison of data across different settings and times. The repository includes the area and date of RAABs that have been undertaken, and, where authors have agreed, the core indicators (sample size, coverage, prevalence of conditions: blindness, low vision, functional low vision, cataract, refractive error, trachoma, posterior segment disease and DR, cataract surgical coverage, cataract surgical outcome and intraocular lens%); publications, reports or even raw data from the survey are available.[16] The repository currently includes 331 entries (January 2019), but more RAABs may have been undertaken, unknown to the repository. Steps are in place to ensure that the quality of RAAB is maintained, so that the data are reliable (box 2). This repository, therefore, provides a rich source of data, with opportunities for cross-country analysis. As one example, Ramke *et al* assessed studies from the RAAB repository to identify how many had been published in the scientific literature to estimate 'avoidable waste' through findings not being made publicly available.[20] Others have compared the ratio between the prevalence of low vision and blindness across RAAB surveys.[21] There are many more opportunities to use this resource, such as to estimate the need for low vision services, trends over time or between regions, or to compare levels of indicators, such as poor surgical outcomes.

WHAT DEVELOPMENTS ARE BEING PLANNED FOR RAAB?

Despite these achievements, there are core areas in which RAAB needs to be strengthened so that the full benefits of undertaking the survey can be reaped. In 2015, a mobile (Android)-based data collection app for RAAB6 (mobile RAAB - mRAAB) was released improving the speed and accuracy of data collection, as well as eliminating the need for manual data entry of survey forms into the RAAB software programme. Further developments of RAAB7 are underway. These plans fall into three main categories: (1) improvements in our ability to use RAAB data for planning, (2) improvements in the data collected and (3) integration of technological advances into data collection and examination procedures.

- Planning: The main aim of RAAB is to generate data that can be used for planning of eye care services, and answering questions such as how many cataract surgeries should be undertaken. However, currently, RAAB generates data on the prevalence of visual loss and its causes, which are less tangible indicators for planners. Translating these figures into actionable plans, therefore, requires additional steps, which are not always made. A needs assessment is required to complement the RAAB, which will collect data on human resources and available services, in order to identify where there are gaps and issues that must be addressed by the plans (eg, insufficient ophthalmic staff and lack of specialist equipment). Additionally, approaches on how to develop eye care plans need to be improved. For instance, planning should include identifying key influencers early in the process and ensuring that they are engaged throughout the planning, conduct and interpretation of RAAB. Development of the planning module is currently in process and will be launched during 2020.
- Additional data collection: It is increasingly recognised that populations are not homogenous, and that certain groups will be particularly vulnerable to visual loss or face additional difficulties in accessing services. Examples of vulnerable groups include women, people living in poverty and people with disabilities. RAAB already allows disaggregation of data by gender to assess whether women have different needs to men in terms of eye care service provision. The updated version of RAAB will also include an equity tool, to measure socioeconomic status, as well as the Washington Group questions to ascertain the presence of disability.[22] These new indicators will allow further inspection of the data to see whether plans need to be adapted take particular account of these subgroups.[23] Specific indicators measured in RAAB may also need to be improved. As an example, RAAB collects barriers to accessing cataract surgery by people who need this service, but this component can be strengthened. Common barriers are almost invariably lack of awareness that services are available and lack of money to pay for services. However, previous research has shown that quantitative reports on barriers are too simplistic, and that qualitative data are needed, though this is difficult to incorporate into a survey.[24] Approaches for the collection of barrier data are being reconsidered.
- Technology: Technological developments are creating fantastic new opportunities for RAAB. Peek is a public eye health platform that includes a portfolio of smartphone-based tools for ophthalmic assessment. The Peek Acuity vision test app is simple to perform and compares well to gold-standard LogMar,[25] and is being integrated into RAAB7 to replace the paper-based tumbling E chart. The advantages of using Peek for visual acuity assessment is that it is more accurate, can be measured at distances of less than 6 metres (not possible with paper-based versions) and fieldworkers enjoy using it, finding it motivating. An IOS version will be developed, to complement the Android tools. In future, other technological advances may be developed that will improve diagnostic accuracy of eye conditions further—such as the development of a high-quality low-cost portable retinal camera, which could allow remote diagnosis of posterior segment eye disease, such as DR. Other mobile tools are at an early stage of development and testing, for instance, to measure visual fields, could to aid the diagnosis of glaucoma, while automated grading could facilitate remote diagnosis. Another development of RAAB7 is that it will operate through uploading data collected on mobile devices directly to the cloud, which will allow mid-survey checking of data,

so that teams can be monitored to assess whether they are getting unlikely or divergent results, and allow quality issues to be flagged at an earlier point. This development will also mean that a backup of the data files is saved to the repository (pending permission from the principal investigator), which does not currently happen. An assessment is currently underway of the feasibility of cloud-based data storage, taking into account information governance issues, such as the varying requirements for different countries.
- Data visualisation: Including more sophisticated tools to visualise and model the data within the repository may help to make it more user-friendly to a wider range of audiences, such as district-level planners, policymakers and the general public. Data visualisation could allow the extrapolation of data to the country, generation of all-age estimates and forecasting trends in visual impairment into the future. These visual tools are currently being developed under the RAAB updates.

There are also future challenges for RAAB. Cataract and uncorrected refractive error will remain the priorities of eye health services in many LMICs. However, in the coming decades, posterior segment disease will make up a larger proportion of the need. This pattern is already clear in high-income countries, and therefore RAAB will need to improve its ability to identify posterior segment causes of visual loss. This will add to the complexity of undertaking RAABs, as it will require improved ability to make diagnoses in the field (eg, visual field and intraocular pressure examinations and availability of more skilled professionals able to make the diagnoses), but would also increase diagnostic accuracy. Costs will consequently also increase, which may reduce the capacity for undertaking RAABs; for comparison, conducting a RAAB plus DR is approximately 50% more expensive than a standard RAAB.

Our experience suggests that undertaking RAAB in high-income countries may be more challenging,[26] and has consequently rarely been undertaken. RAABs may therefore become more complex to complete, potentially with lower response rates, as settings become more economically developed and urbanised. This challenge may require the development of new sampling methods, particularly for high-rise urban settings.

CONCLUSION

RAABs have made major contributions towards our understanding of the epidemiology of global blindness. The world is changing in terms of patterns and causes of disease, including eye disease, as well as the technology available. RAAB needs to take advantage of new opportunities and adapt to changing needs in order to stay relevant and widely used, and to continue contributing towards global eye health.

Contributors The five authors form the task group for the new development of RAAB, described in the paper, and so are responsible for conceptualising and implementing these updates. AB is leading on the technical innovations to RAAB, and HL on the RAAB repository, both described in the review. IM and HK drafted the paper, which was reviewed by the remaining authors. All the authors read and approved the final version of the text.

Funding This work was supported by the CBM and the Commonwealth Eye Health Consortium, funded by the Queen Elizabeth Diamond Jubilee Trust. HK is supported by the PENDA grant from the Department for International Development. MJB is supported by the Wellcome Trust (207473/Z/17/Z).

Competing interests The Peek Vision Foundation (09919543) is a registered charity in England and Wales (1165960), with a wholly owned trading subsidiary, Peek Vision Ltd (09937174). MJB is a trustee of the Peek Vision Foundation and AB is the Chief Executive Officer of the Peek Vision Foundation and Peek Vision Ltd.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

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