Chapter 9

Summary and General Discussion
Clinical eye care in the Republic of Suriname has made considerable strides in recent years. However, no population-based data were available to provide an exact and up-to-date characterization of the current ophthalmic situation in the country. Without these data, it is difficult to evaluate the current system and to implement and evaluate targeted preventive and therapeutic eye care programmes. The findings described in this thesis provide baseline data about the status of eye care in Suriname. This will help developing a VISION 2020 action plan to reduce the burden of avoidable blindness in Suriname.

The specific aim of this thesis was to provide population-based data on the occurrence of eye disease in Suriname. The studies have specifically focused on preventable and treatable causes of these conditions in high-risk and/or socio-economic vulnerable groups, i.e., individuals of 50 years and older, diabetics, the interior population, and children. Furthermore, data have been collected on the aetiology of uveitis in Suriname in order to develop a targeted screening and therapeutic programme for this eye condition.

A Rapid Assessment of Avoidable Blindness (RAAB) survey methodology has been carried out to assess the prevalence and causes of blindness and visual impairment (VI) as well as the prevalence of diabetes mellitus (DM) and diabetic retinopathy (DR) and the cataract situation in the Surinamese population of 50 years and older. In addition, the status of cataract surgical care at the Suriname Eye Centre (SEC) has been evaluated by assessing the impact of a new cataract surgical intervention programme on cataract surgical output and other relevant indicators. Experiences of the SEC with, and the outcome of outreach cataract services - phacoemulsification under topical anaesthesia in remote rural areas - are not covered by the RAAB and have separately been described. The same applies to the specific causes of blindness and VI in the Maroon population in Suriname's interior.

Data on avoidable childhood blindness in school-aged children (8-15 years old) in Suriname were retrieved from the records of the SEC. Using this information the epidemiology and most important causes of childhood ocular trauma were identified.

Finally, a prospective hospital-based study has been performed to address the causes of uveitis in Suriname in order to develop a targeted diagnostic and therapeutic uveitis programme.

Visual impairment and blindness in vulnerable populations in Suriname

Results from the RAAB study: visual impairment and blindness in older adults

In a population-based cross-sectional survey, 2,998 individuals aged 50 years and older were included. Fifty clusters of sixty individuals aged ≥ 50 years were randomly selected with a probability proportional to the size of the population unit. Eligible persons were randomly selected through compact segment sampling and examined in their own house using the standard RAAB protocol.[1] Prevalence and causes of blindness (presenting visual acuity (PVA) <3/60), severe VI (SVI: PVA <6/60 – 3/60), and moderate VI (MVI: PVA <6/18 – 6/60) were assessed. Cataract surgical coverage (CSC), main barriers to the uptake of cataract surgery, and outcomes after cataract surgery were evaluated.

Eventually, a total of 2,806 individuals were examined (response rate of 93.6%). The standardized prevalence of blindness was 1.9% (95% CI: 1.0-2.8). Prevalence of SVI and MVI were 1.1% (95% CI: 0.6-1.6) and 5.6% (95% CI: 4.1-7.0), respectively. Untreated cataract was the most common cause of bilateral blindness (54.0%) followed by glaucoma (23.8%). Cataract also accounted for most cases of bilateral SVI (57.9%). The main causes of MVI were uncorrected refractive error (URE, 48.6%) and untreated cataract (33.7%). The CSC for PVA <3/60 was 88.1% when calculated by eye and 94.3% when calculated by individual. ‘Cannot access treatment’ was the most common barrier (28.9%) for cataract surgery. Of the eyes that received surgery, 80.5% had a good
outcome (PVA >6/18) and 9.8% had a poor outcome (<6/60).

This was the first population-based survey on blindness and VI in Suriname. It is concluded that the prevalence of blindness in Suriname is comparable to that in other South American and Caribbean countries. Of note, 87.3% of all bilaterally blind cases were avoidable. The main strategy to reduce this burden is cataract surgery, followed by the development of cost-effective optical and special glaucoma services.

Results from the interior Maroon population study: causes of visual impairment and blindness

In a preliminary study undertaken before the RAAB study, the scale and causes of blindness and VI in Maroons living in the interior of Suriname was assessed in a rural area along the Upper Suriname River between December 2011 and June 2012. Individuals at risk or suspected to be blind or visually impaired were actively recruited for eye examination by co-workers of the Medical Mission. Systematic ophthalmic examination was performed using the World Health Organization (WHO) Eye Examination Record version III developed for the Prevention of Blindness Programme (PBL) (1988).

A total of 578 participants were included in the study. Thirty-eight of them (6.6%) were either blind or severely visually impaired, and 102 (17.6%) were visually impaired. Cataract was the leading cause of blindness and SVI (60%). Other major causes of blindness and SVI were glaucoma (16%) and idiopathic optic atrophy (10%). A few patients were blind due to phthisis bulbi, aphakia, corneal opacities, retinitis pigmentosa, or toxoplasmosis.

This was the first study to assess the causes of blindness and VI in the interior of Suriname, and the results suggest a relatively high burden of sight-imparing conditions in the Maroon population. This indicates an urgent need for blindness-prevention programmes in these remote rural areas with emphasis on effective treatment of cataract and strategies for early detection and treatment of glaucoma. The latter condition compromises a great challenge when compared to the former, since treatment of glaucoma often fails in the interior population because of poor patient acceptance, compliance, follow-up and post-operative care.

Insight into specific causes of visual impairment and blindness in Suriname

Cataract and cataract surgical care

A newly implemented cataract surgical intervention programme at the SEC was evaluated by analysing the cataract surgical output and related indicators in the period between 2006 and 2014. As cataract was still the most important cause of blindness in Suriname, findings from the RAAB survey were used to describe the prevalence of cataract blindness and the outcome of cataract surgery in the population aged 50 years and older.

The results from this evaluation showed that the number of cataract operations at the SEC has increased from 1,150 in 2006 to 4,538 in 2014, leading to an estimated national Cataract Surgical Rate (CSR) of 9,103 per 1,000,000 inhabitants. Furthermore, the age- and sex-adjusted prevalence of bilateral cataract blindness in Surinamese individuals of 50 years and older was reduced to 0.8% (95% CI 0.2-1.3%). Importantly, the proportion of eyes with a post-operative visual acuity (VA) <6/60 (poor outcome) was lowest in eyes operated at the SEC (8.5%) and highest in surgeries performed by foreign humanitarian ophthalmic missions (33.3%).

It is concluded that the cataract situation in Suriname is well under control since the implementation of the new intervention programme. Important factors contributing to this success were the introduction of phacoemulsification with modern surgical equipment, intensive training courses, and improvement in the affordability and accessibility of cataract surgery. The programme may function as an example for other (developing) countries to reduce the burden of cataract blindness and to improve surgical outcomes. However, to avoid recurrence of the backlog in surgeries and the increase in the prevalence of cataract,
it is mandatory to increase the yearly output of cataract operations.

Cataract and cataract surgical care in the interior
Although the use of phacoemulsification under topical anaesthesia in mobile eye camps has been described before [9], its use in the setting of the Amazon rain forest is unique. In this retrospective observational study we report the use of high-quality cataract surgery in remote areas of the Amazon in Suriname. The experiences with and the clinical outcome of primary phacoemulsification with intraocular lens (IOL) implantation were described in 88 patients. All surgeries were performed under topical anaesthesia in the field by the ophthalmic team of the SEC. Outcomes were evaluated by comparing pre- and post-operative uncorrected visual acuity using WHO criteria, and assessing intra- and immediate post-operative complications by Oxford Cataract Treatment Evaluation Team (OCTET) definitions.[2]

Before surgery, 54 eyes (61%) were either blind or severely visually impaired. Only 8 patients (9%) had a VA ≥6/18. At the final post-operative visit, 61 patients (70%) had an uncorrected VA ≥6/18 and 8 patients (9%) had remained blind or severely visually impaired. Intra-operatively 2 cases (2%) of posterior capsule rupture (OCTET III) occurred, involving one dropped nucleus (1%). The latter case required vitreoretinal surgery at the SEC.

These results indicate that it is possible to perform high-quality cataract surgery in remote areas of the Amazon rain forest and achieving acceptable results with few complications. Unfortunately, the results from the RAAB survey indicated that visual outcome results were often worse in eyes operated in eye camps organized by others when compared to those treated at the SEC or in eye camps organized by the SEC. Analysis of these unacceptable results indicated that 83% of the poor surgeries was performed by foreign ophthalmic teams. In contrast, only one of seven individuals with a poor outcome was operated in an eye camp of the SEC. This eye had a poor outcome due to posterior capsule opacification.

These observations underscore the importance of meticulously evaluating visual outcome after cataract surgery in eye camps. Detailed pre-operative ophthalmic examinations, careful patient selection, improved diagnostic capacities, experienced cataract surgeons, and the possibility of YAG laser capsulotomy are necessary to obtain satisfactory results.

Diabetes mellitus and diabetic retinopathy in older adults
The standard RAAB protocol was expanded with the DR module.[3] Participants were classified as having DM if they had previously been diagnosed with this condition; were receiving treatment for glucose control, or had a random blood glucose level >200 mg/dL. These participants were dilated for funduscopy, assessed for DR following the Scottish DR grading protocol [4], and evaluated for ethnic background and DR ophthalmic screening frequencies.

Our results showed a prevalence of DM in Suriname of 24.6%. Diabetic retinopathy of any type and/or maculopathy occurred in 21.6% of DM patients, and sight-threatening DR in 8.0%. Furthermore, 34.2% had never undergone an eye examination for DR, and 13.0% had his/her last examination more than twenty-four months earlier. The prevalence of DM was statistically significantly higher in Hindustanis when compared to the other ethnic groups.

This was the first survey on DR in Suriname and the first RAAB survey in South America that included the DR module. It is concluded that the estimated prevalence of DM in Surinamese individuals of 50 years and older was higher than expected, and that the proportions of uncontrolled diabetics and patients who never had an ophthalmic examination was unacceptably high. To decrease the prevalence of DR-induced blindness, patient accrual, regular controls for DR and awareness about the importance of a well-adjusted blood sugar level must be increased.
Aetiology of uveitis
So far, no epidemiological data are available on uveitis in Suriname. In this prospective cohort study, 100 consecutive uveitis cases were included between July 15, 2014 and January 29, 2015. All patients were evaluated for their medical history using a specific uveitis screening questionnaire form, as well as for their standard laboratory values. Subsequently, the patients were classified according to their ethnic background, age, and gender, as well as anatomical and aetiological diagnosis using the Standardization of Uveitis Nomenclature Working Group (SUN) criteria.[5]

The results showed that 64% of the 100 recruited patients had an anterior uveitis. Panuveitis was the second most common anatomical location (19%), followed by posterior uveitis (15%) and intermediate uveitis (2%). In 59% of cases no underlying cause could be identified, but toxoplasmosis chorioretinitis was diagnosed as the most common cause of uveitis (24%).

The findings of this study will be used for the development of a targeted and multidisciplinary screening programme for uveitis patients in Suriname. Clearly, such a programme is essential for optimal management and care of this condition. Fortunately, the presentation of the results from the current study have led to the introduction of more diagnostic possibilities for the patient with uveitis, including a more standardized uveitis screening protocol and the QuantiFERON test for the diagnosis of tuberculosis-related-uveitis.

Visual impairment and ocular trauma in children
In contrast to blindness in children, no detailed information is available on childhood ocular trauma in Suriname. In this study, all children who were 8 to 15 years old at the time of the survey and who had previously undergone evaluation and/or treatment at the SEC because of ocular trauma, were retrospectively evaluated. As the SEC is the only tertiary eye care centre in Suriname, this sample probably included almost all school-aged children who had previously suffered from (severe) eye injury.

There were 538 records of children with ocular trauma, including 35 (7%) open-globe injuries (OGI), 458 (85%) closed-globe injuries, 5 (1%) orbital fractures, and 40 (7%) eyelid injuries. The most frequent causes of trauma were body parts (18%) and sticks or branches (13%), which had resulted from poking (20%) or punching (13%) the eye. Final VA <6/60 was reported in 58% of the registered cases of OGI. Living in rural areas (p = 0.007), OGI (p <0.0001), and poor compliance to scheduled check-ups (p <0.0001) were statistically significantly related to an unfavourable outcome, but patient delay was not. Children having OGI were more often hospitalized than those with other injuries (p < 0.0001).

This study was the first providing data on ocular trauma in children in Suriname. According to these findings, targeted preventive strategies to promote awareness, parental supervision, immediate action, and compliance should be developed to eliminate trauma-induced blindness and VI.

Methodological considerations

Strengths and limitations of the study

Rapid Assessment of Avoidable Blindness
The RAAB is an updated and modified version of the Rapid Assessment of Cataract Surgical Services (RACSS).[7] Using epidemiologic methods, the data obtained are used to design and monitor eye care programmes.[1] Important strengths of the RAAB protocol are its rapidness and ease of implementation at relatively low costs. This observation accompanied by the results from the current study, should be communicated to stakeholders in order to develop a comprehensive VISION 2020 action plan that includes the optimum infrastructure for cataract surgical services. The RAAB methodology also helps to identify problems such as causes of poor outcome after surgery and the barriers to surgery, enabling the development of strategies to overcome them.[1]

Furthermore, the standardized RAAB method
makes it possible to compare results of different countries with each other and develop follow-up studies to evaluate the effects of interventions.

On the other hand, the RAAB does not estimate the prevalence of blindness in individuals younger than 50 years of age, and only identifies sight-impairing eye diseases, while the diagnostic facilities are too limited to accurately diagnose causes of posterior segment disease. Furthermore, in the current study, when compared to the most recent census data, the older age groups were overrepresented. This means that the sample prevalence for blindness was likely higher than the age- and sex-standardized prevalence. In addition, the most isolated areas in the interior of Suriname were not included in the study and were replaced by the next nearest areas that were deemed suitable for examinations and cataract surgeries. For these reasons, the cataract prevalence in Suriname’s interior might have been underestimated.

The identification of only visually impairing diseases is also an important limitation of the RAAB method, particularly with regard to the prevalence of glaucoma, the most common cause of bilateral blindness in Surinamese men. As central vision often remains intact in glaucoma patients, this may imply that with so many patients who became blind from glaucoma, the number of patients in Suriname with glaucoma may even be much higher. Unfortunately, these patients may have been overlooked in the current study, as the standard RAAB examination does not include an advanced screening method - such as visual field testing - for glaucoma.

The overrepresentation of older age individuals in the current study might also have led to an underestimation of the prevalence of DM. The latter value may have further been biased by measuring non-fasting glucose levels only once instead of repeatedly, and the lack of an oral glucose tolerance test and/or fasting glucose level test.

Still, the relatively new DR module of the RAAB survey is a feasible tool to rapidly obtain large numbers of population-based data on DM and DR.

Studies in the interior
The studies described in this thesis were the first on blindness, VI, and cataract surgery in the population living in the interior of Suriname. A limitation of the study in the Maroon population was the self-created selection bias to ensure the inclusion of all blind and visually impaired individuals. Thus, patient recruitment was not ad random, which makes it difficult to determine the exact prevalence of blindness and eye diseases in these people. The most important limitation of the report on cataract surgery in the Amazon rain forest was the retrospective study design.

Hospital-based studies: uveitis and childhood ocular trauma
An important drawback of the uveitis study was the relatively small sample size (only 100 patients). In addition, the lack of comprehensive diagnostic tools – largely attributable to financial constraints - prohibited analyses of HLA-B27 status and angiotensin-converting enzyme levels. This information is particularly helpful for the prognosis and the identification of underlying systemic diseases in patients with suspected acute anterior uveitis. It was also not possible to perform polymerase chain reaction-based aqueous fluid analysis for the diagnosis and treatment of patients suspected of having posterior uveitis caused by an infection such as herpes simplex. Notwithstanding, the data that emerged from this study are very useful for the development of a targeted uveitis screening and treatment programme at the SEC.

The most important weakness of the study on childhood ocular trauma was the incompleteness of the medical records, particularly with respect to data on VA at presentation and final VA. Still, as the SEC is the only eye care centre in Suriname, the current data probably covered most cases of severe ocular trauma in school-aged children in Suriname and consequently, are useful for the planning of preventive eye care programmes. However, we
do not consider the data as population-based since mild cases are treated in other health care settings and cases that were not able to receive ophthalmic care in the SEC were also not included in our analyses.

Implications for policy makers and clinical practice

The results of the RAAB and the studies on cataract in the interior of Suriname led to the following recommendations for the SEC and policy makers:

1. Maintain and expand the CSR through:
   a. intensified national health promotion campaigns about the benefits of cataract surgery;
   b. appeals for allocating more resources to the treatment of cataract with argument that treatment of cataract reduces poverty;
   c. intensified case finding;
   d. an increased efficiency in the referral system for cataract surgery;
   e. the application of more high-output methods;
   f. measures to increase CSR by at least 10% per year to compensate for population growth.

2. Increase the number of women undergoing cataract surgery by:
   a. developing special strategies to promote cataract surgery in women.

3. Improve the visual outcome of cataract surgery in eye camps through:
   a. analyses of the reasons for poor visual outcome after surgery in eye camps through routine monitoring of cataract outcome, including analyses of current (foreign) surgical practices to reduce surgical complications;
   b. detailed reports that underscore the importance of detailed pre-operative ophthalmic examinations and improvements of the diagnostic capacity of eye camps;
   c. analyses of current practice to determine the power of IOLs;
   d. improvement of biometry and optical services for cataract surgery;

4. Develop and expand the uptake of special services for glaucoma by:
   a. expanding health information on glaucoma and emphasizing the importance of regular check-ups;
   b. active screening of family members of glaucoma patients aged 40 years and older, and the interior Maroon population.

5. Expand the uptake of special services for DR by:
   a. increasing the number of regular fundus controls for DM patients;
   b. increasing the proportion of DM patients with a well-adjusted blood sugar level.

6. Expansion of low-vision and optic services.

The results from the studies on ocular trauma in children indicate the need for:

1. educational interventions to promote awareness, parental supervision, immediate action, and compliance in both rural and urban populations, particularly in the high-risk population of boys 3 to 11 years of age.

2. the use of protective glasses and restrictions on the use of catapults, fireworks, and chemical substances by children.

The most important recommendation of the uveitis study is:

1. the need to develop and extend the diagnostic tools for uveitis patients

Considering the burden of (avoidable) VI and blindness and societal costs, especially with respect to productivity losses, it may be cost-effective to carry out the above recommendations and to invest into adequate ophthalmic care as soon as possible.

Future studies

As mentioned above, the findings from the RAAB survey can be used to prioritize the specific needs for ophthalmic care in Suriname. Importantly, a follow-up RAAB survey can be implemented to assess achievements over time and make adjustments if necessary. In
order to maintain and even improve the level of cataract surgical care, the SEC should also obtain a detailed analysis of the current cataract surgical services to identify possibilities to increase the surgical output and to improve the outcome of cataract surgery in eye camps.

When considering the magnitude of DM in Suriname, prospective cohort studies involving every new patient with DM should address the risk factors involved in the susceptibility of diabetics to develop DR. These studies should also elaborate on methods to improve care for individuals suffering from DM. Furthermore, the multi-ethnic and multicultural composition of the Surinamese population warrants studies on the influence of genetics and life-style on the development of DM and DR.

The multi-ethnic nature of the Surinamese population also warrants studies on the genetic background of glaucoma, the second most important cause of bilateral blindness in Surinamese of 50 years and older. Particularly primary open angle glaucoma (POAG) frequently manifests in certain Afro-Surinamese families (expert opinion ABM), supporting the hypothesis about a genetic background of this disease. Although various POAG genes have been identified in Caucasian and Asian patients, most of them are presumably not associated with the development of POAG in individuals from African descent. For all these reasons, studies on the genetic risk factors for POAG in Suriname may help contribute to the growing knowledge on the genetics of this condition.

A notable finding of the current study was the relatively high percentage of blindness caused by idiopathic optic atrophy, which is consistent with comparable population-based studies with black participants.[8] Between 1974 and 1977, a retrospective case record and field study was conducted about the occurrence, forms, and aetiology of optic atrophy in Suriname [9]. It was concluded that the black population groups in Suriname might develop optic atrophy because of a hereditary predisposition combined with exogenous factors such as toxic influences of nutritional cyanide intake in various cassave products [9], but the exact cause is still unknown. Thus, more detailed studies should be carried out to understand the aetiology of optic atrophy in populations of African descendent.

When considering the data gathered in children, much work has already been done, but further research should be performed to optimize ophthalmic health education and eye care for children in Suriname.
References


