Chapter 1

General Introduction
Prevention of blindness and visual impairment

Visual impairment (VI) and blindness are associated with considerable disability, loss of productivity, psychosocial problems, and excess mortality.[1–3] Therefore, prevention of blindness and VI receive a high priority in health programmes of many countries throughout the world. In the year 2010, the global number of visually impaired individuals was estimated at 285 million, 39 million of whom were blind.[4] The most recent global estimates suggest numbers of 3.2 million blind and 26.6 million visually impaired people in the Americas.[4] This is the reason for the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) to initiate the VISION 2020 programme, which aims to reduce the burden of avoidable blindness by the year 2020. In order to achieve this goal, regular population-based surveys are crucial to provide an updated characterization of the visual problems, establish local eye care programmes, and initiate future eye care planning.[4] So far, no standardized population-based surveys on the prevalence and causes of blindness and VI have been conducted in Suriname. This makes it difficult to estimate the extent of preventive or therapeutic eye care needed in the country and to design and conduct effective programmes that address these issues.

Ophthalmic care in the Republic of Suriname

The Republic of Suriname, an independent state situated on the northeast coast of South America, is an example of a developing country where avoidable and treatable blindness remains an important public health problem. The population size of Suriname for 2014 has been estimated at 573,311.[5] Around 90% of the population lives in the capital city Paramaribo and in other cities located in the narrow coastal zone in the northern part of the country.[6] The remaining 10% inhabits the interior, which comprises more than three-quarters of Suriname’s land surface and consists largely of tropical rain forest.[6] Suriname has an annual gross national income per capita of US$ 9,370 and is an upper middle-income country according to World Bank criteria.[7] The country belongs to the Caribbean, is part of the WHO Americas-B (AMR-B) sub-region and is a member of the South American and Pan American Health Organization (PAHO) that represents the WHO in the region.[8]

The ten ophthalmologists of the Suriname Eye Centre (SEC) at the Academic Hospital Paramaribo (AZP) mainly provide specialized ophthalmic care in Suriname. Ophthalmology in Suriname has considerably advanced in the past years and the SEC has been accepted as an associate member of the World Association of Eye Hospitals (WAEH).[9] Each ophthalmologist performs cataract surgery and most have their own sub-specialization including glaucoma surgery, vitreoretinal surgery, cornea, and paediatric ophthalmology. Currently, a Surinamese resident is trained in oculoplastic and orbital surgery. The SEC itself provides training and education of medical and paramedical staff, and this is combined with a residency in The Netherlands at the Rotterdam Eye Hospital.

Since ophthalmic care is centralized in Paramaribo, decentralization of eye care represents an important problem in Suriname. For this reason, eye care for the interior and the rural districts is provided by regular visits (Eye Bus) and cataract surgical missions, both organized by the SEC. Nevertheless, every day new patients from the city as well as the surrounding districts present at the SEC with severe and sometimes end-stage eye disease. Obviously, treatment possibilities for such patients are limited. Particularly older individuals from rural parts of Suriname are not always able to reach the SEC. As a result, a high burden of avoidable blindness can be expected in these vulnerable populations. Unfortunately, data on the prevalence of blindness and VI for Latin America and the Caribbean between 1980 and 2012 are limited to only six nationally representative studies[10] and even non-existent for Suriname. This makes it difficult for the country to determine whether or not the goals of Vision 2020 - to reduce the burden of avoidable blindness - are achieved.
Potential causes of visual impairment and blindness in Suriname

Cataract

Cataract is the main cause of blindness globally, accounting for 51% of reported cases of blindness and one-third of those of VI in many parts of the world.[11] Improving cataract surgical care continues to be a road with many obstacles, which holds particularly true for the rapidly aging population in developing countries where over 90% of the world’s visually impaired live.[12] This is for an important part attributable to the lack of, and inequity of access to modern diagnostic and treatment facilities in these countries.[1,2]

Improvements in the infrastructure of cataract surgery are mandatory to reduce avoidable blindness. This requires the set-up of more regional eye care and training centres in order to reach remote areas and unaware communities.[11] Furthermore, regular population-based studies should be carried out in order to obtain data on the impact of such intervention programmes, related trends, and surgical outcome.[1] Notably, these data can help motivate other countries to improve cataract surgical care.[1] For these purposes, cataract surgical coverage (CSC) can serve as a reliable parameter of cataract status and the impact of cataract intervention programmes in a specific area.[1]

Impressive strides have been made to increase cataract services in South and Latin America.[11] Since 2005, improving cataract surgical care has also been one of the principal goals of the SEC. For this purpose, the SEC implemented a cataract surgical screening and intervention programme in 2006. The programme focused on the training of ophthalmologists and paramedical surgical staff in using modern phacoemulsification techniques; improvement of the infrastructure of cataract surgical care services, including the systematic inclusion of distant rural areas; and the creation of a cataract Ambulatory Surgical Centre as well as the acquisition of modern and in part transportable equipment. The result has been a substantial increase in the annual number of cataract surgeries performed (unpublished data medical office SEC). So far, no other information on the cataract situation in Suriname is available. However, data on the CSC in Suriname and the effectiveness and safety of the current cataract surgical programme are needed to evaluate the current cataract surgical care programme in Suriname and make adjustments based on future needs.

Diabetic retinopathy

It is estimated that in the year 2014 387 million individuals throughout the world suffered from diabetes mellitus (DM), and that this number will increase to 438 million by the year 2030.[13] Since nearly 80% of all diabetics live in low- and middle income countries[14], this increase will largely occur in developing countries including those in South and Latin America.[15] Diabetic retinopathy (DR), a severe eye complication of DM, is responsible for 1.0% of blindness and VI worldwide.[4] Even in high-income countries it is the leading cause of blindness in the working-age population.[14] Although the number of visually impaired individuals are likely to decrease due to Vision 2020 programmes, that of blind people due to posterior segment disease including DR, is anticipated to increase.[14] Population-based surveys on DM and DR are scant but necessary to provide an up-to-date assessment of the problem, improve awareness, and develop effective intervention programmes.

In Suriname, the prevalence of DM is estimated at 20% in individuals of 50 years and older.[13] Despite high-quality ophthalmic care including laser therapy and vitreoretinal surgery, DR seems to be a major problem in Suriname (expert opinion Jerrel Pawiroredjo, vitreoretinal surgeon SEC). More detailed data on the prevalence of DM and DR in Suriname are lacking but urgently needed for appropriate planning of DR services. Since Suriname is renowned for its multicultural composition[6], its population also offers the possibility to identify ethnic (genetic) differences related to the prevalence of DM and DR.
Glaucoma

Glaucoma seems to be another major health problem in Suriname (expert opinion of ophthalmologists at the SEC), an inclination that could be attributable to the relatively high proportion of the Surinamese population being of African descent (37.4% Maroon and Creole, 12.5% mixed).[6] This has also been reported for several other Caribbean and South American countries including Cuba, where the proportion of blindness due to glaucoma even amounts to 26.2%.[8] Many patients with glaucoma present at a late stage when treatment possibilities are limited. The consequence may be massive loss of visual field which is often seen in patients from distant, rural areas.[16] This is unnecessary when considering the wide range of effective medical and surgical interventions that are available. Therefore, awareness of glaucoma in families at risk could decrease patient delay and prevent people from becoming blind. Together, these considerations indicate the need of population data on the prevalence of blindness and VI due to glaucoma in order to develop preventive glaucoma programmes.

Uveitis

Uveitis is a common form of inflammatory eye disease and represents an important cause of VI and blindness worldwide.[17] It comprises a large group of diverse diseases that affect not only the uvea but also retina, optic nerve, and vitreous.[18] The aetiology of uveitis includes infectious causes such as toxoplasmosis and herpes as well as associations with various non-infectious systemic disorders such as sarcoidosis. If not diagnosed and treated early, uveitis may cause complications that can lead to permanent VI.

In Suriname, no data are available on the prevalence of the various forms of uveitis and on the prevalence of related systemic disorders. The same holds true for standardized diagnostic and treatment protocols for patients with uveitis, and this often results in delay of diagnosis and efficacious forms of treatment. Thus, data on the aetiology of uveitis in Suriname are necessary for the development of a targeted screening programme to optimize ophthalmic care for uveitis patients in Suriname.

Causes of visual impairment and blindness in childhood

Although blindness in children is relatively uncommon, it is a priority of Vision 2020 for several reasons. These include the detrimental psychological impact on patients and the substantial socio-economic consequences for both patients and the community in terms of productivity loss and medical care, including rehabilitation services.[19] The prevalence of blindness in children varies between approximately 0.3/1,000 children in industrialized countries and 1.5/1,000 in developing countries.[20] Causes range from corneal scarring secondary to vitamin A deficiency and measles in low-income countries to retinopathy of the prematurity (ROP) and cataract in middle-income countries.[21] Still, many causes of blindness in children are treatable and avoidable.[22]

The first data on childhood blindness in school-aged children in Suriname became available in 2013.[23] In that study, childhood cataract and ROP were identified as the major causes of bilateral blindness and severe visual impairment (SVI), and more than one third of cases was avoidable.[23] Although not published, trauma was the major cause in 20% of children with unilateral blindness (visual acuity (VA) <3/60)). Since an estimated 90% of particularly in childhood ocular trauma can be prevented [24–26], data on the epidemiology and aetiology of childhood ocular trauma could help increase awareness of, and reduce blindness in Surinamese children.

Collection of epidemiological data

Rapid Assessment of Avoidable Blindness

The Rapid Assessment of Avoidable Blindness (RAAB) survey is a rapid, simple, and inexpensive standardized methodology to assess the prevalence and causes of blindness in people aged 50 years and older in a specific
geographic area.[27] The RAAB focuses primarily on the prevalence of avoidable causes of blindness such as cataract, refractive errors, and corneal scarring [27] So far, the RAAB has been successfully undertaken in more than sixty countries worldwide.[28] Due to its standardized methodology, results from different countries can reliably be compared with each other. Furthermore, the findings from a specific country can be used to prioritize the specific needs for ophthalmic care of the communities in that country. Importantly, the RAAB can be used to assess the achievements of intervention programmes over time and make adjustments where necessary.[27] Longitudinal studies have already been carried out in Cuba (Havana, 2004 and 2012), Mexico (Nueva León state, 2005 and 2014), and several districts in Vietnam, with encouraging results in most of these areas.[28] Increasing awareness of the burden of DR worldwide has led to the development of a new method to estimate the prevalence of this condition. This new method has been incorporated in various RAAB surveys and proved successful in eleven countries including Mexico, Moldova, Saudi Arabia, and Jordan. [15,29–31] This method has also been standardized so that DR data from certain regions can also be compared to those from others. However, significant gaps still exist in reliable population-based DR data from many developing nations.[14] Patients’ records of the Suriname Eye Centre As the SEC is the main eye care centre in Suriname, its ophthalmologists are consulted by all other hospitals in the country. This also holds true for, for instance, cases of multi-system disease and eye disease in remote rural areas. For these reasons, the records of the SEC contain information about the majority of eye patients in the country, which makes them useful for epidemiological studies. In addition to providing adult population-based RAAB data, the SEC records can be used to obtain information on childhood blindness and VI, eye disease and ophthalmic care in the interior of Suriname, and more detailed data on specific aetiologies of eye disease in Suriname.

Aims of this thesis
This thesis provides population-based data on the occurrence of eye disease in the Republic of Suriname. These data not only give an indication of the current situation in the country, but also are required for the development of targeted intervention programmes to reduce the burden of avoidable blindness. The studies have specifically focused on preventable and treatable causes in high-risk and/or socio-economic important groups, i.e., individuals aged 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 on this eye condition.

A RAAB survey has been carried out to assess the prevalence and causes of blindness and VI as well as the prevalence of DM and DR in the Surinamese population of 50 years and older. These data also gave detailed insight into the current cataract situation in Suriname, including the cataract surgical coverage, cataract surgical outcome, and the main barriers to cataract surgery. The cataract surgical care of the SEC has been assessed by evaluating the cataract surgical output, the average number of surgeries performed per ophthalmologist per year, and the weighted mean number of ophthalmologists per one million individuals in the period between 2006 and 2014, after the implementation of the new cataract surgical intervention programme.

The 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.

The records of the SEC also provided data on avoidable childhood blindness and VI in Suriname. Using this information, all school-aged children (8-15 years old) who had attended
the SEC have been assessed for VI and/or (severe) eye injury. This analysis helped to identify the frequency and causes of childhood ocular trauma.

Finally, a prospective hospital-based study has been performed to assess the causes of uveitis in Suriname. As mentioned above, these data are needed for the development of a targeted diagnostic and therapeutic programme on uveitis in the country.

Outline of this thesis

The prevalence and causes of blindness and VI in people aged 50 years and older in Suriname are reported in **Chapter 2**. The population-based data have been obtained using the RAAB methodology and also include CSC, cataract surgical outcomes, and the barriers to undergo cataract surgery.

**Chapter 3** describes the causes of blindness and VI in the Maroon population in the interior of Suriname. Data from this study can be used for the development of targeted eye care programmes in this group.

**Chapter 4** provides a detailed evaluation of the cataract situation in Suriname since the implementation of the new cataract surgical intervention programme in 2006. The efficacy and safety of the programme has been discussed in terms of cataract surgical output, average number of surgeries performed per ophthalmologist per year versus weighted mean number of ophthalmologists per one million individuals, prevalence of cataract in individuals older than 50 years, and location and outcome of cataract surgery.

**Chapter 5** describes experiences with phacoemulsification under topical anaesthesia in the interior of Suriname. The logistic and technical details provided clarify the feasibility to perform state-of-the-art phacoemulsification under topical anaesthesia in the Amazon rain forest.

Information on the prevalence of DR in Suriname, including the number of diabetics on regular ophthalmic monitoring, has been obtained using the RAAB+DR method and is given in **Chapter 6**. Since Suriname comprises a multicultural society, estimates on ethnic differences in the prevalence of DM and DR are also provided.

**Chapter 7** deals with the aetiology of uveitis in Suriname. In a prospective cohort study, 100 consecutive cases of uveitis have been classified according to ethnic background, age, and gender, as well as anatomical and aetiological diagnosis using Standardization of Uveitis Nomenclature Working Group (SUN) criteria.

**Chapter 8** gives details on the epidemiology and aetiology of childhood ocular trauma in Suriname. Using a hospital-based retrospective approach, all cases of children who were school-aged at the time of the survey and had visited the SEC because of ocular trauma, have been evaluated.

The general discussion in **Chapter 9** summarizes and discusses the results of this thesis, evaluates the current ophthalmic care system in Suriname, and concludes with recommendations for further eye care programmes and research in the country.
References


