The prevalence and causes of blindness and vision impairment in Trinidad & Tobago

Postgraduate Medical Institute

Braithwaite T[1], Bartholomew D[2], Deomansingh F[3], Fraser A[3], Maharaj V[3], Bridgemohan P[4], Sharma S[3], Singh D[4], Ramsewak SS[5] and Bourne RR[1], for the NESTT Study Group

1 Vision & Eye Research Unit, Anglia Ruskin University, UK; 2 Department of Ophthalmology, Port of Spain General Hospital, Trinidad; 3 Department of Optometry, University of the West Indies, Trinidad; 4 Department of Ophthalmology, Sangre Grande Hospital, Trinidad; 5 Faculty of Medical Sciences, University of the West Indies, Trinidad

veru
vision and eye research unit

Introduction

- The WHO Global Action Plan 2015-2019 "Universal Eye Health" reiterates the need for robust evidence on the magnitude and causes of vision impairment and on current eye care services to guide strategies to address the burden of avoidable vision loss[1]

- The Global Burden of Disease Study identified a paucity of epidemiological data for the Caribbean region[2]; the last comprehensive, national survey was conducted over 20 years ago (Barbados Eye Survey[3])

- Trinidad and Tobago has a population of 1.3 million with an aging demographic profile and an emerging epidemic of obesity, hypertension, diabetes and cardiovascular disease. In 2012, the Ministry of Health agreed to fund the National Eye Survey of Trinidad and Tobago (NESTT), to gather robust evidence to develop a National Eye Care Strategy

Methods

- Population-based, cross-sectional study using randomised multistage cluster sampling with probability-proportionate-to-size methods
- Primary outcome measure: % blind aged ≥ 40 years
- Sample size n = 4200
  - Assumptions: 1.7% blind[3], precision 0.5%, 20% non-participation, 1.4 design effect
- 2011 Census sampling frame, 120 clusters, compact segment sampling (Figure 1)
- 35 people aged ≥ 40 years per cluster plus 5 to 39 year olds alongside (Figure 2)
- Vision screening (LogMAR) and basic assessment at doorstep
- Comprehensive clinic for all ≥40 years (Figure 3)
- Independent grading of imaging data (Moorfields Reading Centre UK)
- Data collection between October 2013 and November 2014
- Ethics committee approval from Anglia Ruskin University, The University of the West Indies and the Ministry of Health of the Republic of Trinidad and Tobago
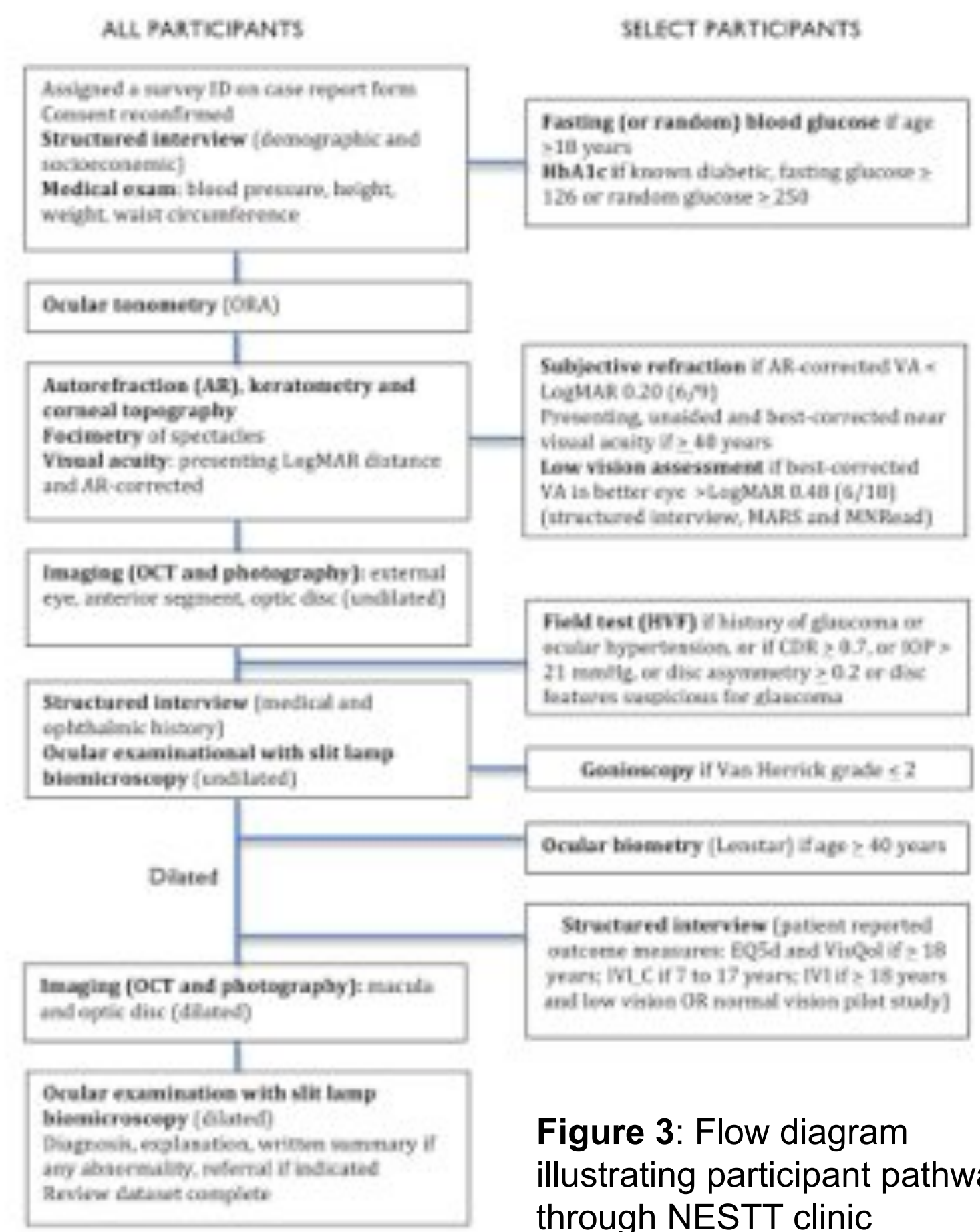

Figure 3: Flow diagram illustrating participant pathway through NESTT clinic

Statistical analysis

- Statistical analysis using STATA 13.1
- Crude prevalence adjusted for the multilevel design, weighted for cluster response rate, and adjusted using 2011 Census population stratified into 15 municipalities, 5-year age categories and gender
- Multilevel single and multiple logistic regression analysis for a) the odds of responding versus not responding, and b) the odds of having vision < 6/18 (Moderate+Severe vision impairment+Blind) versus ≥ 6/18
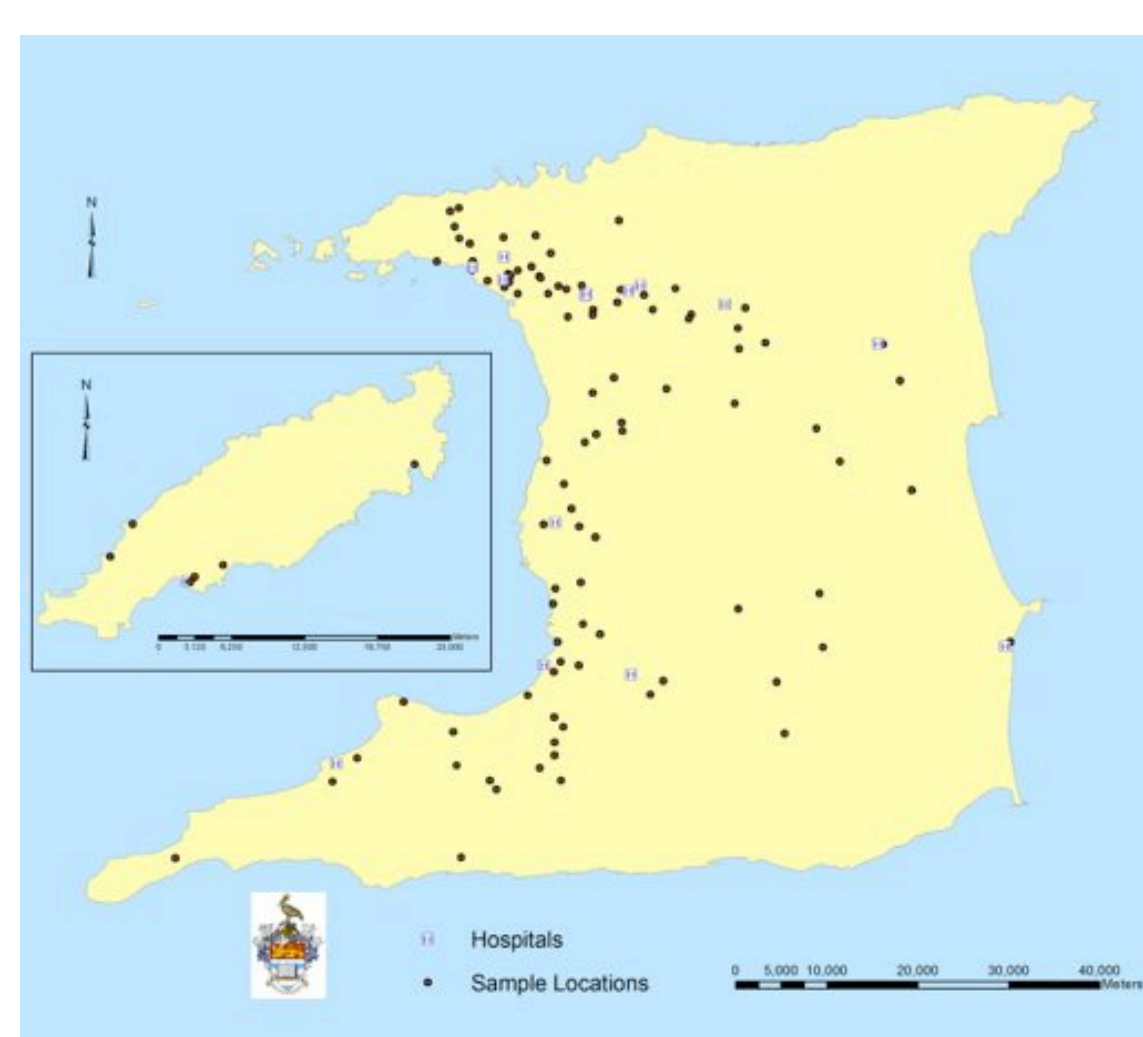

Figure 1: Map of Trinidad & Tobago showing location of 120 NESTT Study Clusters

Results

- n = 9898 aged ≥ 5 years enumerated
- Response rate ≥40 years 84.6% (3597)
  - 54.5% female, mean age 57.2 (sd 11.9) years, 42.6% African descent, 39.0% South Asian descent, 17.6% insured

- Responders versus non-responders:
  - Women significantly more likely to participate than men (OR 1.81, 95% CI 1.3-2.5, p<0.001)
  - Workers significantly less likely to participate than those on home duties (OR 0.36, 95% CI 0.2-0.6, p<0.001)
  - No significant difference in region, insurance status, ethnicity or gender (Table 3)

Population-based prevalence estimates for persons aged ≥ 40 years:

Blind (B): 0.73 % (95% CI 0.53 to 1.02)
Moderate or severe vision impairment (MSVI): 5.34 % (95% CI 4.71 to 6.04)

- Presenting visual acuity < 6/18 vs ≥ 6/18:
  - The odds of vision impairment increase linearly with age (OR 1.10, 95% CI 1.08-1.11, p<0.001)
  - The odds of vision impairment are significantly lower for people who have an active job (OR 0.39, 95%CI 0.21-0.74, p<0.01), and health insurance (OR 0.34, 95% CI 0.14-0.82, p 0.02)
  - There is no significant regional variation in vision impairment, or difference by sex or ethnicity
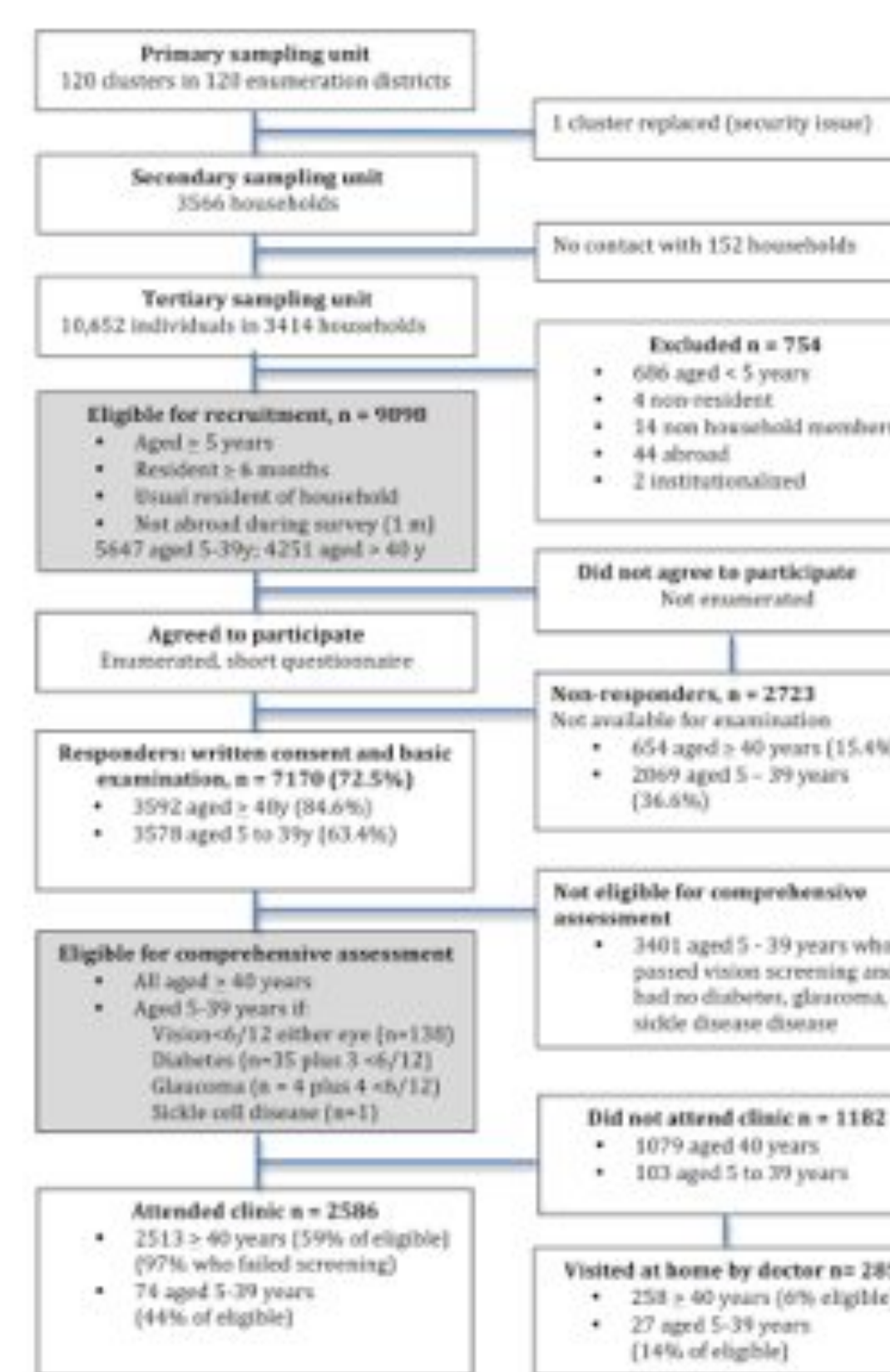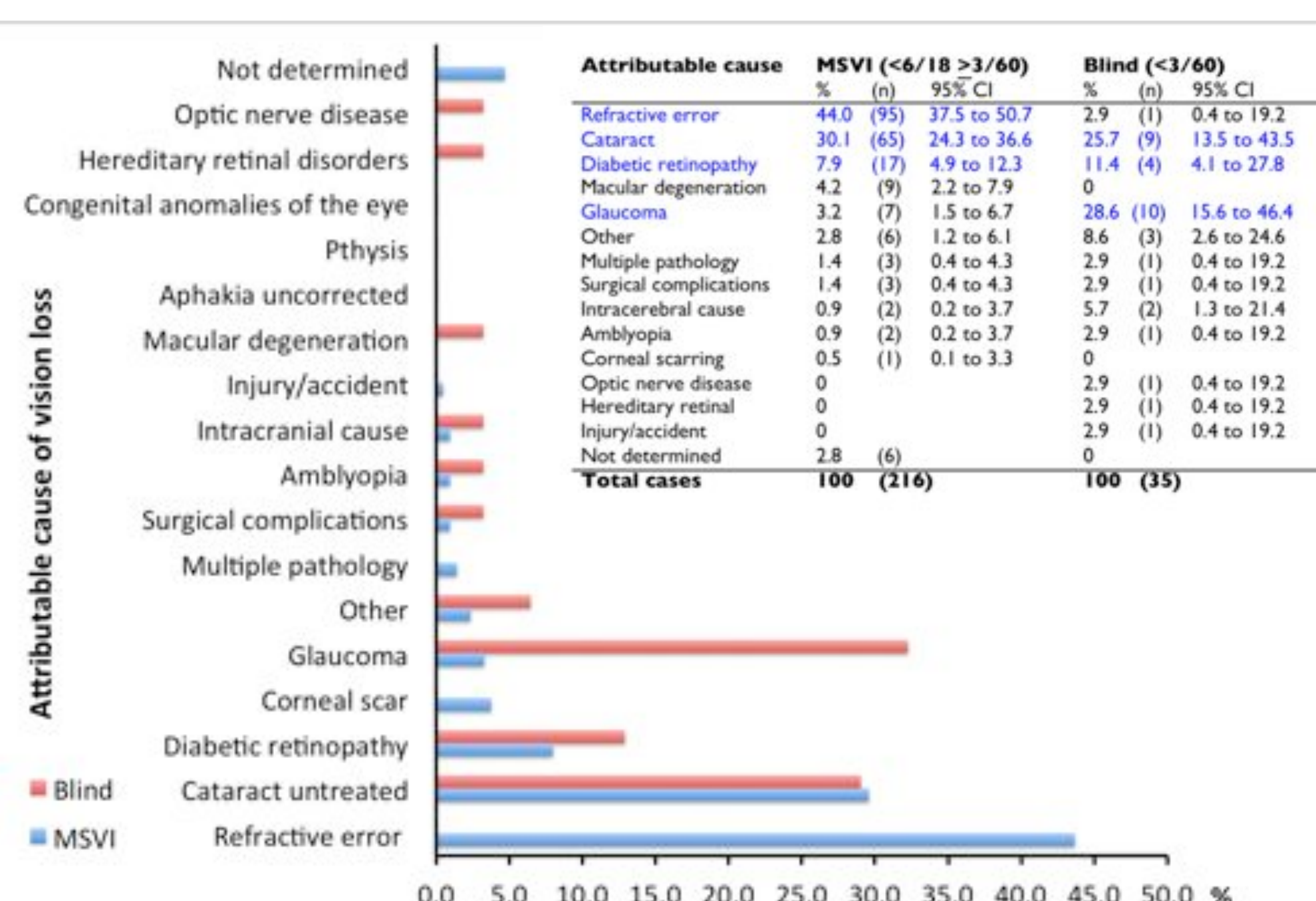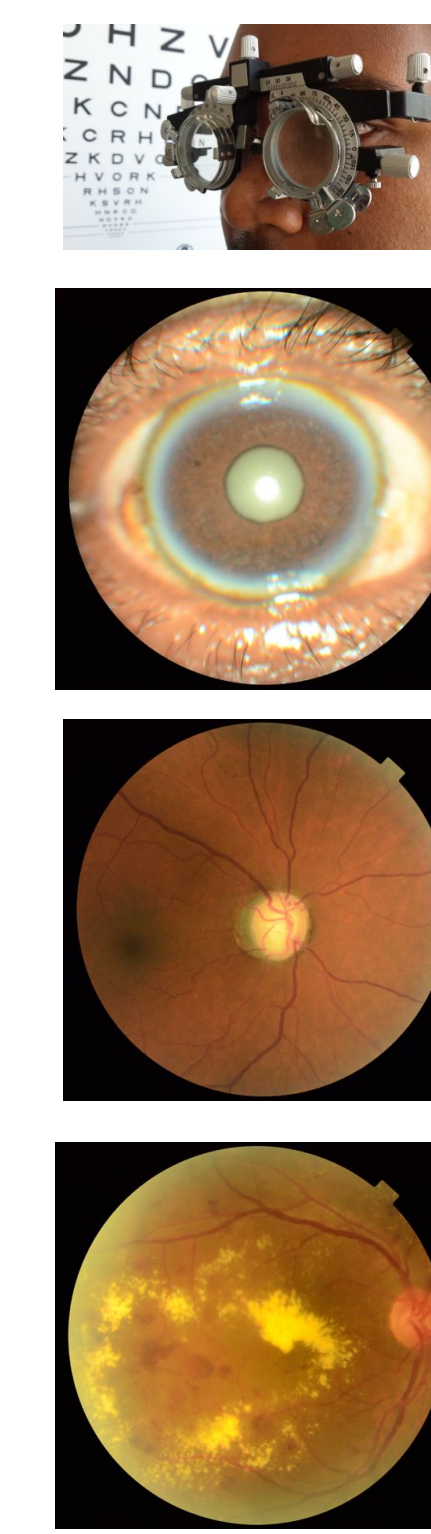
Table 1: Crude and adjusted prevalence of blindness (B) and moderate or severe vision impairment (MSVI)

Category of presenting vision impairment in better eye	Definition (Snellen)	Crude prevalence %	Crude prevalence (n)	Crude prevalence 95% CI	Adjusted prevalence* %	Adjusted prevalence* 95% CI
Normal vision and mild impairment	≥ 6/18	93.0	(3334)	92.1 to 93.8		
Moderate or severe vision impairment (MSVI)	< 6/18 to ≥ 6/60	6.03	(216)	5.3 to 6.9	5.34	4.71 to 6.04
Blind (B)	< 3/60	0.98	(35)	0.70 to 1.36	0.73	0.53 to 1.02
TOTAL % (n)		100	(3585)			

*Adjusted for multilevel design (island, cluster), weighted for response rate (by cluster), with post-stratification adjustment to 2011 Census population stratified by municipality (15), 5-year age groups and gender.

Figure 2: Diagram illustrating NESTT multistage study design and response rates

The causes of presenting vision impairment and blindness in the better seeing eye amongst adults ≥ 40 years

Attributable cause	MSVI (<6/18 >3/60) %	(n)	95% CI	Blind (<3/60) %	(n)	95% CI
Refractive error	44.0	(95)	37.5 to 50.7	2.9	(1)	0.4 to 19.2
Cataract	30.1	(65)	24.3 to 36.6	25.7	(9)	13.5 to 43.5
Diabetic retinopathy	7.9	(17)	4.9 to 12.3	11.4	(4)	4.1 to 27.8
Glaucoma	4.2	(9)	2.2 to 7.9	0		
Other	2.8	(6)	1.2 to 6.1	8.6	(3)	2.6 to 24.6
Multiple pathology	1.4	(3)	0.4 to 4.3	2.9	(1)	0.4 to 19.2
Surgical complications	1.4	(3)	0.4 to 4.3	2.9	(1)	0.4 to 19.2
Intracerebral cause	0.9	(2)	0.2 to 3.7	5.7	(2)	1.3 to 21.4
Amblyopia	0.9	(2)	0.2 to 3.7	2.9	(1)	0.4 to 19.2
Corneal scarring	0.5	(1)	0.1 to 3.3	0		
Optic nerve disease	0			2.9	(1)	0.4 to 19.2
Hereditary retinal	0			2.9	(1)	0.4 to 19.2
Injury/accident	0			2.9	(1)	0.4 to 19.2
Not determined	2.8	(6)				
Total cases	**100**	**(216)**		**100**	**(35)**	

Uncorrected refractive error is the leading cause of moderate and severe vision impairment (44%), as expected (GBD predicted 44.6%)[4]

Cataract is a leading cause of blindness (25.7%) and moderate and severe vision impairment (15.9% and 30.2%)[4]

Glaucoma is the leading cause of blindness (26.6%), which was not expected (GBD predicted 11.2%)[4]

Diabetic retinopathy (DR) causes 11.4% blindness and 7.9% of moderate and severe vision impairment. The GBD predicted 2.3% and 7.9%[4], so DR is a more important cause of blindness than expected. An estimated 20.5% of adults in T&T have diabetes, 26.3% have high blood pressure and 55.7% are overweight or obese[5]

*Provisional data (Independent grading of imaging data currently in progress)

Table 3: Characteristics of responders versus non responders, and of those with normal versus impaired vision. Odds ratios showing significant differences between groups are highlighted in blue

Conclusions

- T&T has approximately 27,787 people aged ≥ 40 years with MSVI and 3799 people who are blind

- The prevalence of blindness and MSVI in T&T in the ≥ 40 year group is lower than predicted by the Global Burden of Disease Study model for the 2010 Caribbean population ≥ 50 years of age (Blind 1.9%, 95%CI 1.4 to 2.4; MSVI 11.0%, 95%CI 7.1 to 13.9)

- Cataract (30.1%) and diabetic retinopathy (7.9%) make a **greater** contribution to MSVI in T&T than expected from the GBD model. Glaucoma (28.6%) and diabetic retinopathy (11.4%) are also more important causes of blindness in T&T than expected from the GBD model

- NESTT has collected robust epidemiological data on the magnitude of blindness and vision impairment in the population ≥ 40 years for 2013-2014. Unexpected findings in the secondary outcome measures highlight the value of contemporary country-specific data over estimates of prevalence and cause predicted by a Caribbean model using older data

- In addition to ongoing efforts to reduce avoidable vision loss from uncorrected refractive error and cataract, it will be important for the Trinidad and Tobago National Eye Care Strategy to target policies and resources toward addressing avoidable blindness and vision impairment from glaucoma and diabetic retinopathy, especially in light of the rising prevalence of obesity, hypertension and diabetes in Trinidad and Tobago

Key References

1. World Health Organisation. Universal Eye Health: a global action plan 2014-2019. WHO Report (2013), Geneva
2. Bourne, R; Price, H., Taylor, H. et al. New systematic review methodology for visual impairment and blindness for the 2010 global burden of disease study. Ophthalmic Epidemiology (2013); 20(1):33-39
3. Hyman, L., Wu, S.Y., Connell, A.M. et al. Prevalence and causes of visual impairment in The Barbados Eye Survey. Ophthalmology (2001); 108(10):1751-6
4. Leasher, J.L.; Lansingh, V.; Flaxman, S.R. et al. Prevalence and causes of vision loss in Latin America and the Caribbean: 1990-2010. British Journal of Ophthalmology (2014); 98(5):619-28
5. Ministry of Health of Trinidad and Tobago. Panamerican STEPS Chronic Non-communicable disease risk factor survey Report (2012)

Research Innovation Collaboration
For further information: Please email Dr Braithwaite, tasaneebraithwaite@gmail.com
Focused on excellence