Blindness in children – major causes and control



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Tropical Ophthalmology course

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iceh.lshtm.ac.uk/

INTERNATIONAL CENTRE FOR EYE HEALTH

Overview

- Impact of blindness on children and their families
- Clinical aspects of main blinding eye diseases
- Strategies for control
- Epidemiology
- Conclusions

Impact of blindness in children



- More likely to die than sighted children
- Global developmental delay
- Lack of independence
- Less likely to be educated
  - lack of employment
  - poverty
- Not likely to get married
- Parents: anxiety, depression, marital breakdown
- BUT with schooling, rehabilitation and support can achieve a great deal and live very fulfilled and happy lives

Impact on parents of ROP blind children in India

“Nobody will make friends with him (starts sobbing)…nobody will play with him….”

“We worry whether she will be able to do everything on her own” (starts crying).”

We feel (the difference)…everything…I mean, she has a twin brother. He is ahead in everything, and she is like this.

Strategies for control of diseases in populations

Primordial prevention

- Prevent underlying disease / condition e.g. prematurity

Primary prevention

- Interventions to prevent blinding condition e.g., measles immunization; vitamin A supplementation

Secondary prevention

- Early detection and treatment of the condition to prevent loss of vision e.g., treatment of corneal ulcers; laser treatment of ROP

Tertiary prevention

- Interventions which restore vision e.g., cataract surgery
- Vision rehabilitation to improve functioning

Causes of blindness in children

Preventable

- conditions causing corneal scarring
- retinopathy of prematurity

Treatable

- cataract
- glaucoma*
- retinopathy of prematurity
- uncorrected refractive errors*

Unavoidable

- congenital anomalies
- retinal dystrophies
- cerebral vision impairment*

Corneal scarring

Main causes

- Vitamin A deficiency
- Measles infection
- Conjunctivitis of the newborn
- Use of harmful traditional remedies

Vitamin A deficiency



Vitamin A rich foods – plant sources



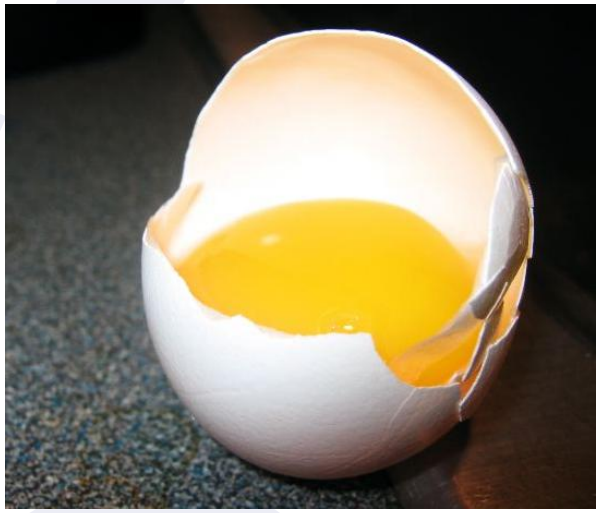






Vitamin A rich foods – animal sources









Vitamin A – poor sources









Causes of vitamin A deficiency

- Poverty at macro and household level
- Agricultural and cultural factors
  - seasonality of foods
  - feeding practices and taboos
- Childhood factors
  - measles
  - malnutrition
  - malabsorption (diarrhoea)
  - poor intake
  - increase demand (fever)

Pathophysiology of vitamin A deficiency

- Fever increases the metabolic rate and demand for vitamin A
- Squamous metaplasia of mucous membranes throughout the body
  - loss of barrier function and greater risk of infection
- Reduced immunity
  - greater risk of infection

Xerophthalmia

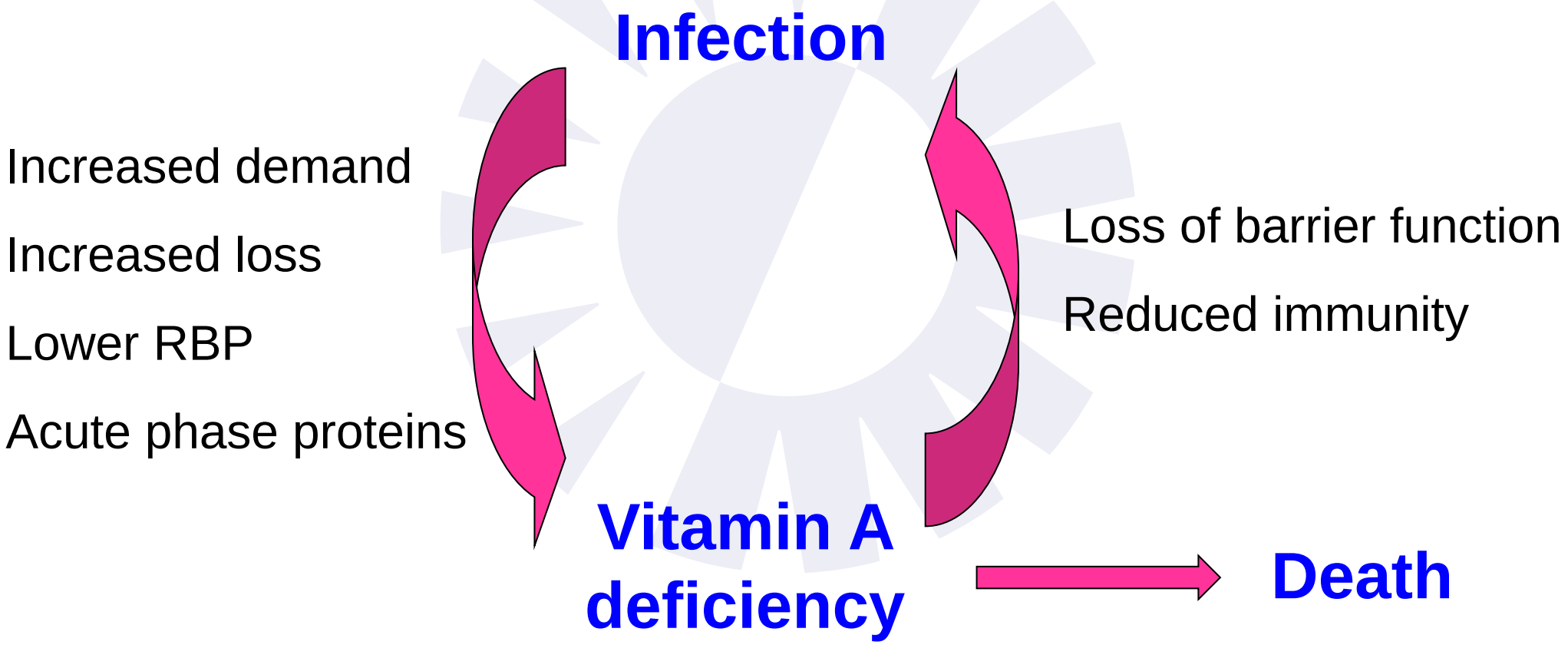
Signs of chronic deficiency – children 3-6 years

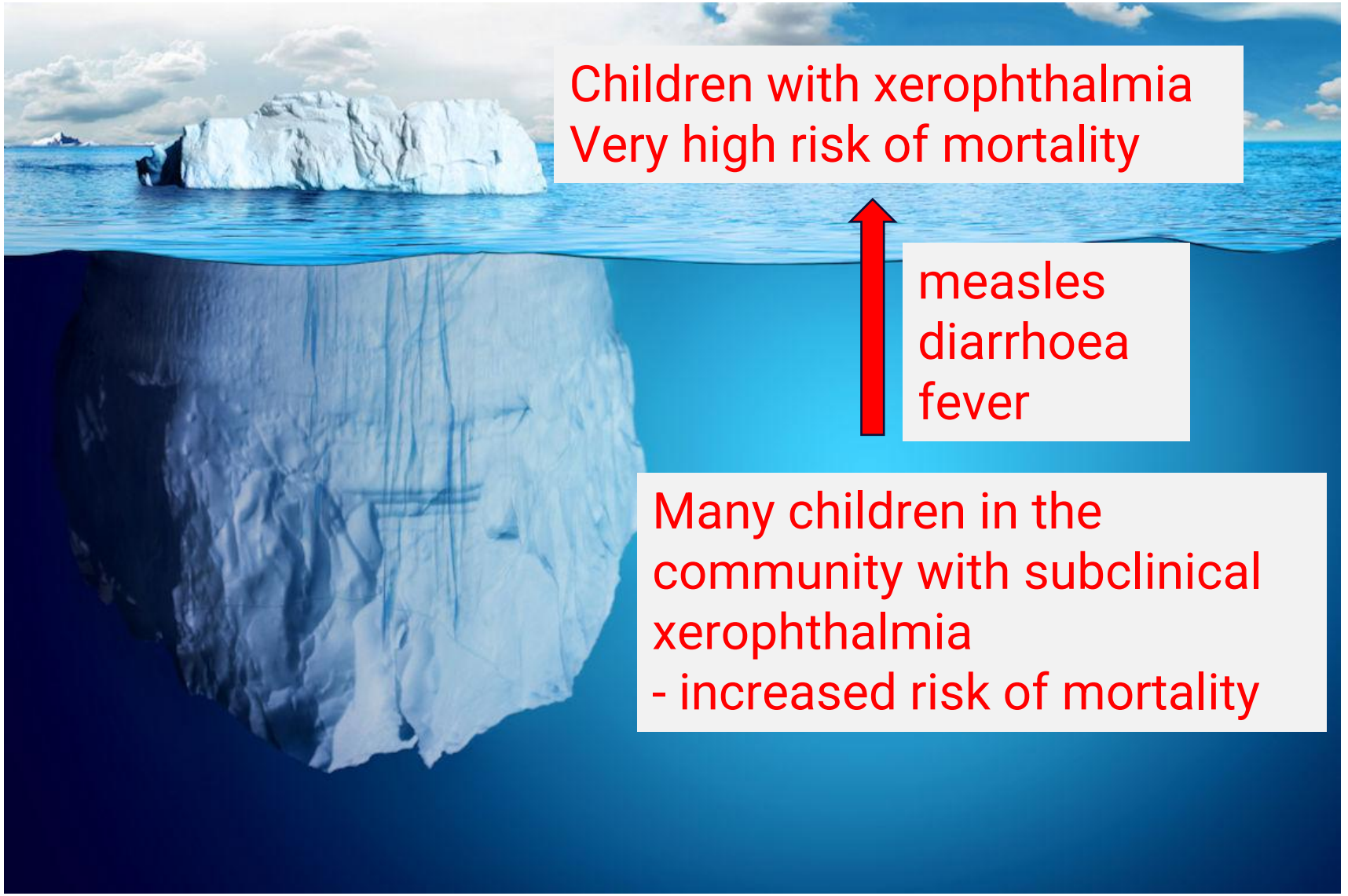
- Conjunctival xerosis
- Bitots spots
- Corneal xerosis

Signs of acute, severe deficiency – usually <3 years

- Corneal ulcer <1/3 or 1/3 or larger
- Keratomalacia
- Corneal scarring

Vicious cycle in vitamin A deficiency



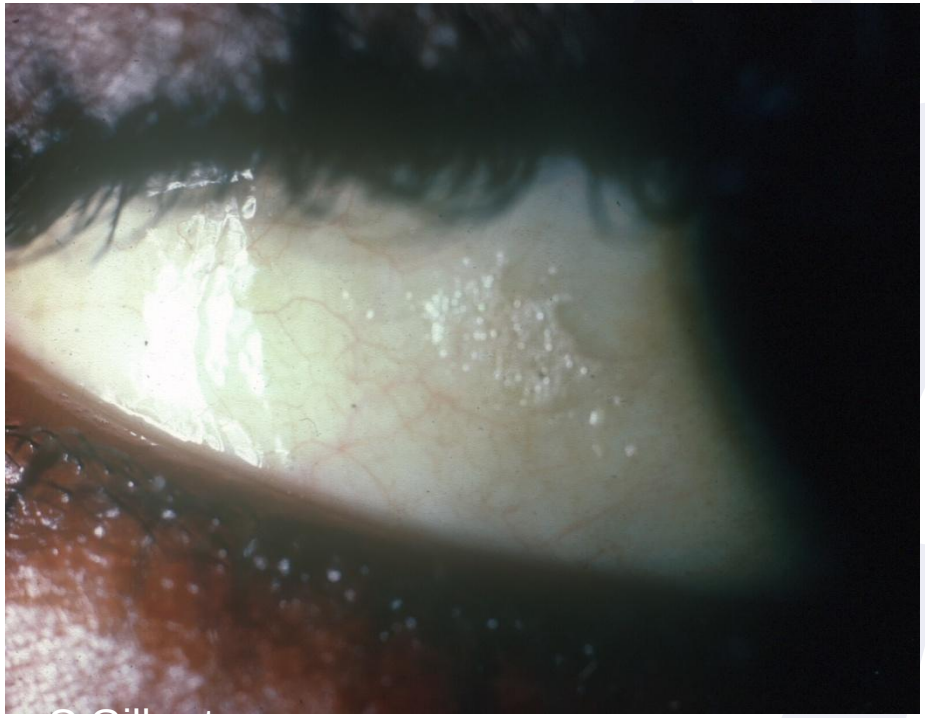

Children with xerophthalmia
Very high risk of mortality
measles
diarrhoea
fever
Many children in the community with subclinical xerophthalmia
- increased risk of mortality

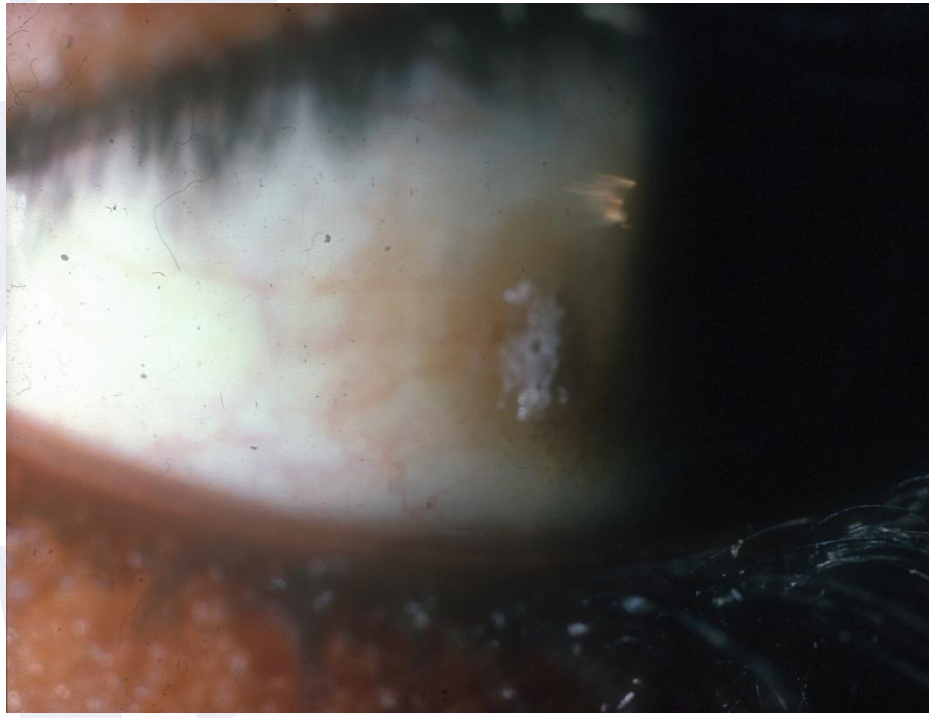
Conjunctival xerosis



Difficult sign to elicit

Bitots spot



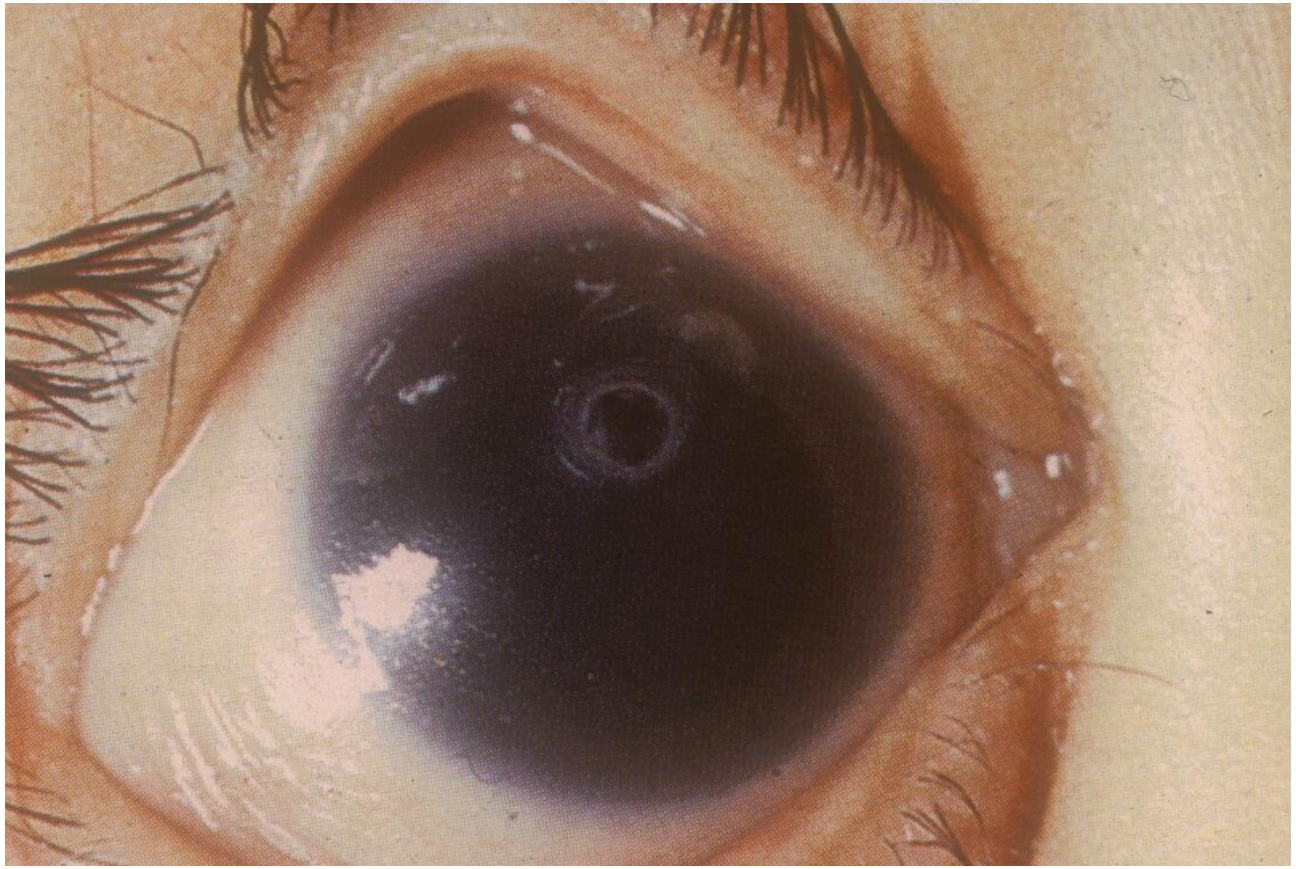


Only occurs in vitamin A deficiency

Accumulations of keratin, acted on by bacteria. Can be wiped off.

Disappear when vitamin A status improves

Corneal ulcer <1/3 cornea

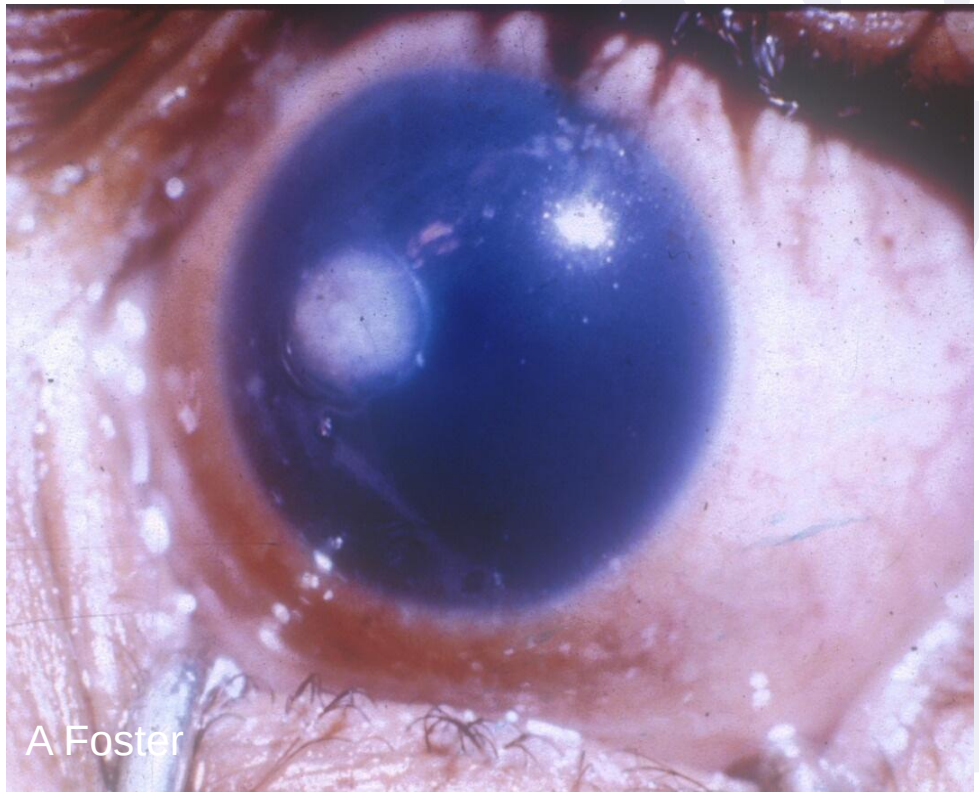


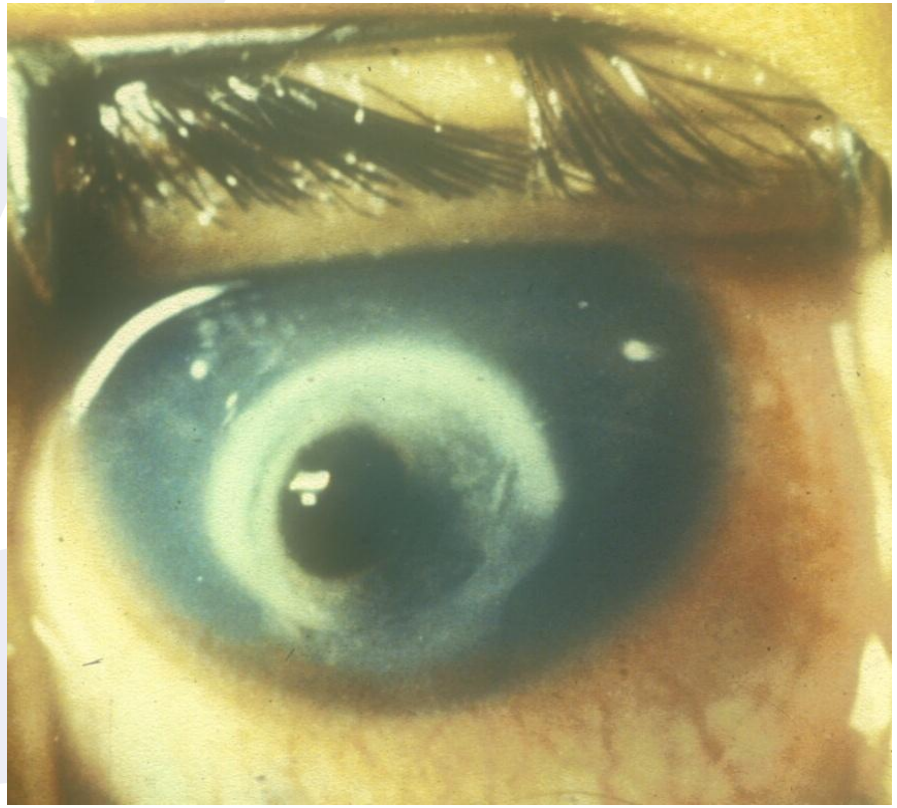
Night blindness



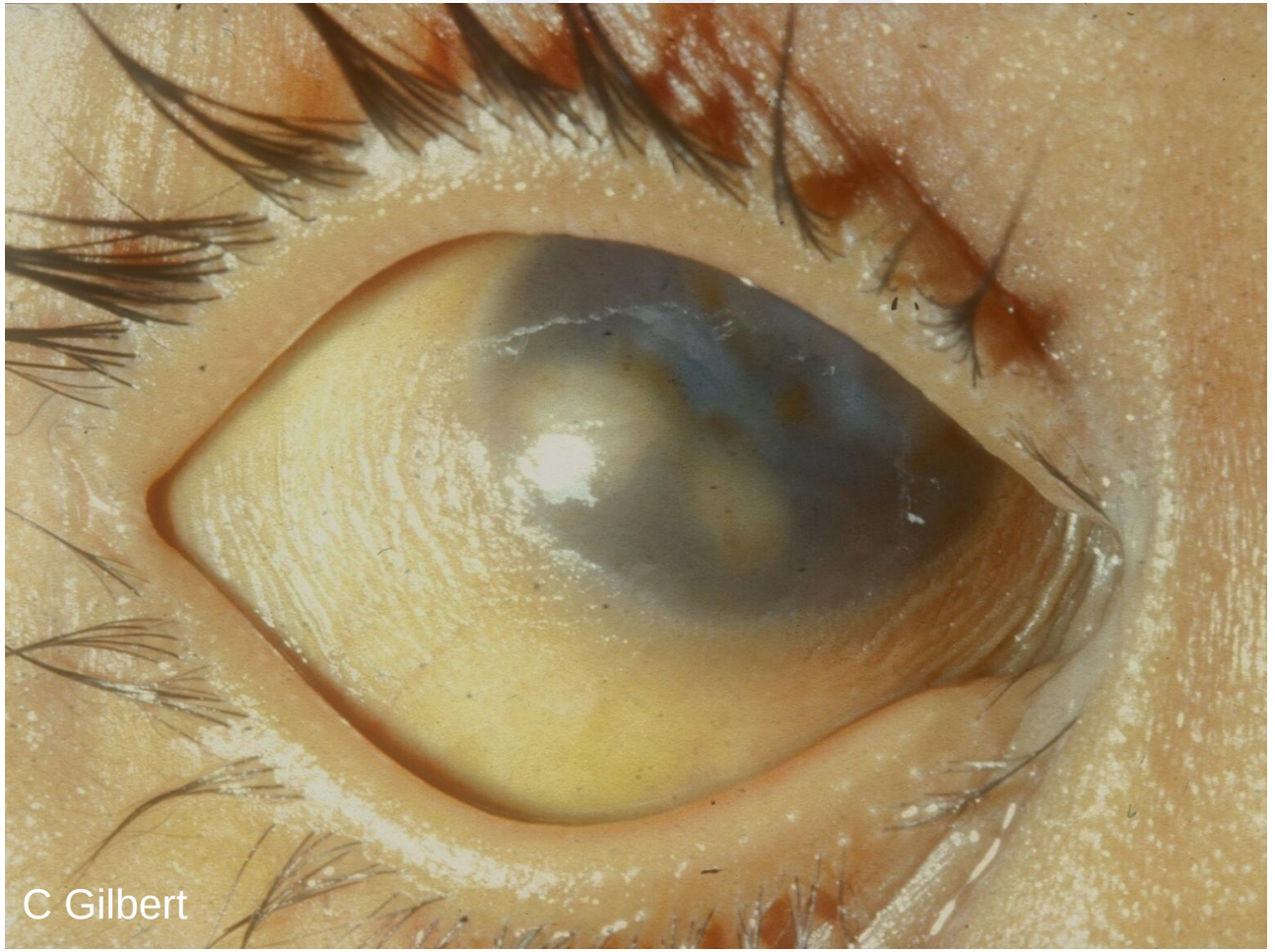


Corneal ulcers

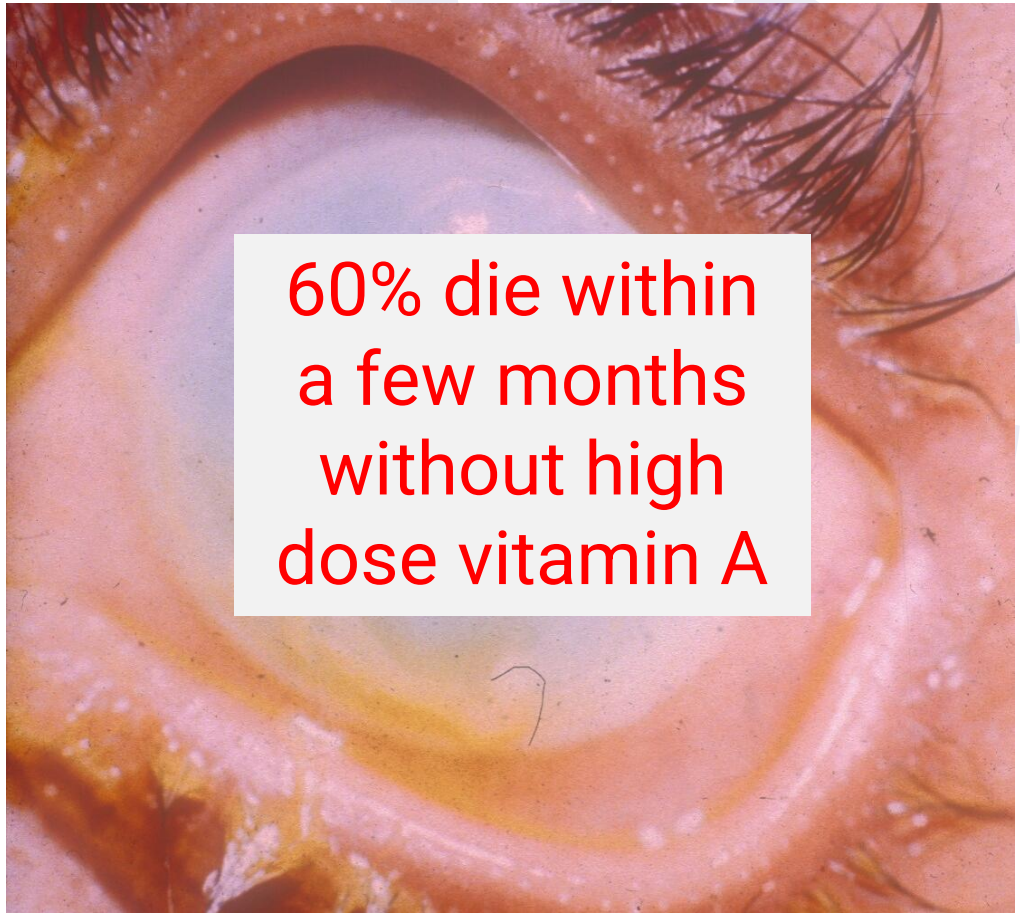




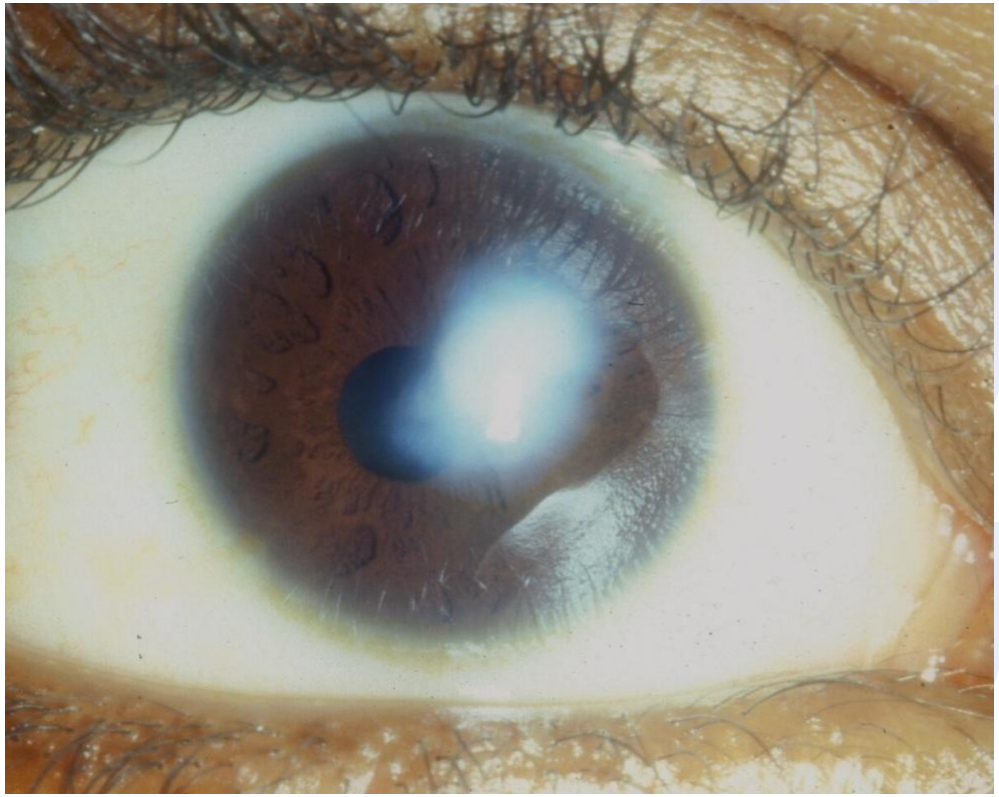
Keritinsation, xerosis and scarring



Keratomalacia: full thickness necrosis



Corneal scarring





Strategies for control of vitamin A deficiency

- Primordial prevention
  - address poverty and food and agriculture systems
- Primary prevention
  - high dose vitamin A supplementation children 6-59 months
  - high dose vitamin A for lactating women in endemic areas
- Secondary prevention
  - high dose vitamin A for children with any of the signs of xerophthalmia
- Tertiary prevention
  - optical iridectomy (corneal graft)

Control of vitamin A deficiency

Short term

- Intermittent supplementation with high dose vitamin A
  - 6-11 months 50,000 IU
  - 12-59 months 200,000 IU 6 monthly

Medium term

- Food supplementation programmes
- Food fortification

Long term

- To address underlying causes

Supplementation with high dose retinal palmitate





Often given with at time of measles immunization

Courtesy A Sommer

Fortified foods



“Golden rice”



Fortified sugar

Kitchen gardening



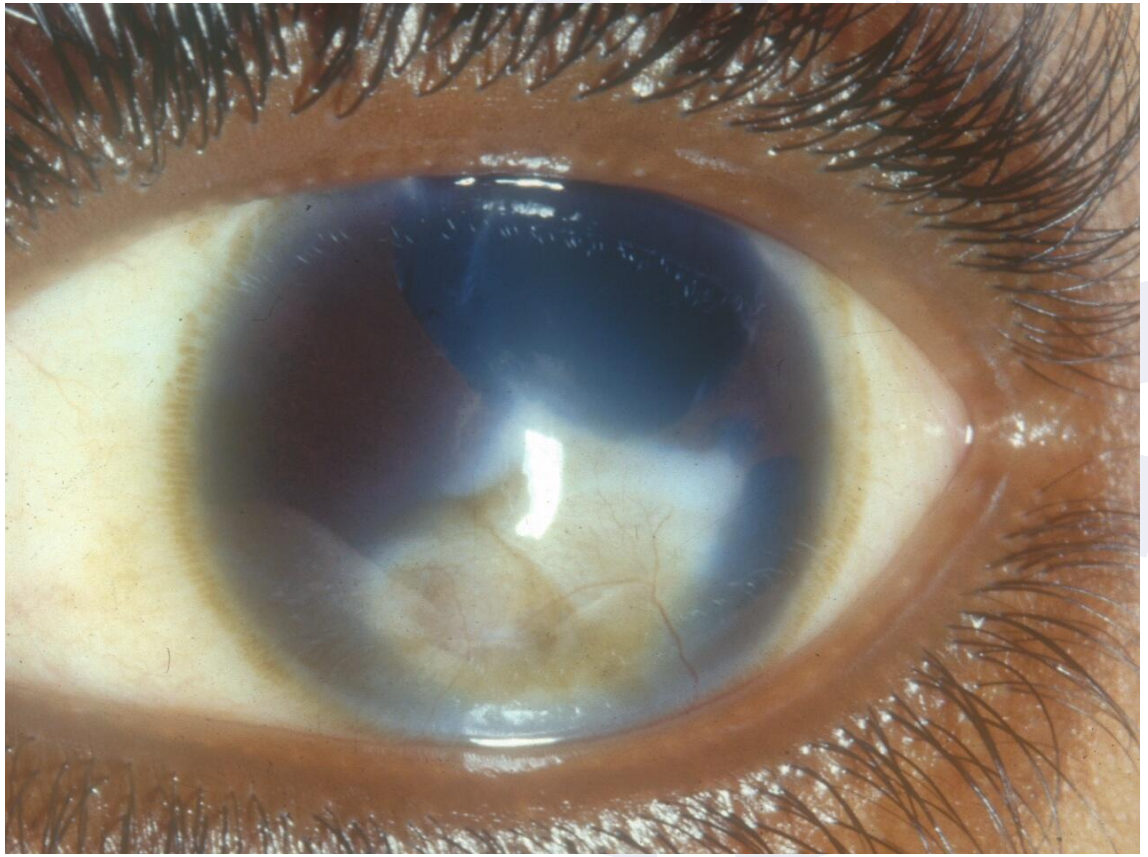


Water and sanitation to prevent diarrhoea





Management of xerophthalmia



Optical iridectomy [corneal grating]

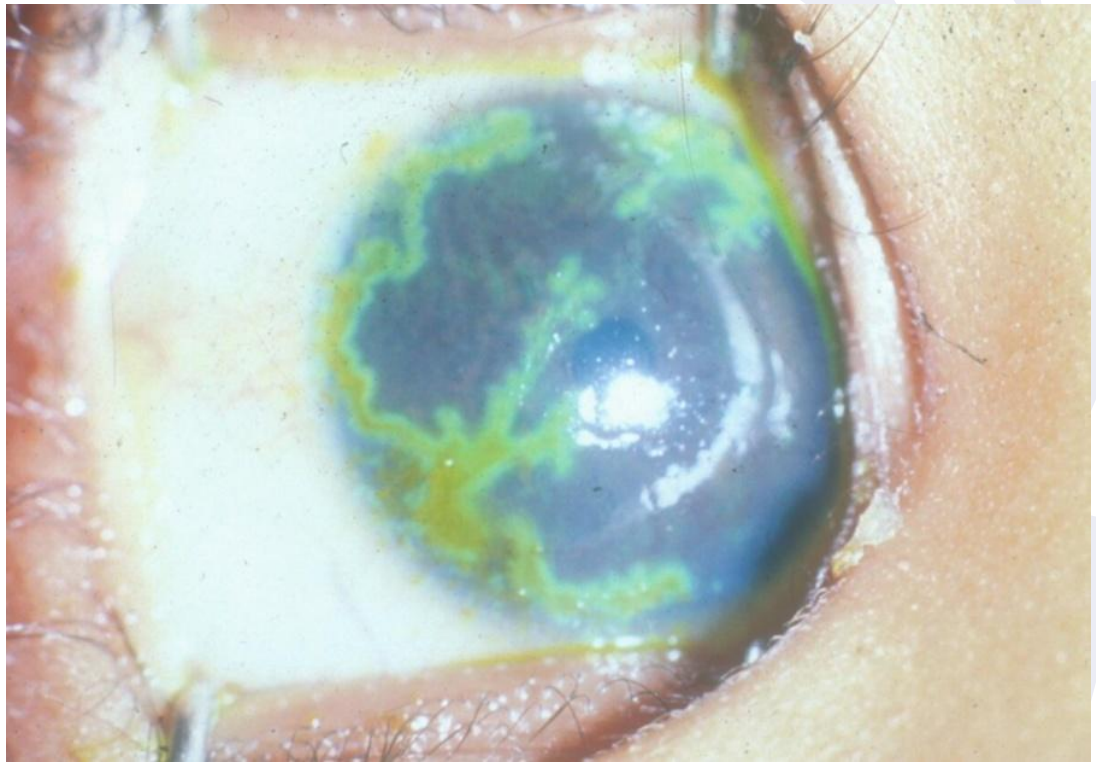
Measles



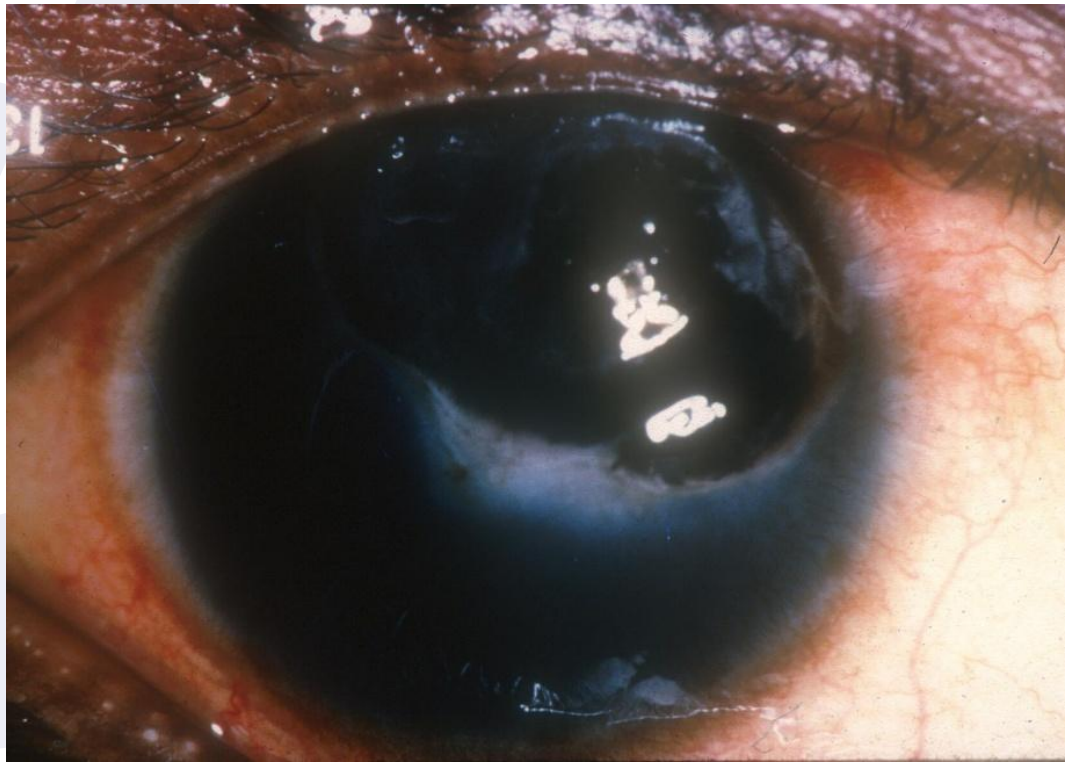
Measles and blindness in children

- Extremely infectious virus
- Important cause of corneal scarring in children, particularly in Africa
- Immunisation programmes need very high coverage (>95%) to prevent epidemics
- Less corneal blindness since measles vaccine introduced in the 1980s

Causes of corneal ulcers in children with measles

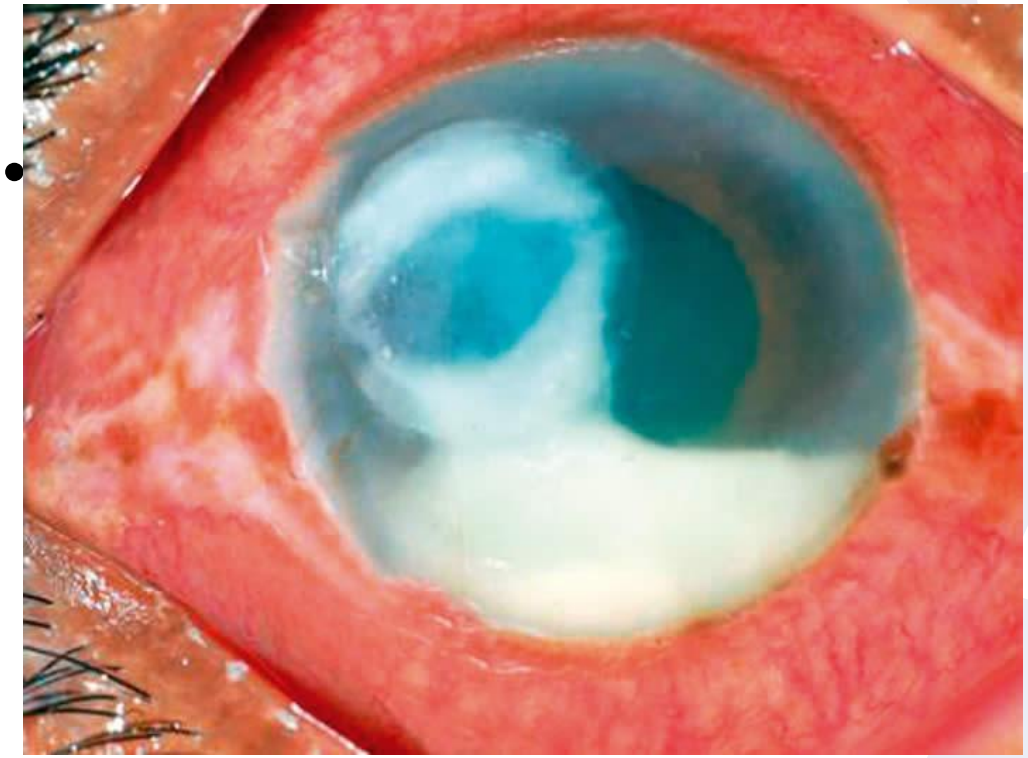


Herpes simplex keratitis

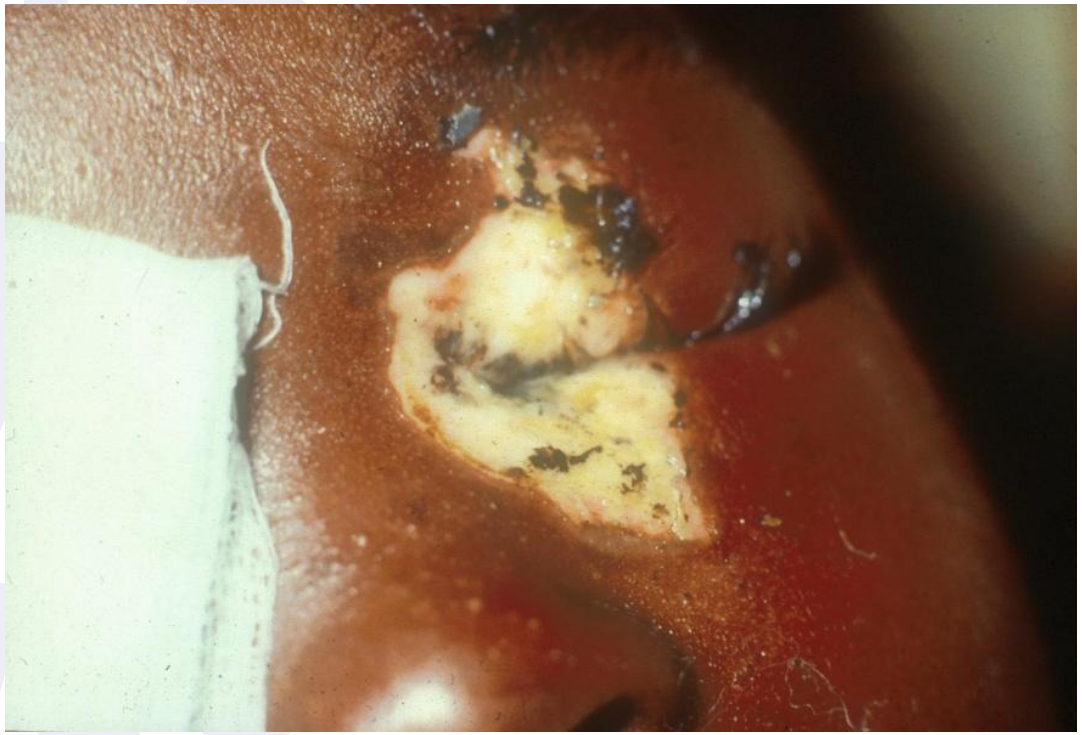


Acute, severe VAD with keratomalacia

Causes of corneal ulcers in children with measles



Secondary bacterial infection



Use of harmful traditional remedies

Measles blindness



Prevention of blindness from measles blindness

Primary prevention

- Measles immunisation – high coverage
- Vitamin A supplementation
- Proper treatment of children with measles including high dose 200,000 IU vitamin A x 3

Secondary prevention

- Diagnosis and treatment of ulcers including high dose 200,000 IU vitamin A x 3

Tertiary prevention

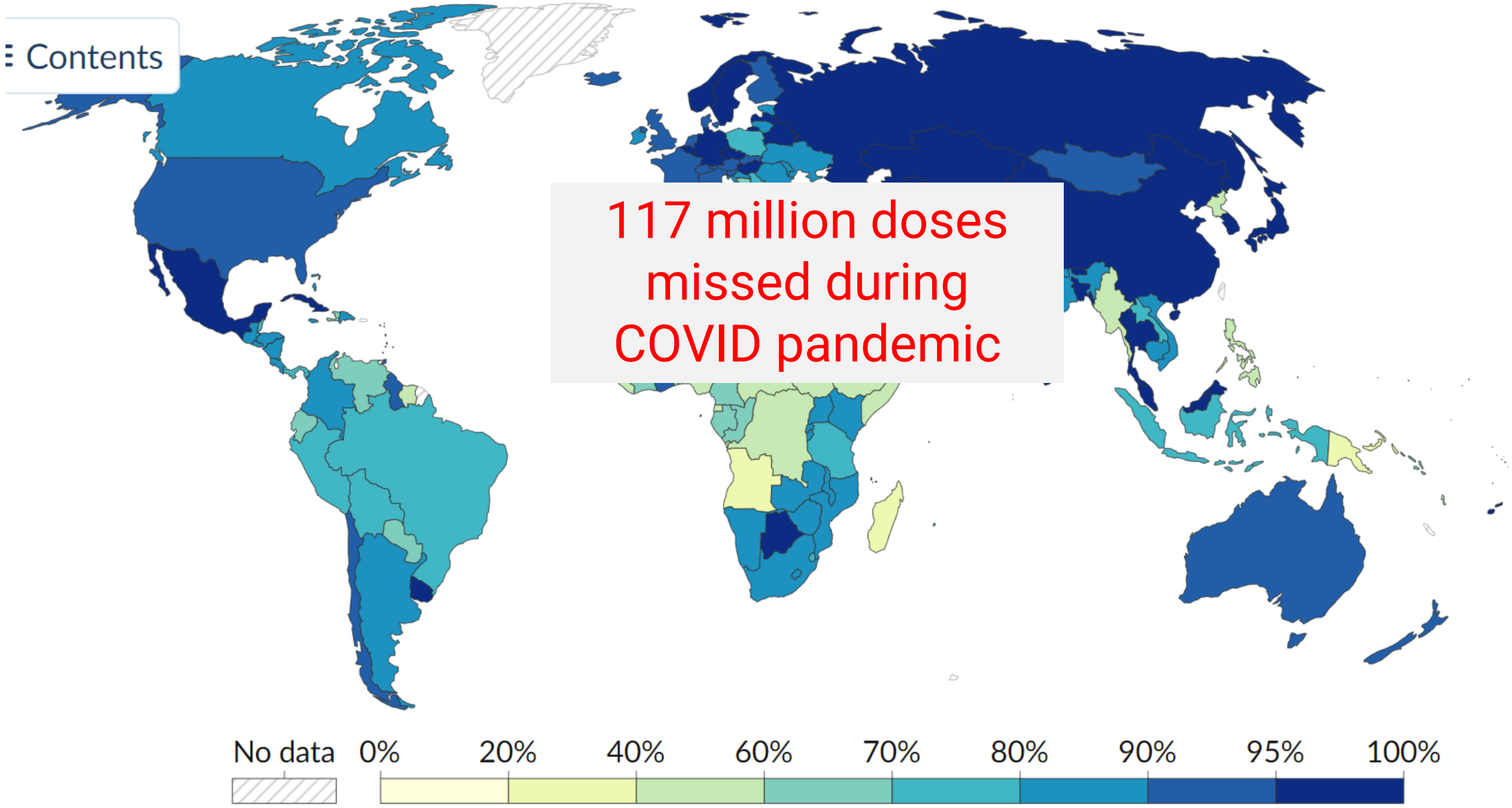
- Optical iridectomy for unilateral, central scars

Measles immunization coverage 2021

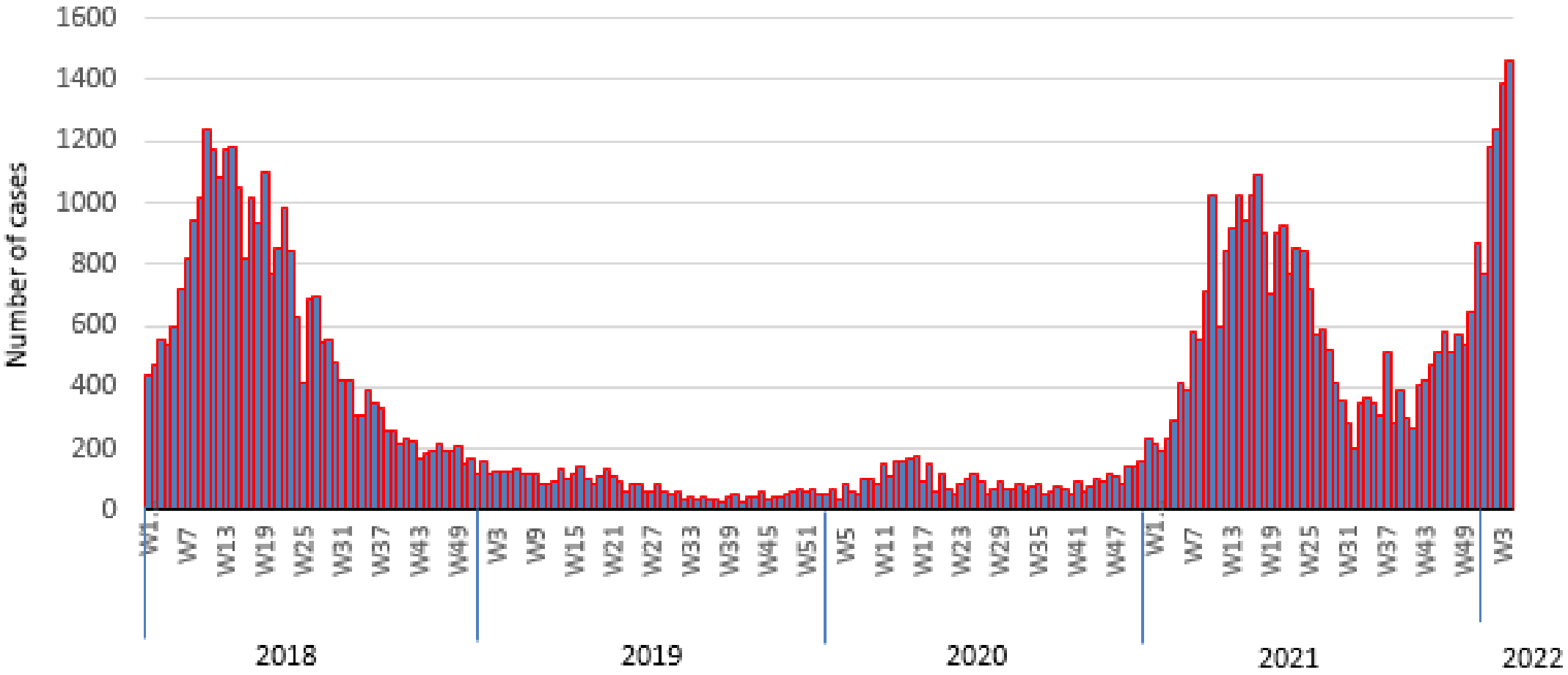
LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

Contents

117 million doses missed during COVID pandemic



Measles cases - WHO



Ophthalmia neonatorum due to gonococcus

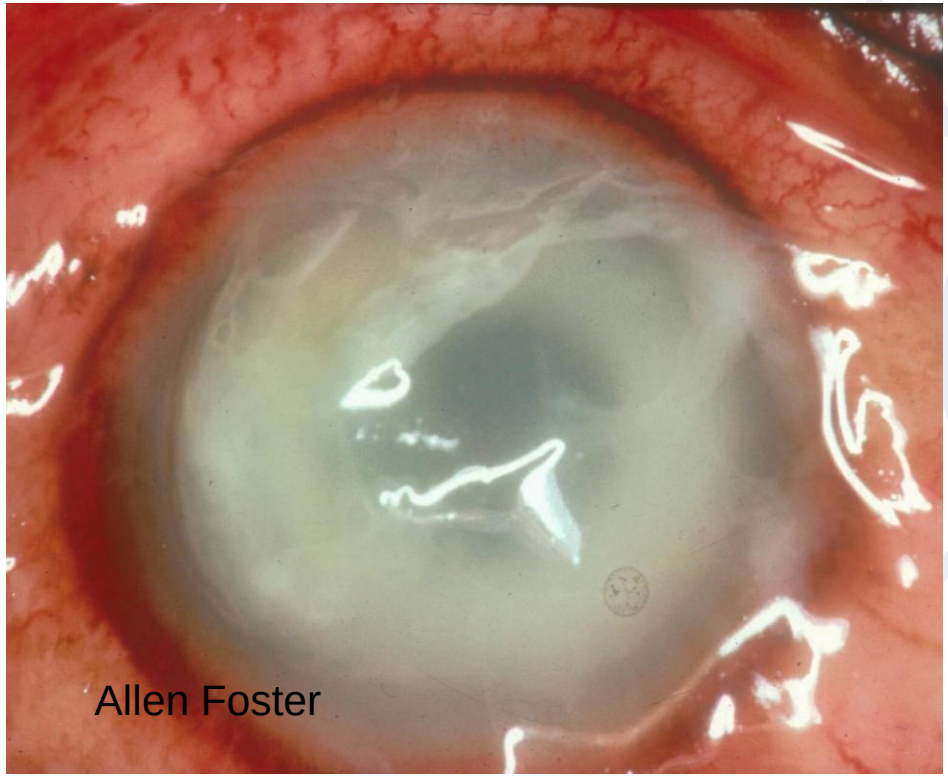


In urban Zimbabwe 28% of pregnant women have STIs; 4% have gonorrhea

Ophthalmia neonatorum

- Infection acquired during delivery
- Most harmful is infection due to Gonococcus
- Rates of GC ophthalmia depend on rates of gonorrheoa (Africa > Asia > other regions)
- Penecillinase resistance causes problems in some regions

Serious ocular complications



Corneal involvement in gonococcal ON

- 16% Kenya
- 10% Bangladesh


Volker Klauss



Prevention of blindness from ophthalmia neonatorum

Primary prevention

- Education about STDs (barrier contraceptives; abstinence etc)
- Treatment of STDs before delivery, with treatment of sexual partners
- Credes prophylaxis (clean eyelids at birth before lids open; instill antiseptic or antibiotic)

Secondary prevention

- Gram stain if possible
- Intensive topical and systemic treatment with antibiotic recommended for the locality

Tertiary prevention

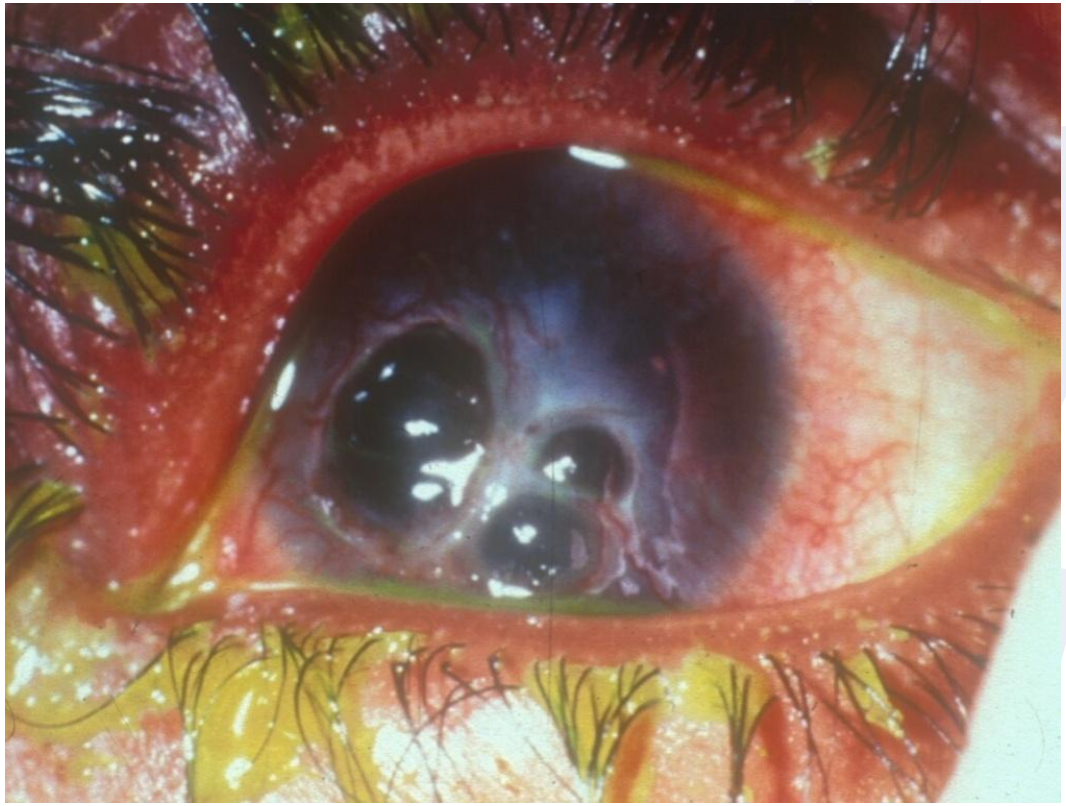
- Rehabilitation

Harmful traditional eye remedies

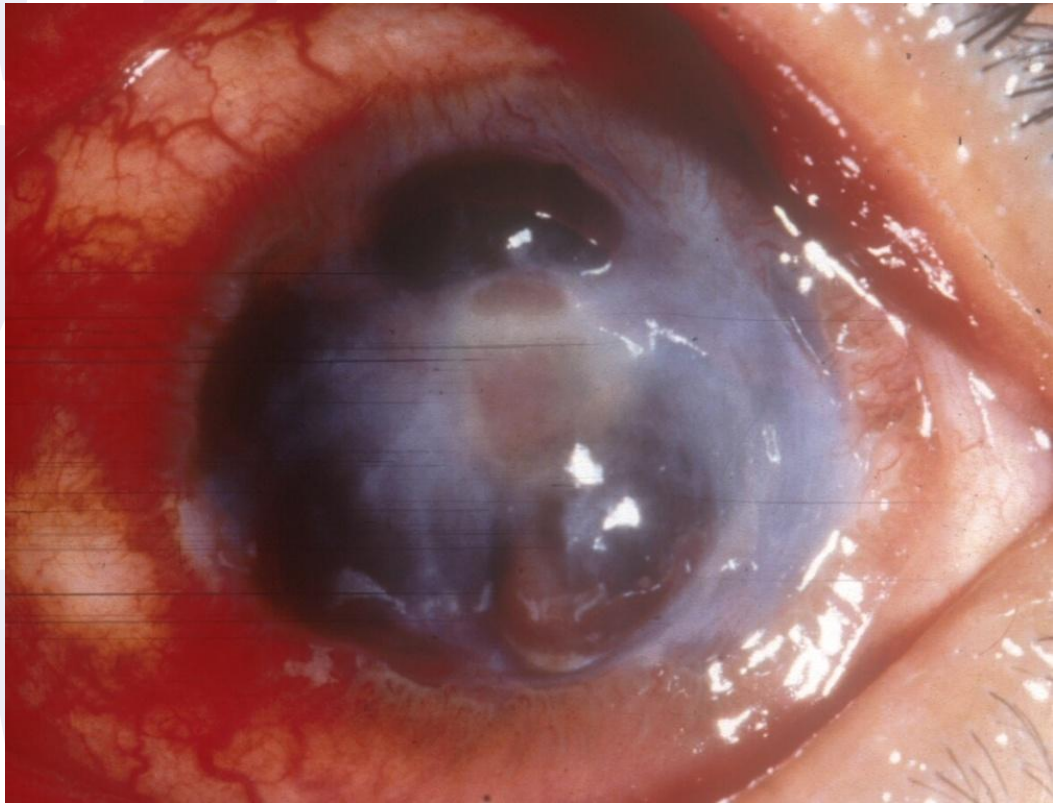
Can cause corneal ulceration/scarring from

- Trauma (chemical; thermal; mechanical)
- Infection (bacteria; fungi)
- Exposure (lids held open; cicatricial lid scarring)

Traditional eye remedies



Atypical corneal ulcer



Gonococcal ulceration from urine

Traditional eye remedies



Mechanical trauma



Chemical burns

Prevention of blindness from traditional eye remedies

Primary prevention

- Good primary eye care
- Health education
- Training of traditional healers

Secondary prevention

- Identification and appropriate treatment

Tertiary prevention

- Optical iridectomy
- Rehabilitation

Cataract in children



Cataract in childhood

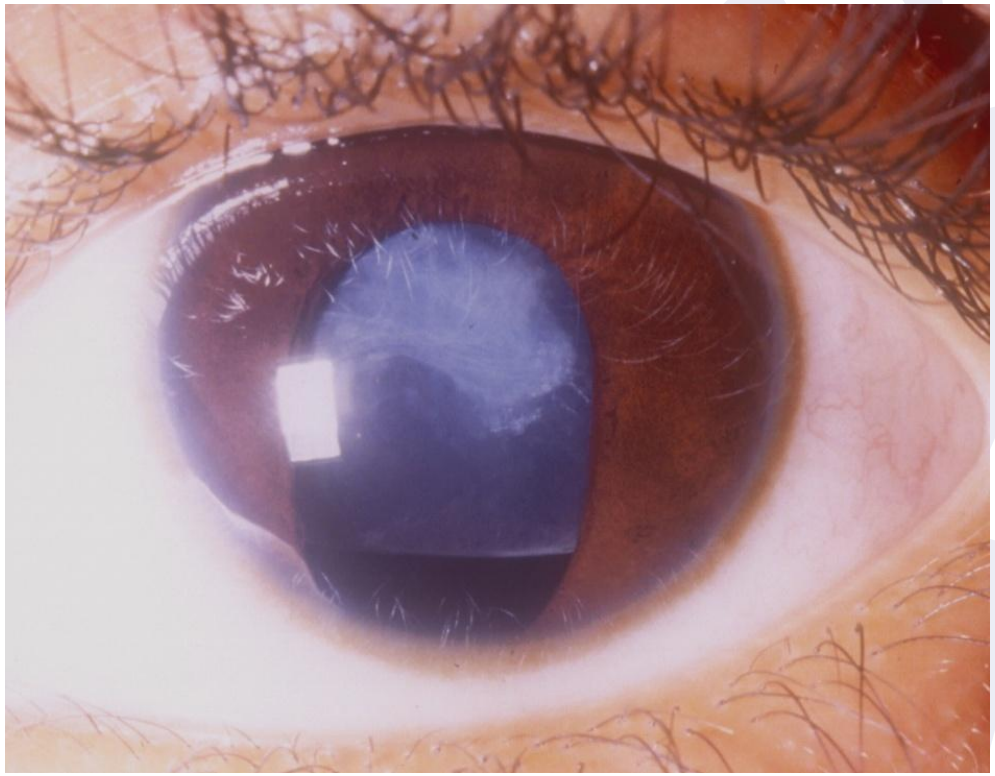
- Commonest treatable cause of blindness in children
- May be familial
- Can affect 1 or both eyes
- Needs early surgery to avoid amblyopia
- Surgery and management more difficult than adults
  - needs specialist surgeons
  - needs special equipment
  - IOLs more difficult than in adults
  - post operative complications more common (inflammation, PCO, glaucoma)
  - spectacle wear can be challenging
  - long term follow up is essential
  - low vision support often needed for cataract of early onset



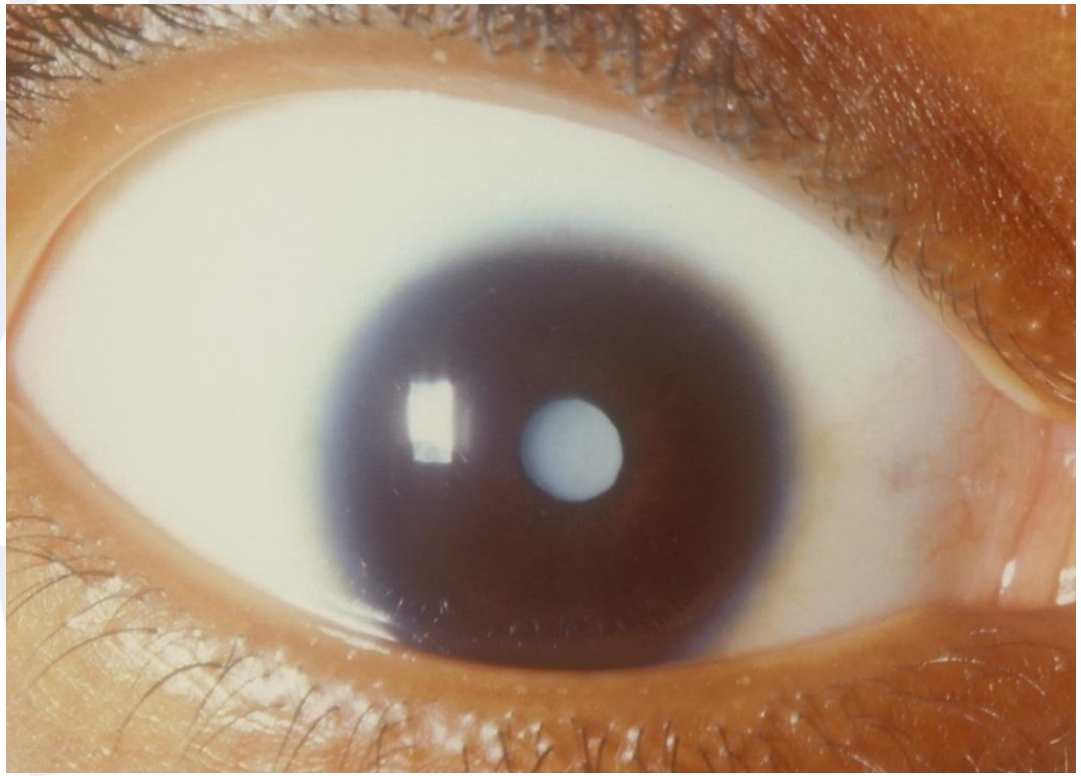
A family where 5/6 a children had cataract (Bangladesh)

Children often present very late (distance; cost; fear; lack of awareness)

May have other ocular and systemic abnormalities (rubella)



Coloboma



Microphthalmos

Getting the right glasses can be a challenge



Suggestion for bilateral cases

- Operate on both eyes during the same admission (not the same day)
- Reduces costs for families
- Ensures second eye is operated
- Reduces risk of dense amblyopia in 2nd eye

Control of blindness due to cataract

- Primary prevention
  - Rubella immunization
  - [Genetic risk counselling]
- Secondary prevention
- Tertiary prevention
  - Early, good surgery by an experienced, trained ophthalmologist and team
  - Very good correction of aphakia
  - Long term follow up

Low vision services are essential...



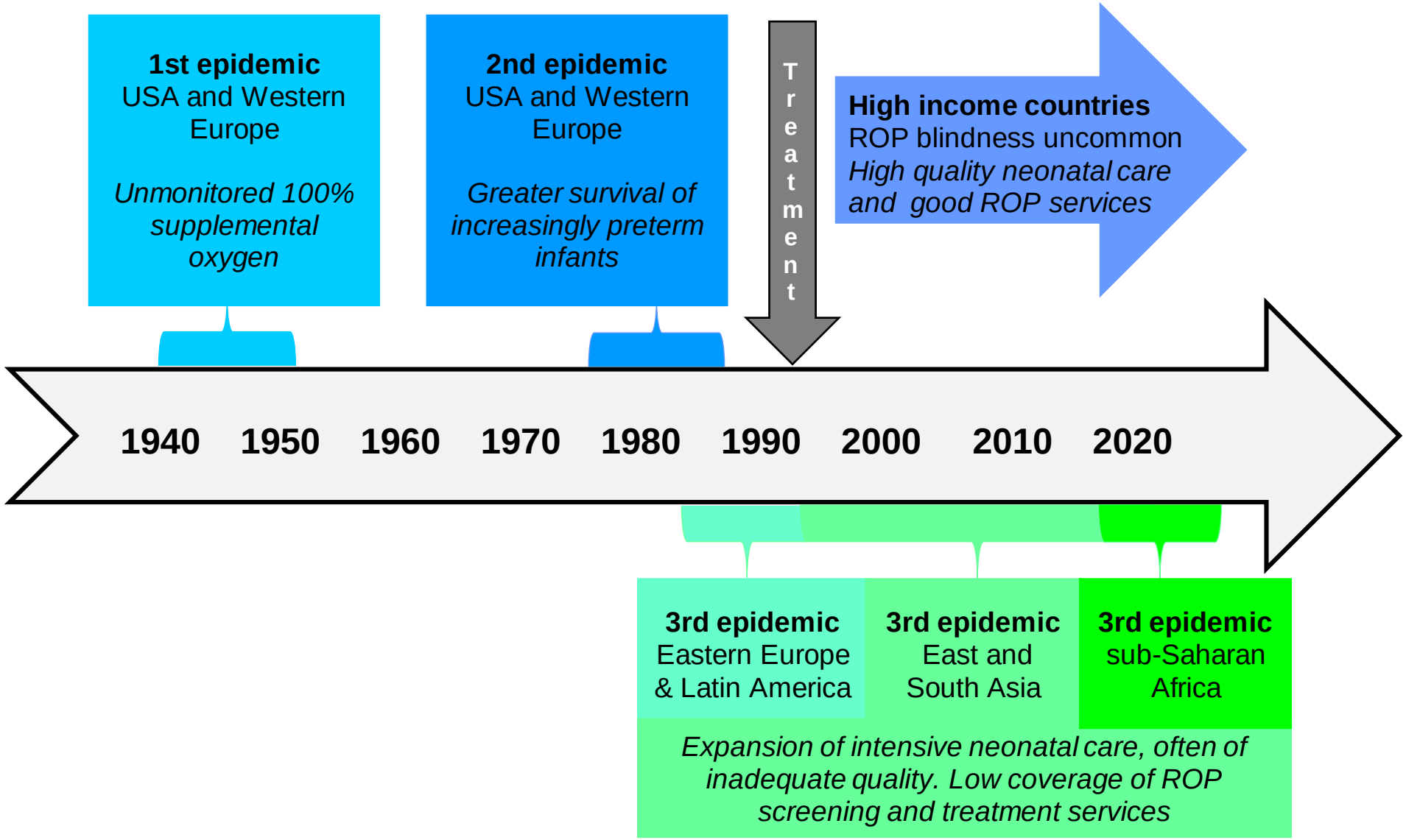


Retinopathy of prematurity



- >32,000 preterm infants become blind or vision impaired every year from ROP
- All world regions are now affected – increasing survival
- Preterm birth rates are increasing – globally around 10%

Epidemics of ROP blindness

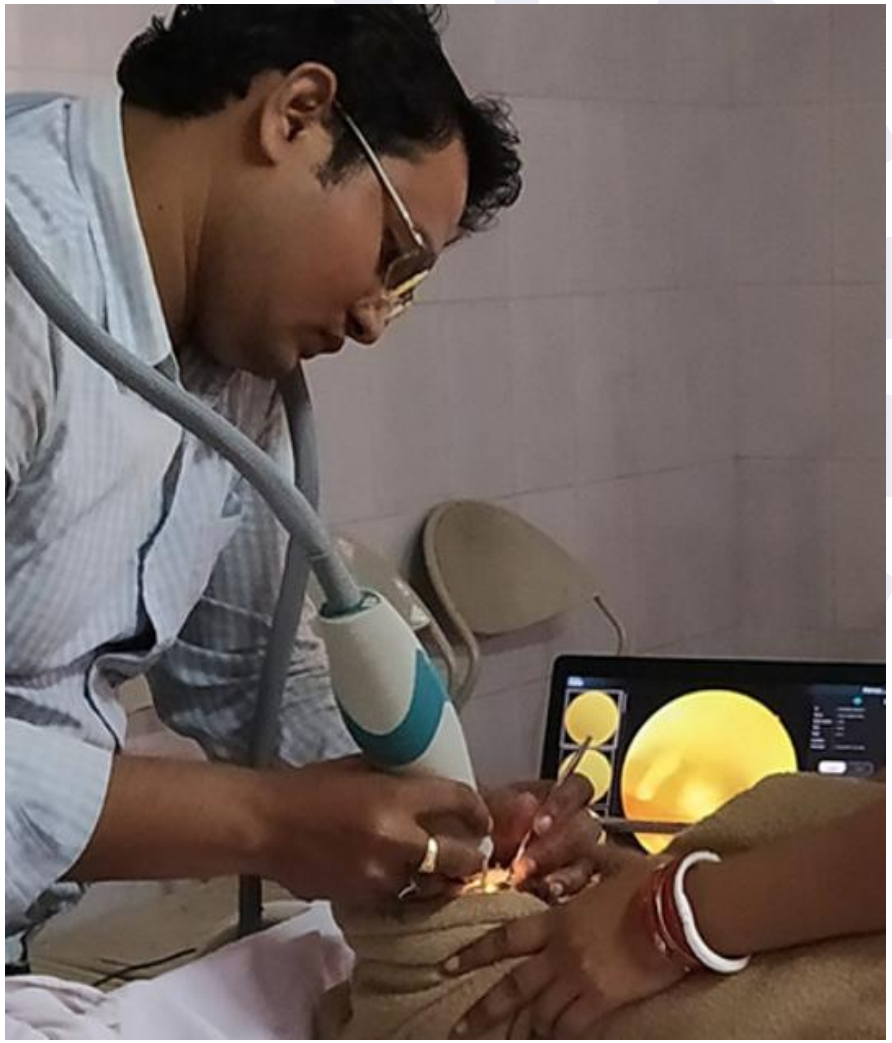


Risk factors for ROP

- Increasing prematurity
- Sepsis
- Hyperoxia
- Failure to gain weight
- Thrombocytopenia
- Blood transfusion
- Maternal factors – little evidence from LMICs

Timely screening and treatment







Low- and middle-income countries

- “New” condition – non included in curricula
- Inadequate intensive neonatal care in many units
  - Bigger, more mature infants (>33 weeks) develop Type 1 ROP
- Latin America
  - most countries have good or very good ROP services
- Asian
  - some countries are doing well, but not all
- Africa
  - good services in South Africa, just starting in other countries

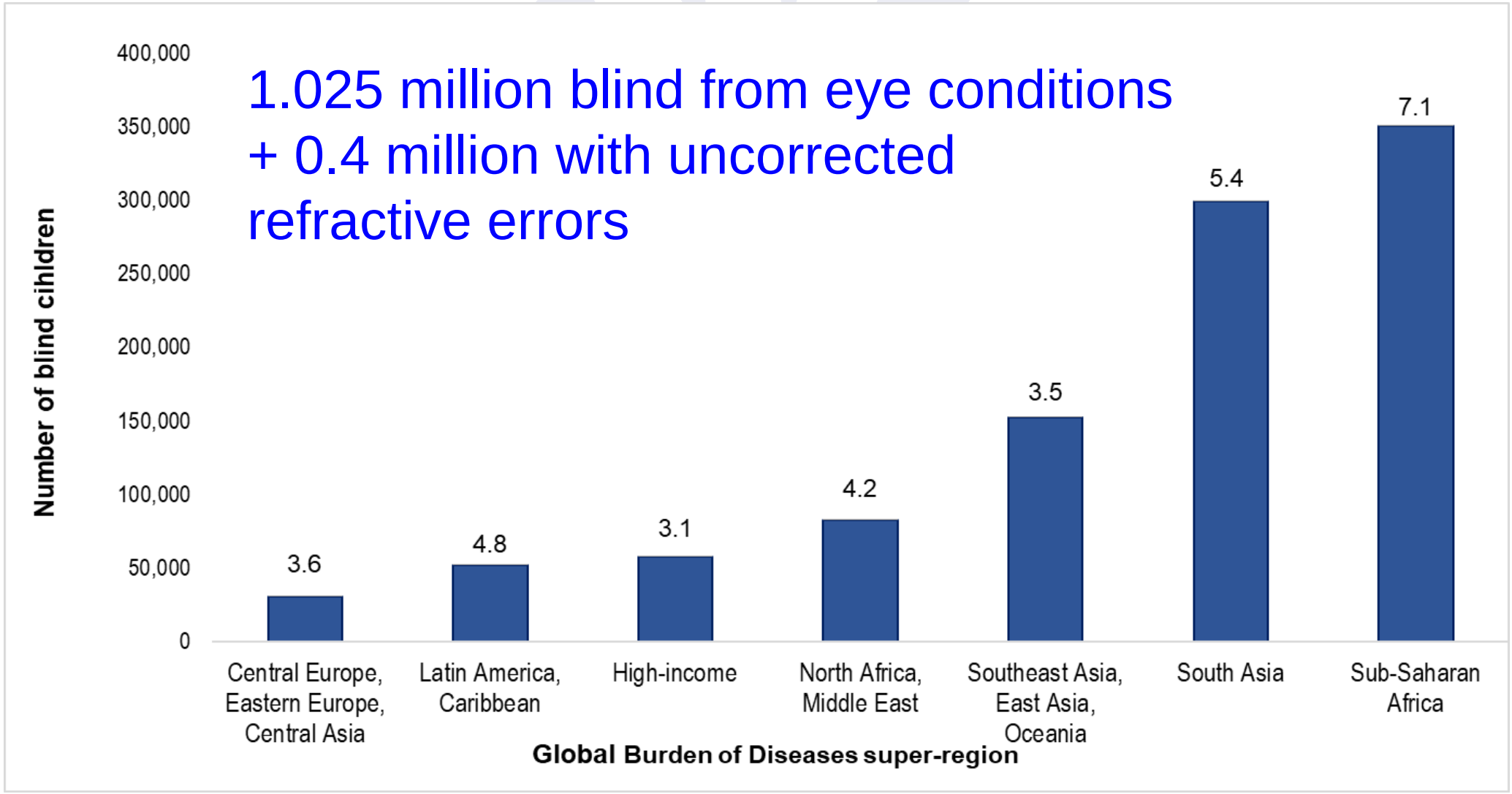
Challenges in LMICs

- Poor quality neonatal care from immediately after birth
  - high mortality in infants <28 weeks and <1000g
  - bigger, more mature infants can develop Type 1 ROP
  - Higher rates of aggressive ROP
- Wider screening criteria needed: more babies to screen
- Lack of ophthalmologists to screen
- Poor follow up screening after discharge from unit
- Lack of equipment and experienced ophthalmologists to treat

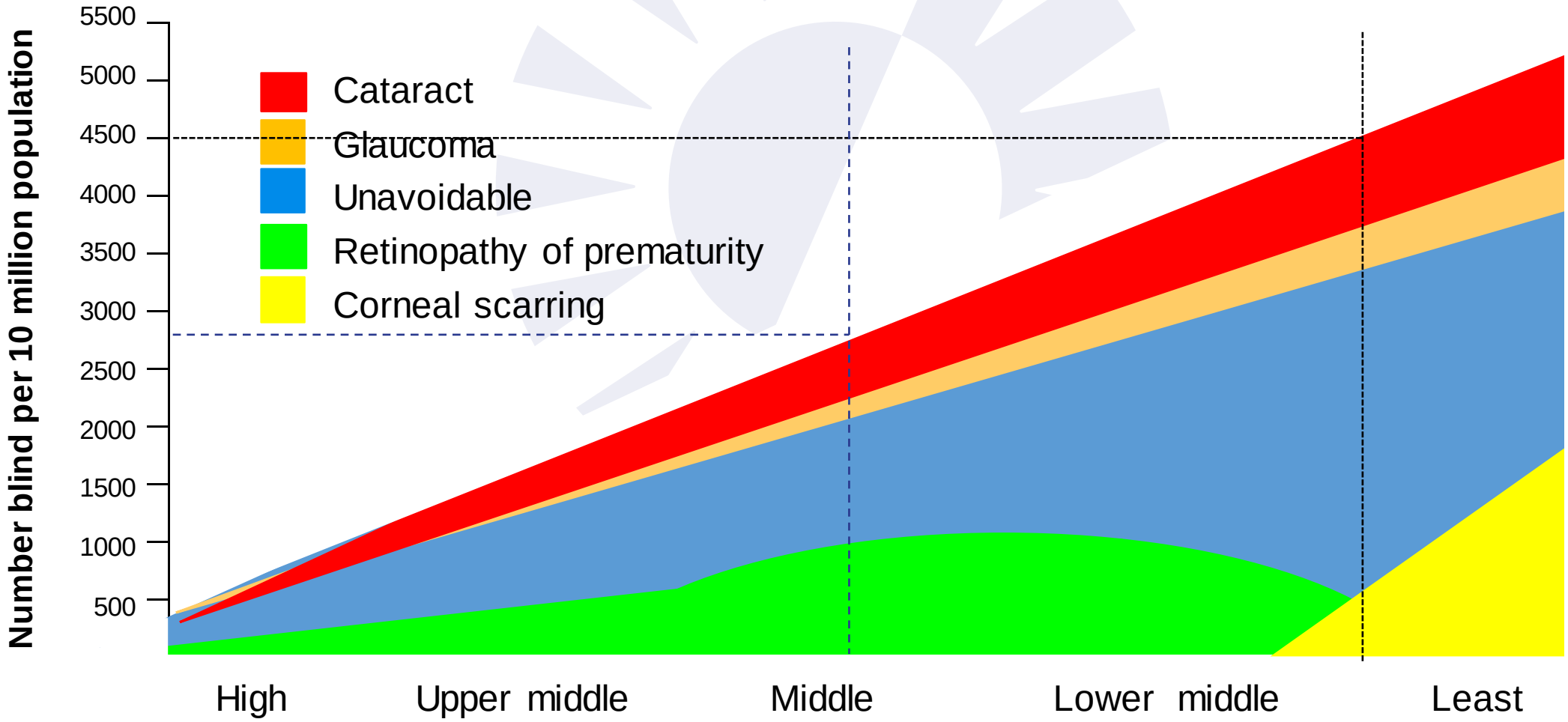
Digital imaging by a nurse / technician with AI assisted image grading will have a lot to offer

Epidemiology

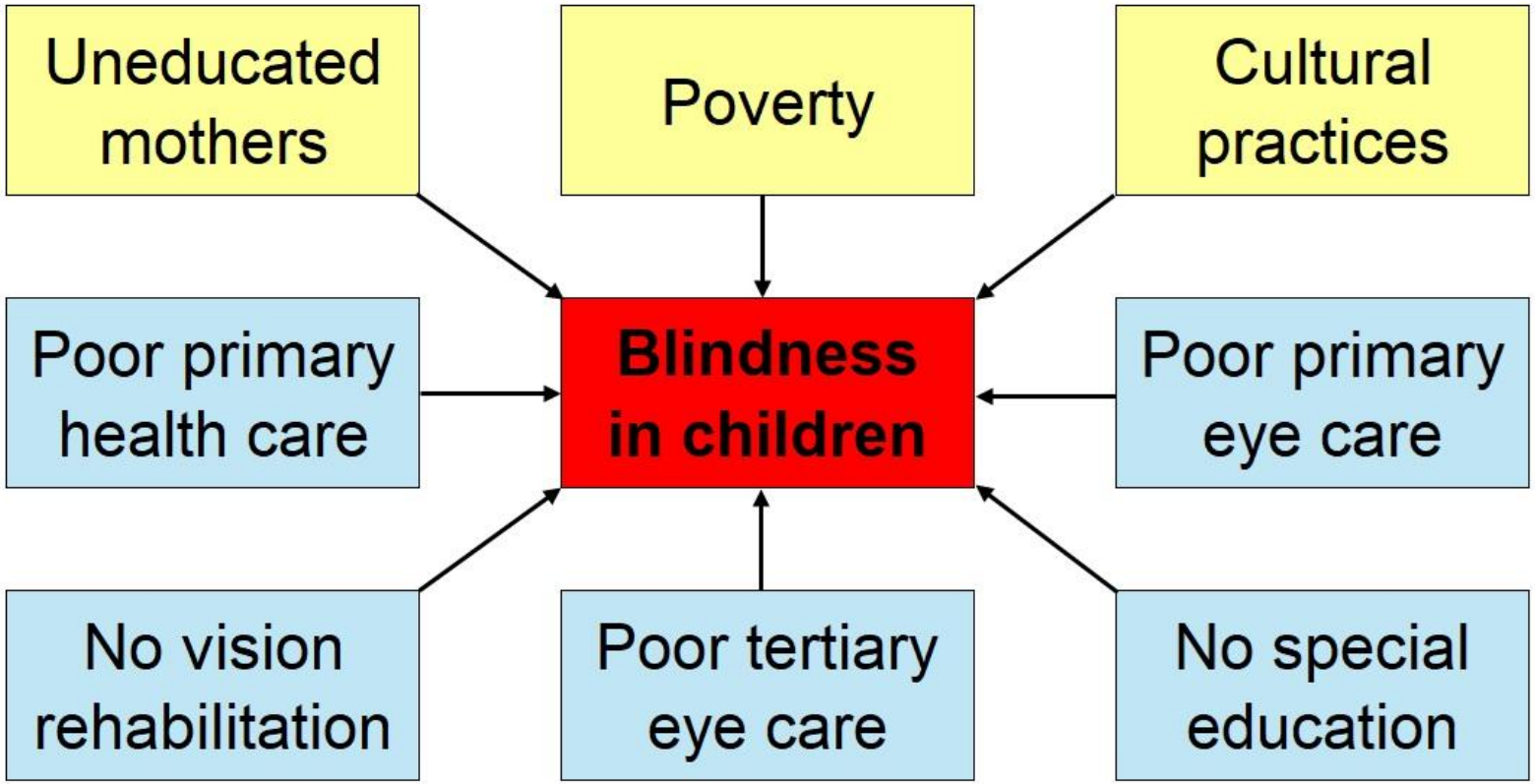
Number of blind children in 2020, by GBD super regions [regional prevalence/10,000]



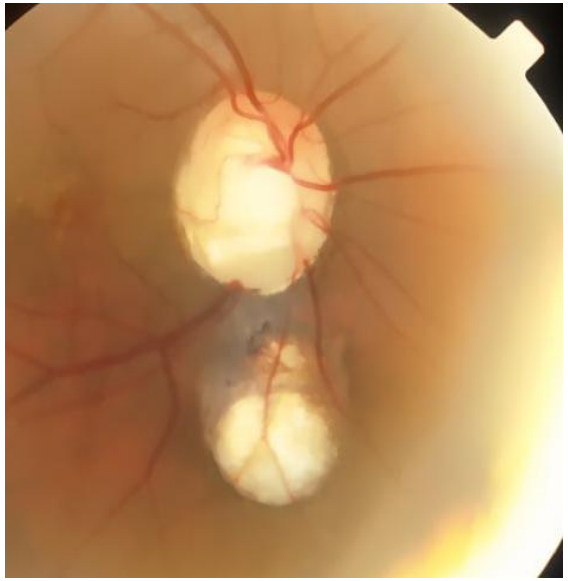
Number of blind children/10 million pop, by cause and level of development (2020)



Underlying causes of blindness in children



Magnitude and pattern: affluent communities



10 million

20% 0-15 = 2 mill

Prev = 0.3/ 1,000

600 blind



Scar 0%	Cat/gl	ROP	Others
0	10% 60	10% 60	80% 480

Magnitude and pattern: middle income

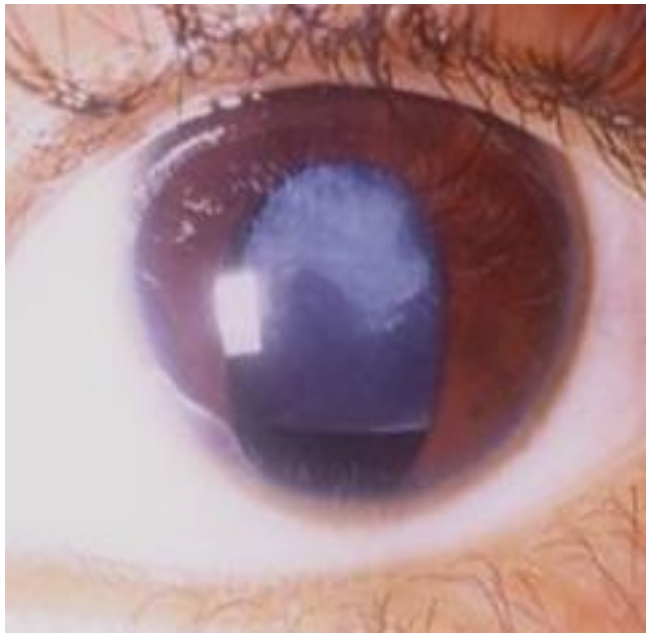


10 million

30% 0-15 = 3 mill

Prev = 0.6/ 1,000

1,800 blind



Scar 0%	Cat/gl	ROP	Others
0	20% 360	25% 450	55% 990

Magnitude and pattern: poor communities



10 million

40% 0-15 = 4 mill

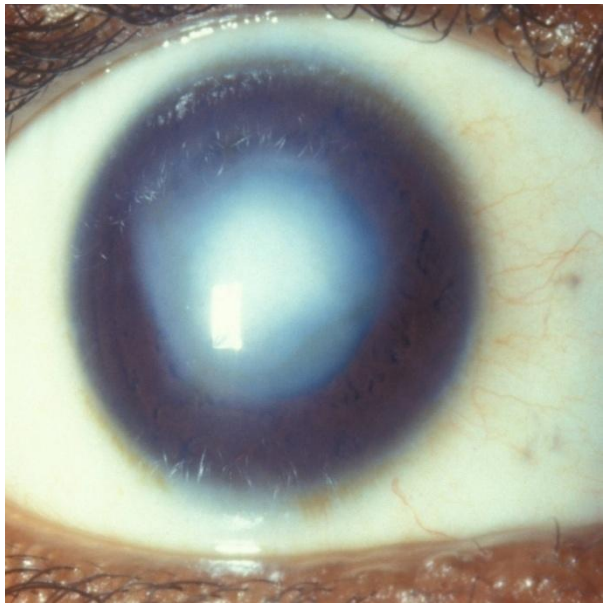
Prev = 0.9/1,000

3,600 blind



Scar	Cat/gl	ROP	Others
20% 720	20% 720	0% 0	60% 2,160

Magnitude and pattern: very poor communities – Africa only

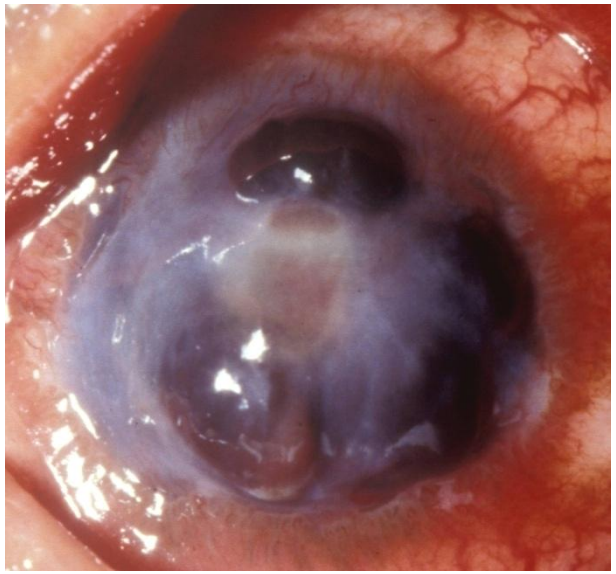


10 million

50% 0-15 = 5 mill

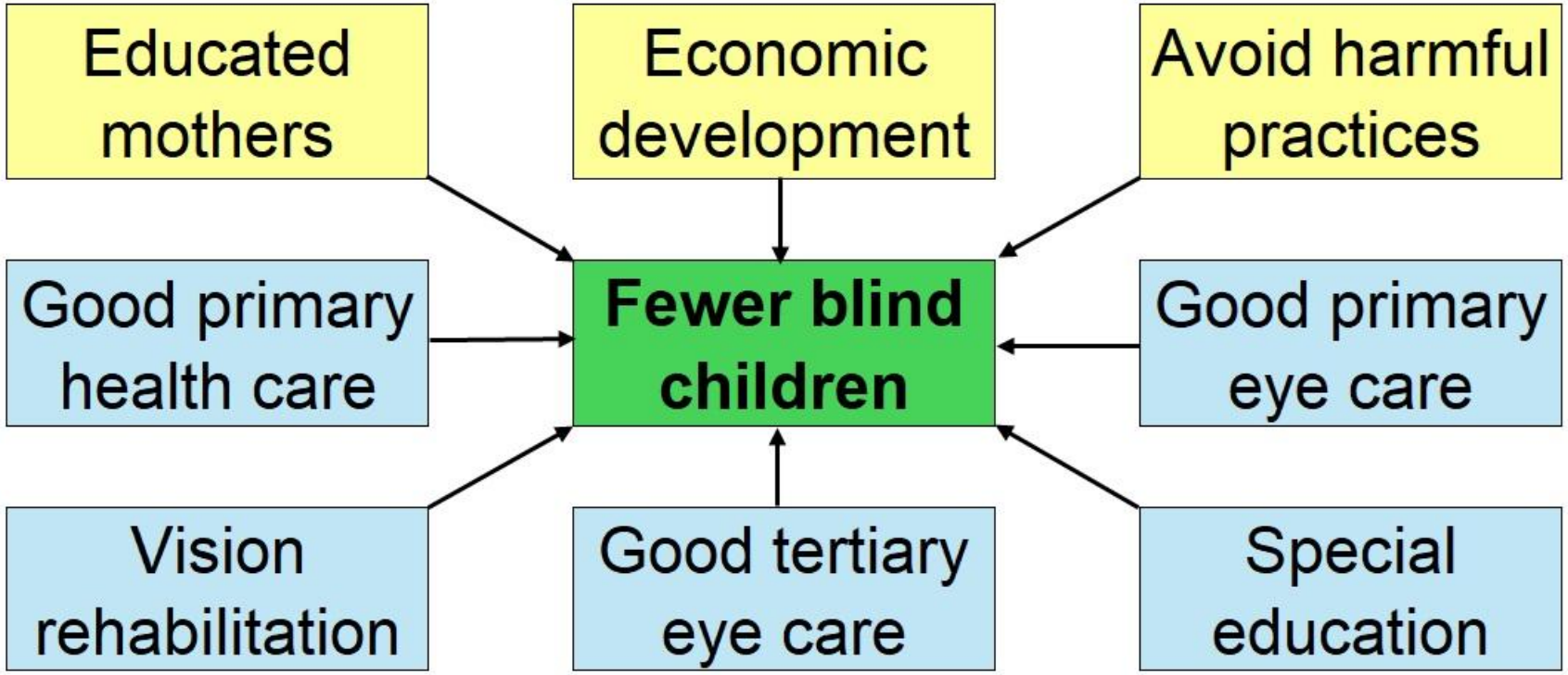
Prev = 1.2/1,000

6,000 blind



Scar 50% 3,000	Cat/gl 15% 900	ROP 0% 0	Others 35% 2,100

Control of blindness in children



Main priorities

- Improve primary health care for children
  - with eye health education for carers
- Improve eye care for children in district hospitals
- Develop more tertiary levels child eye care centres outside main urban areas
- Scale up ROP services

Thank you