



INFANT HEARING LOSS IN DEVELOPING COUNTRIES - EXPOSING A SILENT EPIDEMIC

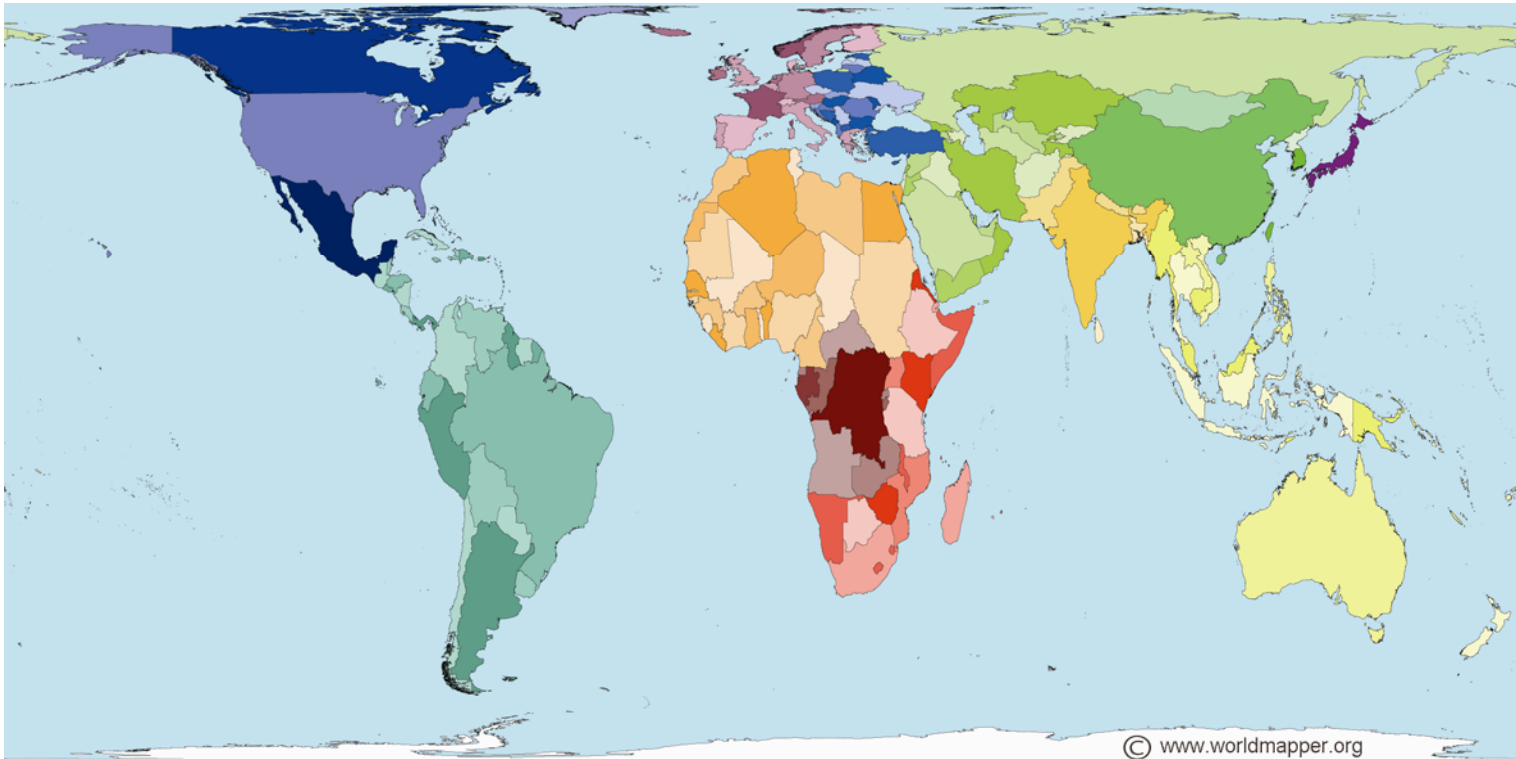
SOUND FOUNDATION THROUGH EARLY AMPLIFICATION

8 – 10 November 2010

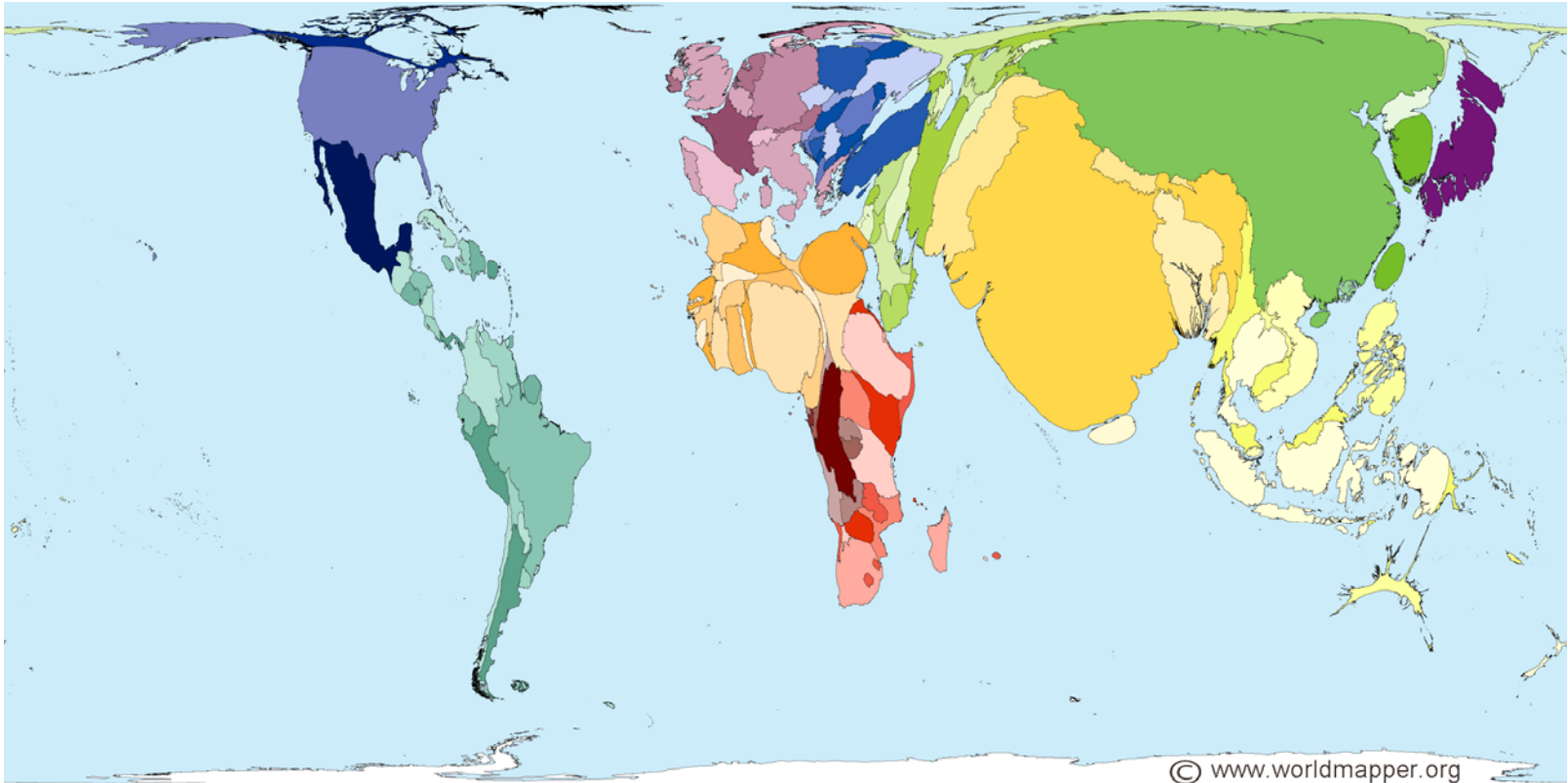
De Wet Swanepoel, Ph.D *University of Pretoria, South Africa*
University of Texas at Dallas, USA

**CHANGE THE WAY WE LOOK AT
THE WORLD**

THE WORLD AS WE KNOW IT...

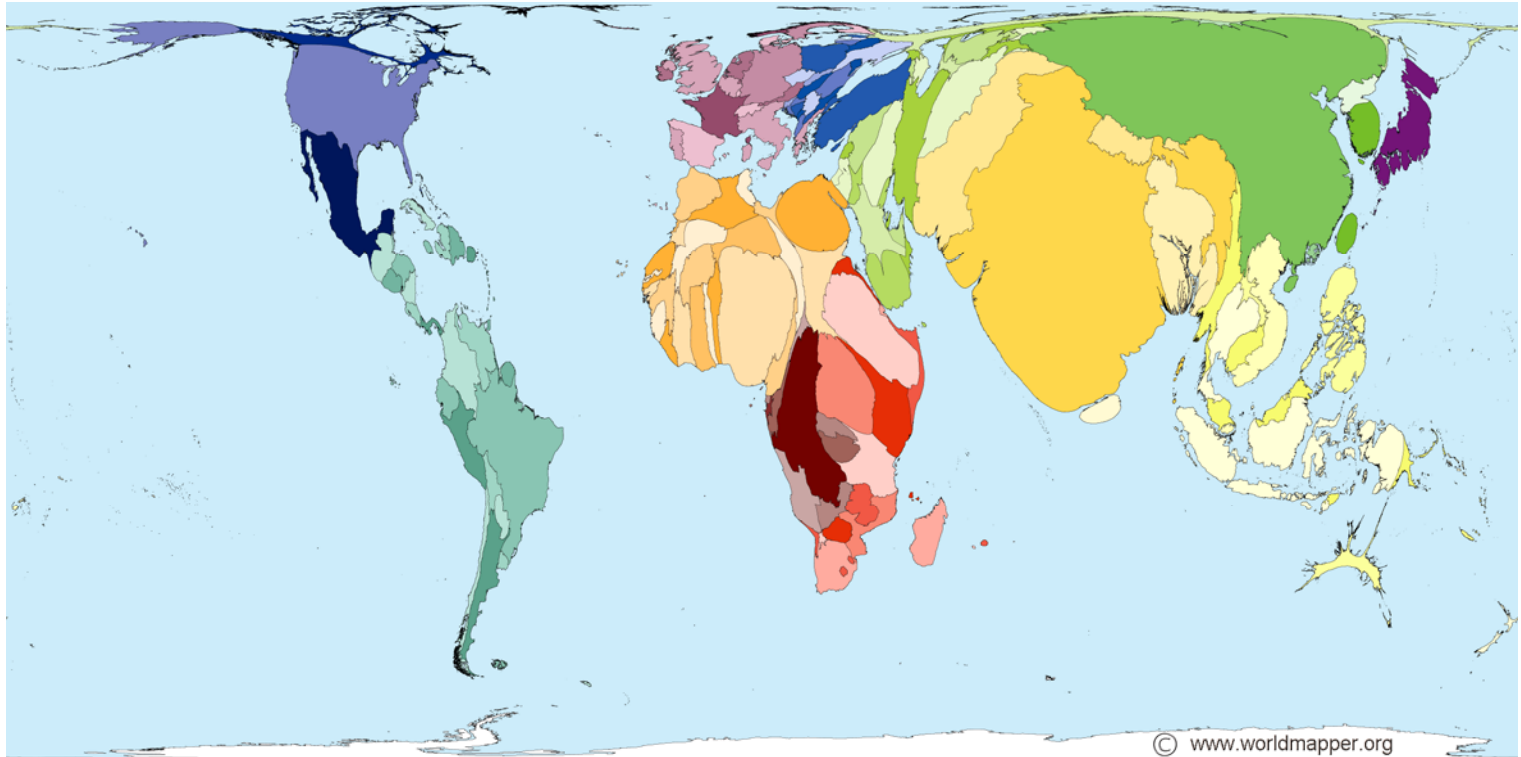


WORLD POPULATION

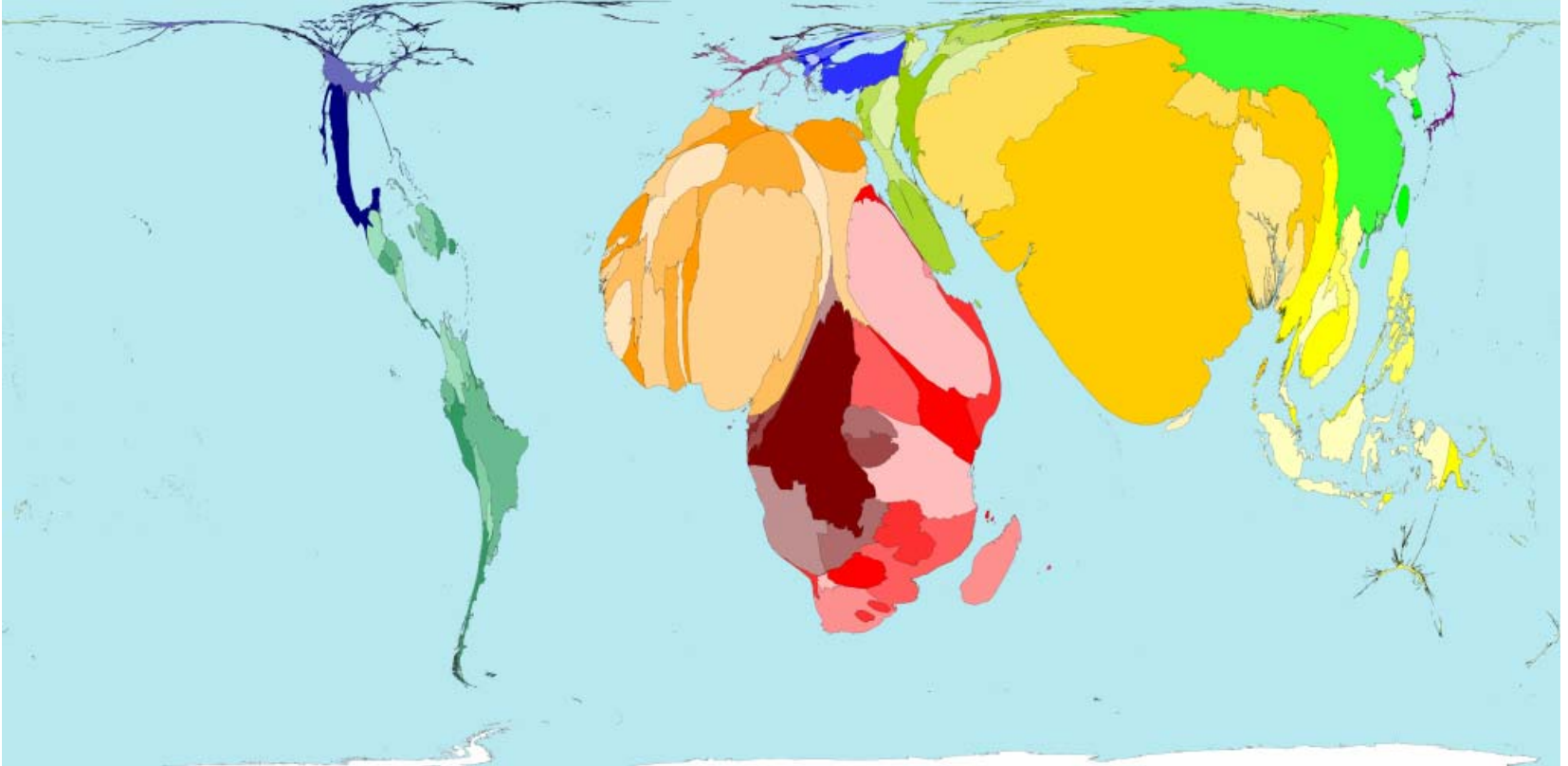


*"Out of every **100** persons added to the population in the coming decade, **97** will live in developing countries."* Hania Zlotnik, 2005

POPULATION 2015

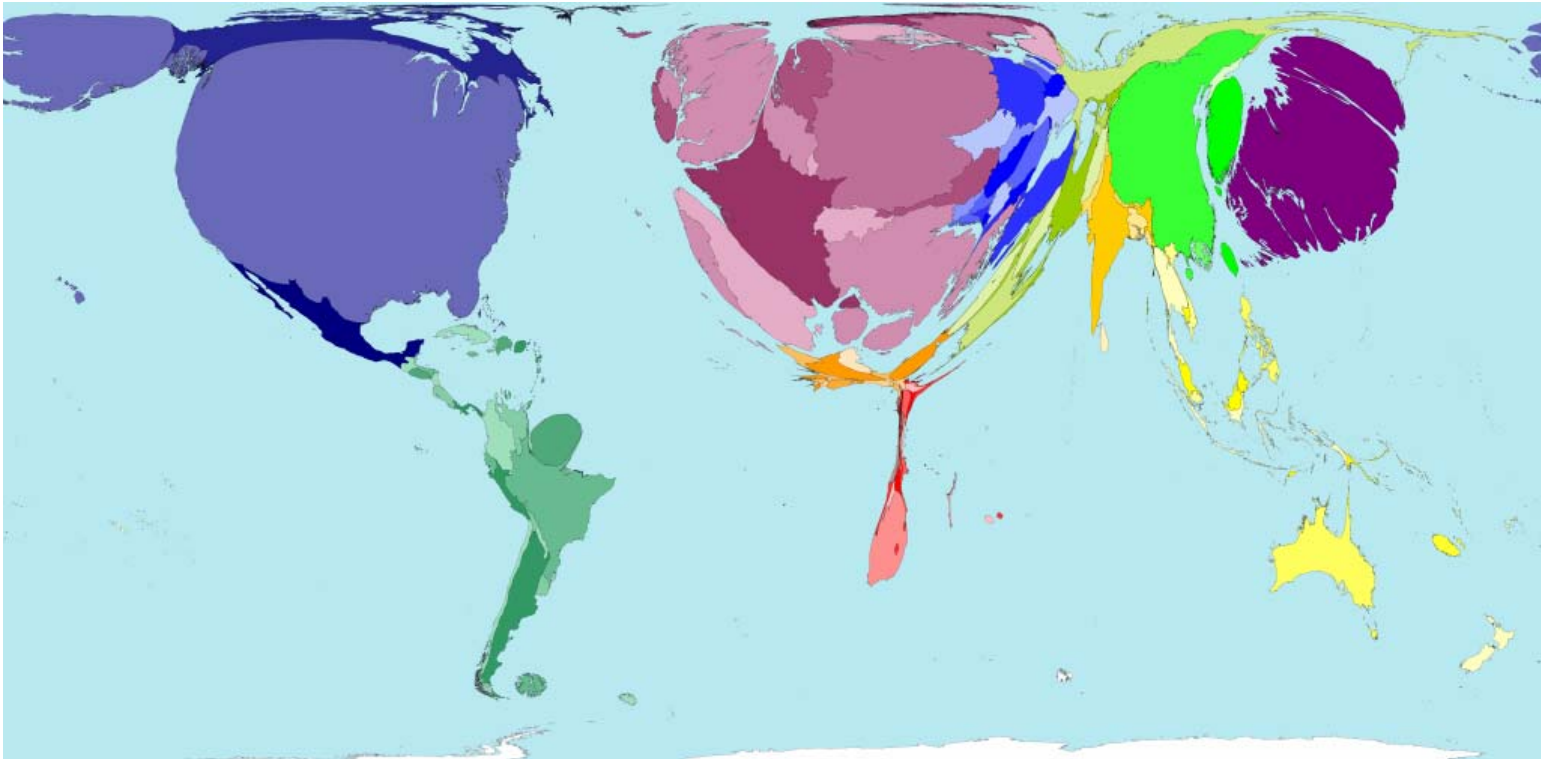


INFANT MORTALITY



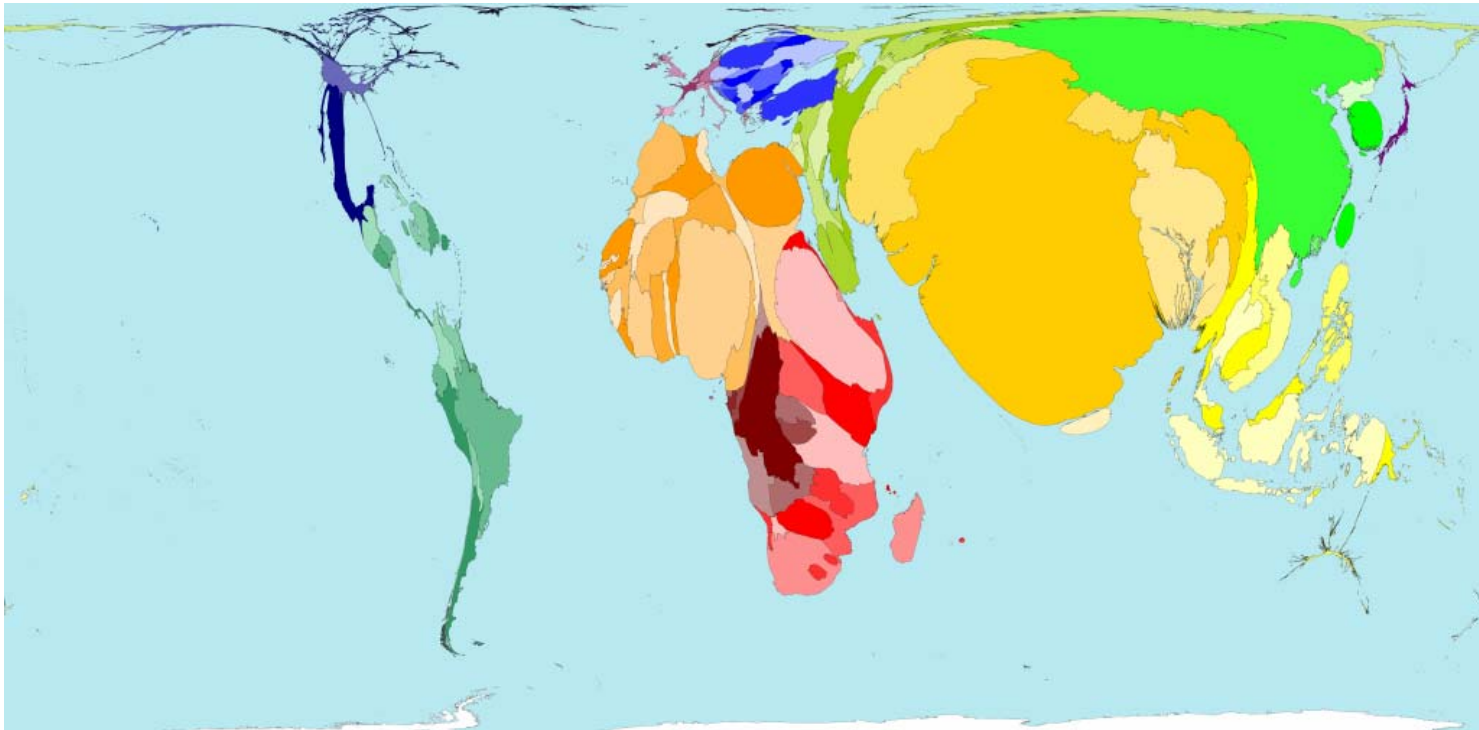
"If we are the future and we're dying, there is no future." Mary Phiri, 2001

PUBLIC HEALTH SPENDING



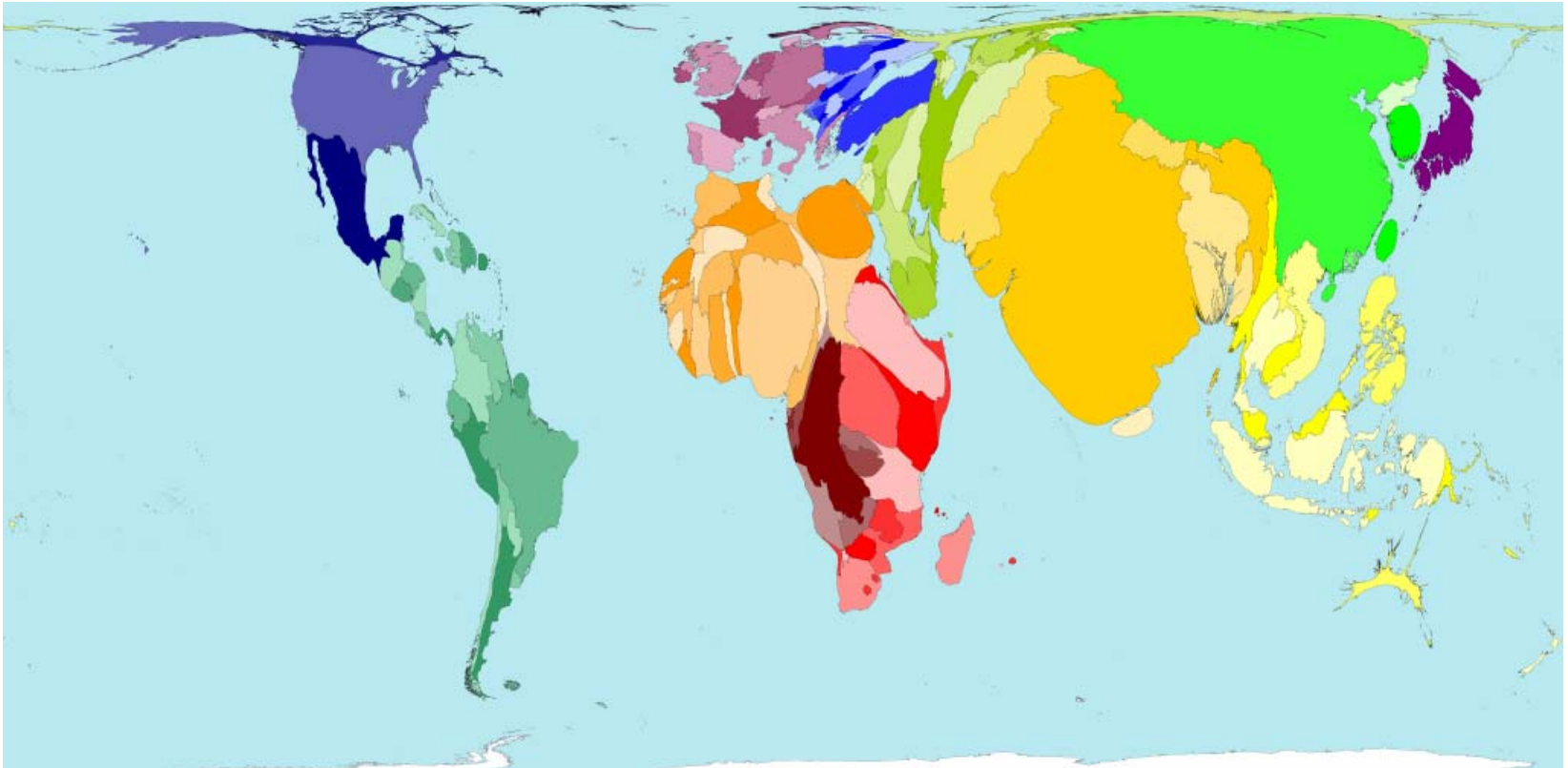
"... I brought my little girl to the health center in my district in the south of Bujumbura. But the nurse wouldn't see us as I didn't have any money to pay for the consultation." Simeon, 2004

POVERTY INDEX



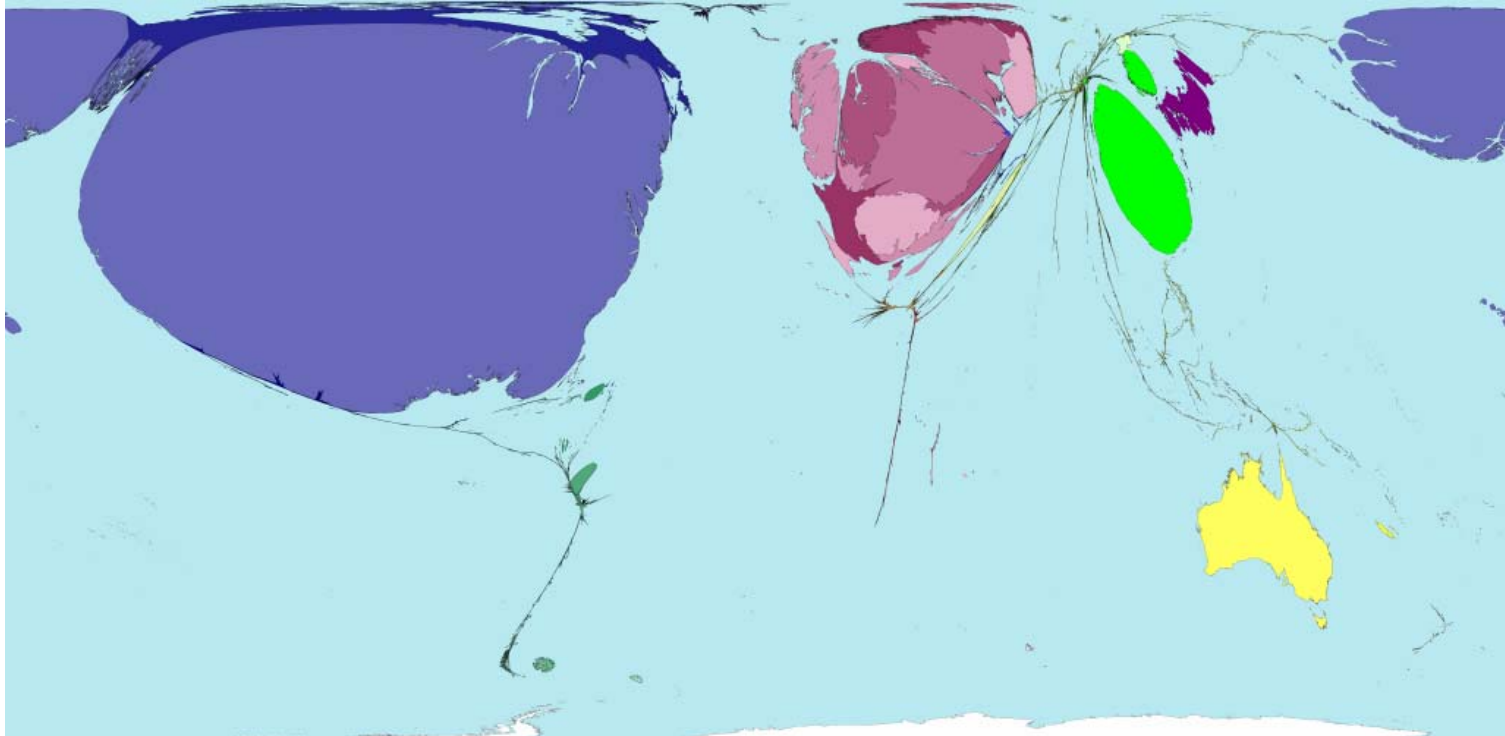
The human poverty index uses indicators that capture non-financial elements of poverty, such as life expectancy, adult literacy, water quality, and children that are underweight.

CHILDREN WITH HEARING LOSS WHO ARE SCREENED AT BIRTH?



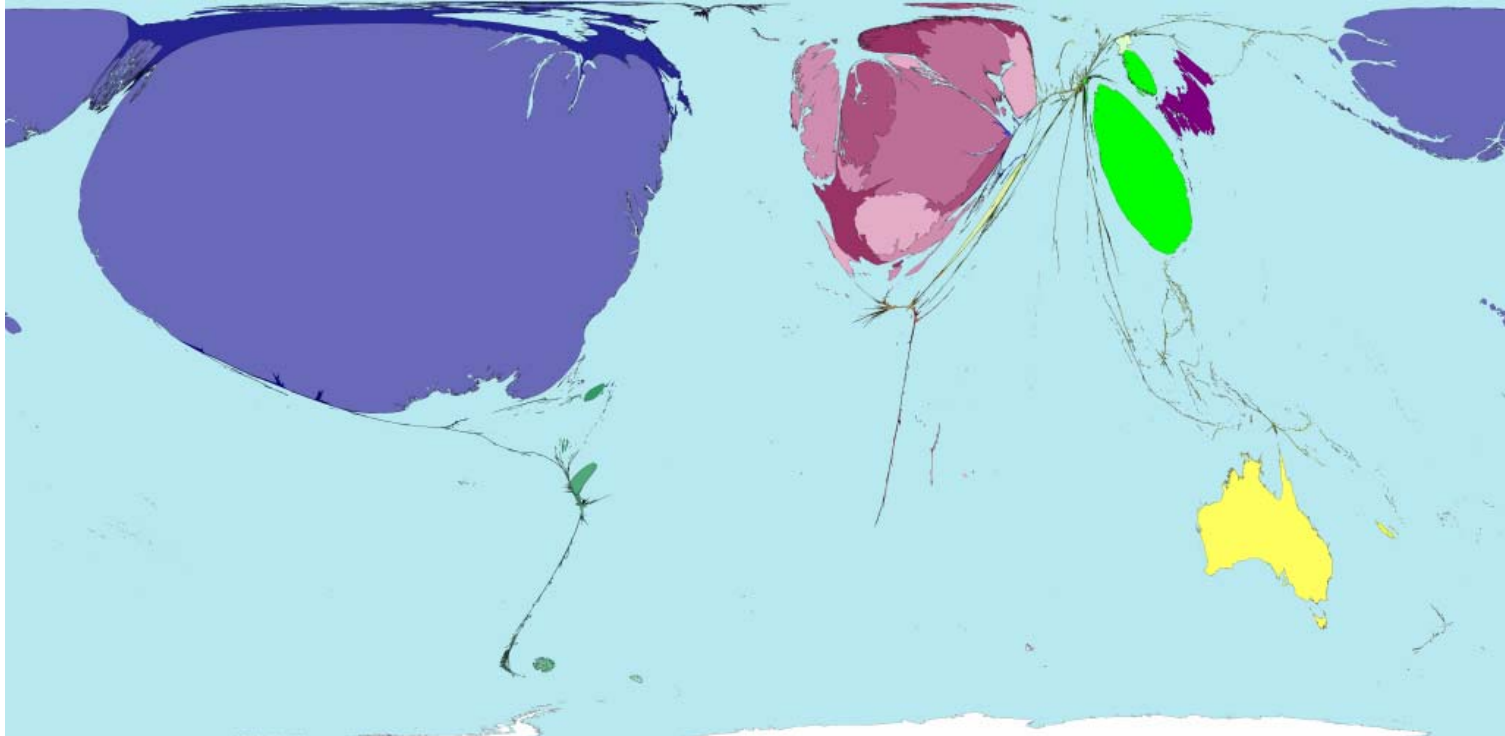
**Estimated*

CHILDREN WITH HEARING LOSS IDENTIFIED BEFORE 3 YEARS OF AGE?



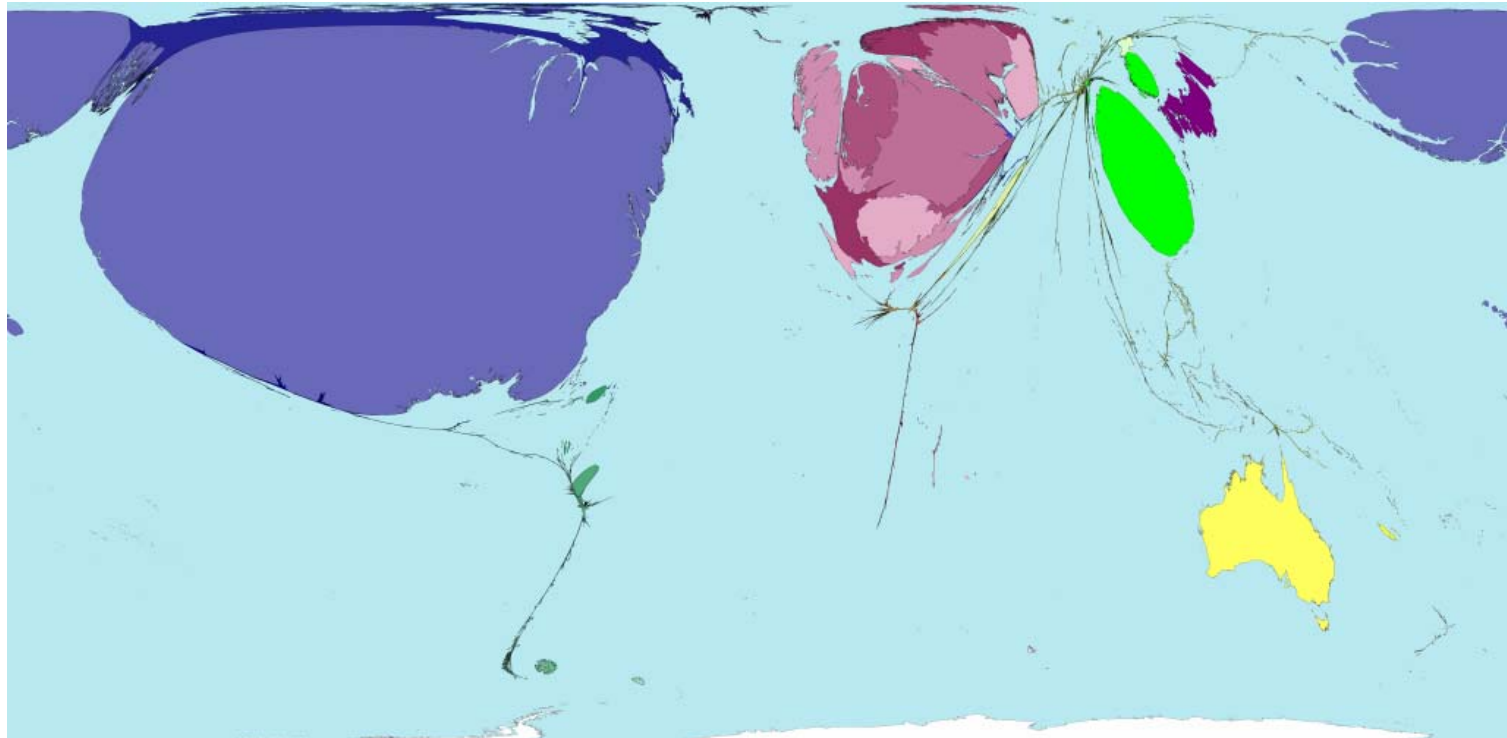
**Estimated*

CHILDREN WITH HEARING LOSS WHO RECEIVE HEARING AIDS?



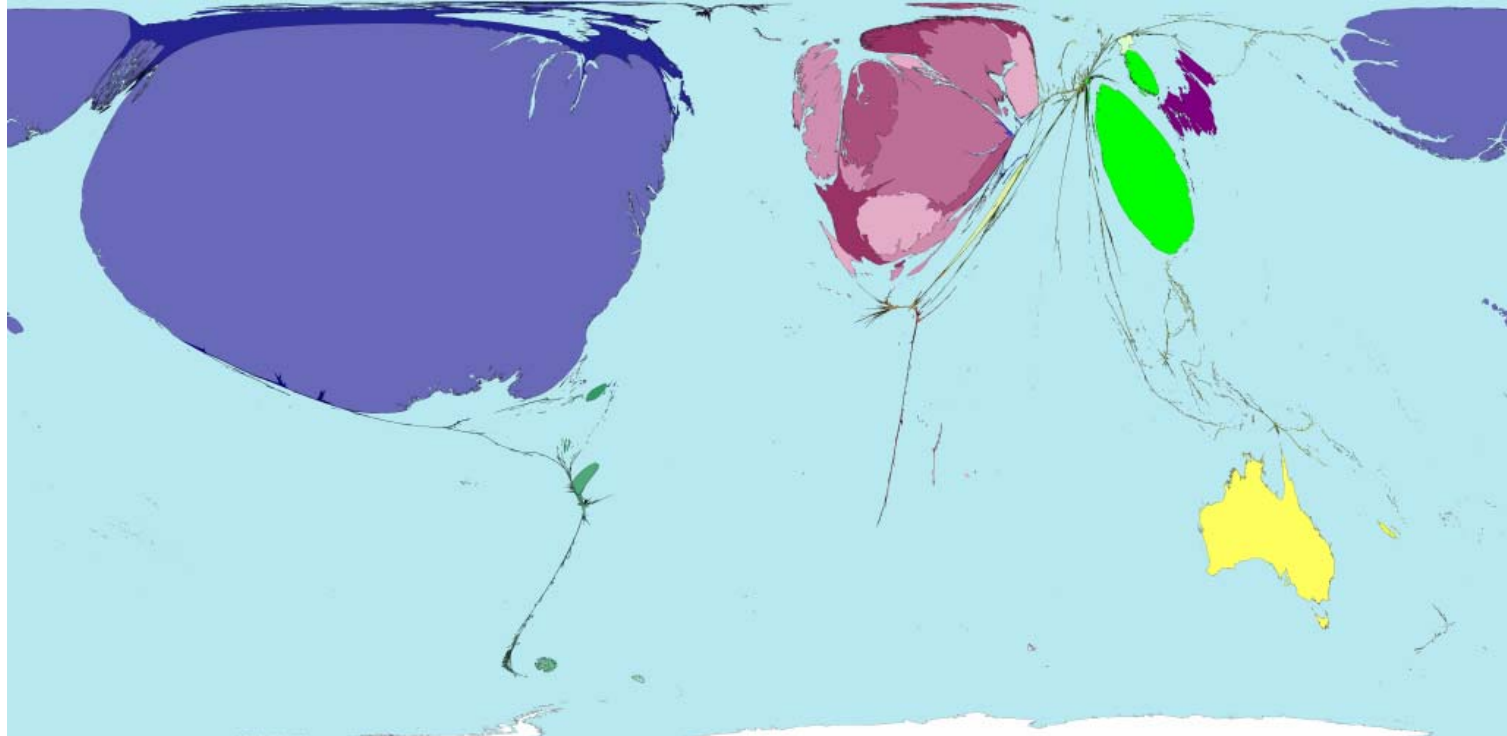
**Estimated*

CHILDREN WITH HEARING LOSS WHO LEARN SPOKEN LANGUAGE?



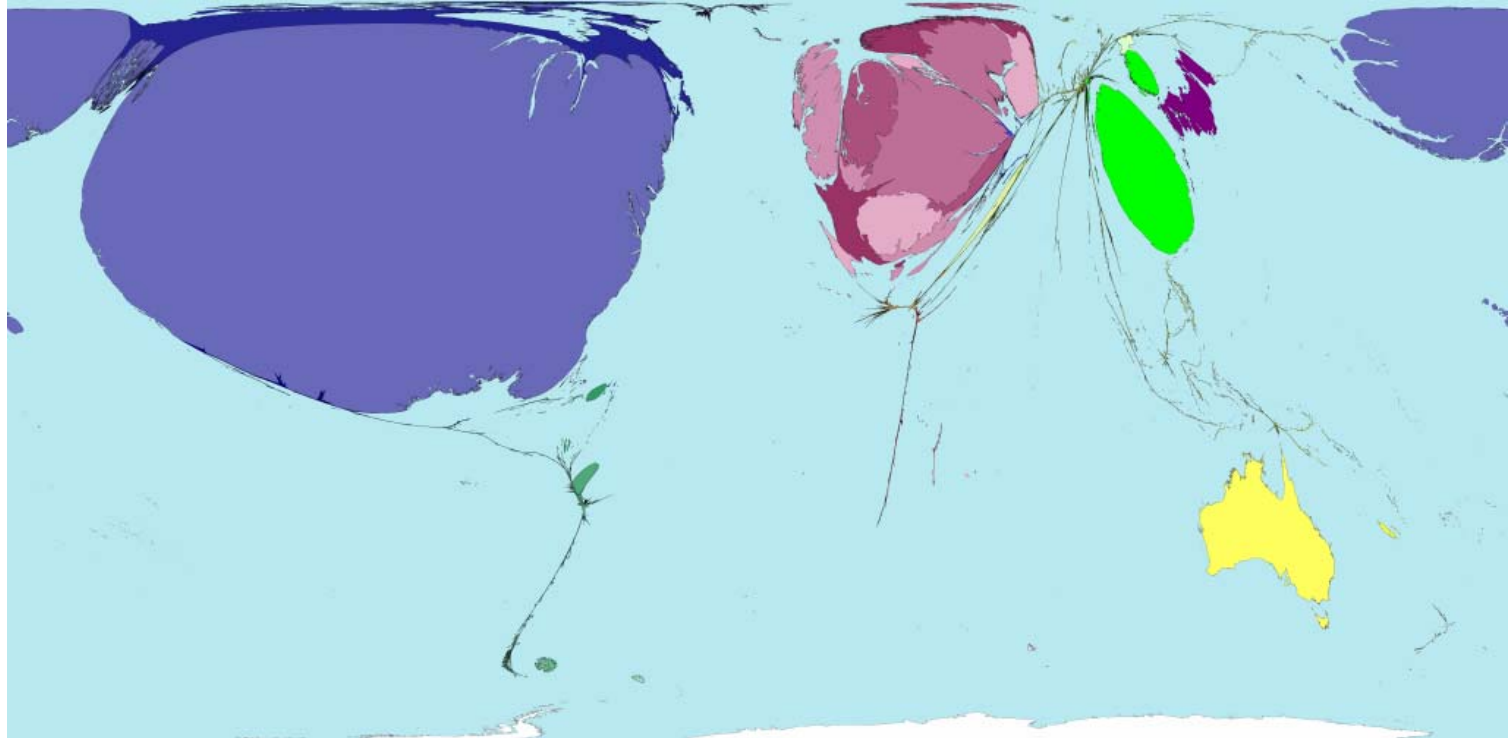
**Estimated*

CHILDREN WITH HEARING LOSS WHO LEARN TO READ AND WRITE?



**Estimated*

CHILDREN WITH HEARING LOSS WHO BECOME ACTIVE CONTRIBUTING MEMBERS OF THEIR ECONOMIES?



**Estimated*

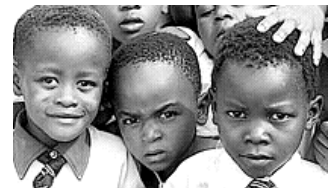
WHO ARE THESE COUNTRIES?

- 164 Developing countries
- 31 Developed countries
- Heterogeneous group

REGION	NUMBER OF COUNTRIES
Sub-Saharan Africa (SSA)	46
Middle East & North Africa (MEN)	21
South Asia (SOA)	8
East Asia & Pacific (EAP)	29
Latin America & Caribbean (LAC)	33
Central/Eastern Europe & Baltic State Countries (CEE)	27

WHO IS THE DEVELOPING WORLD?

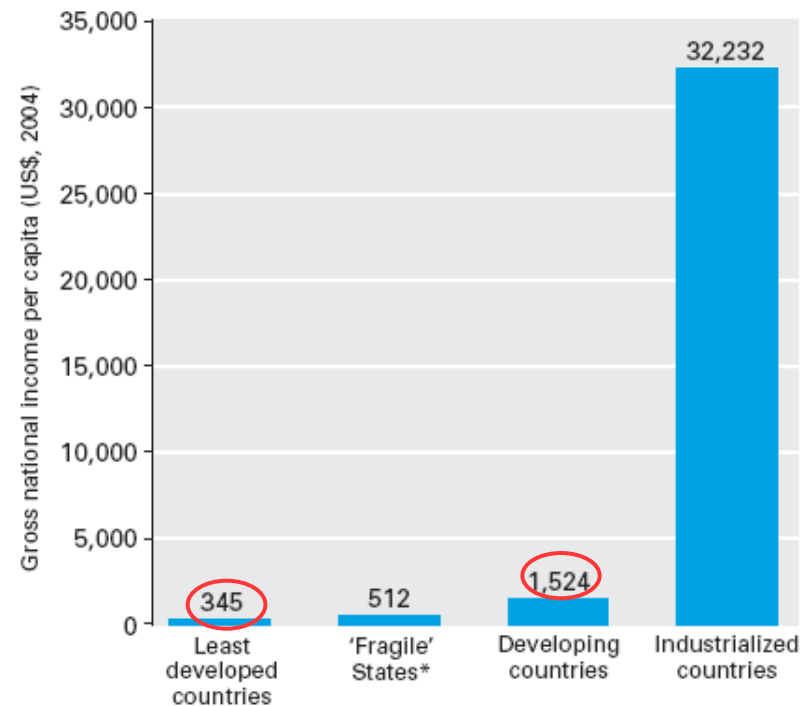
- 5+ billion people
- Global population: >80%
- 90% of children under 5 live in Developing world
- Classified by indicators of development (e.g.)



WHO IS THE DEVELOPING WORLD?

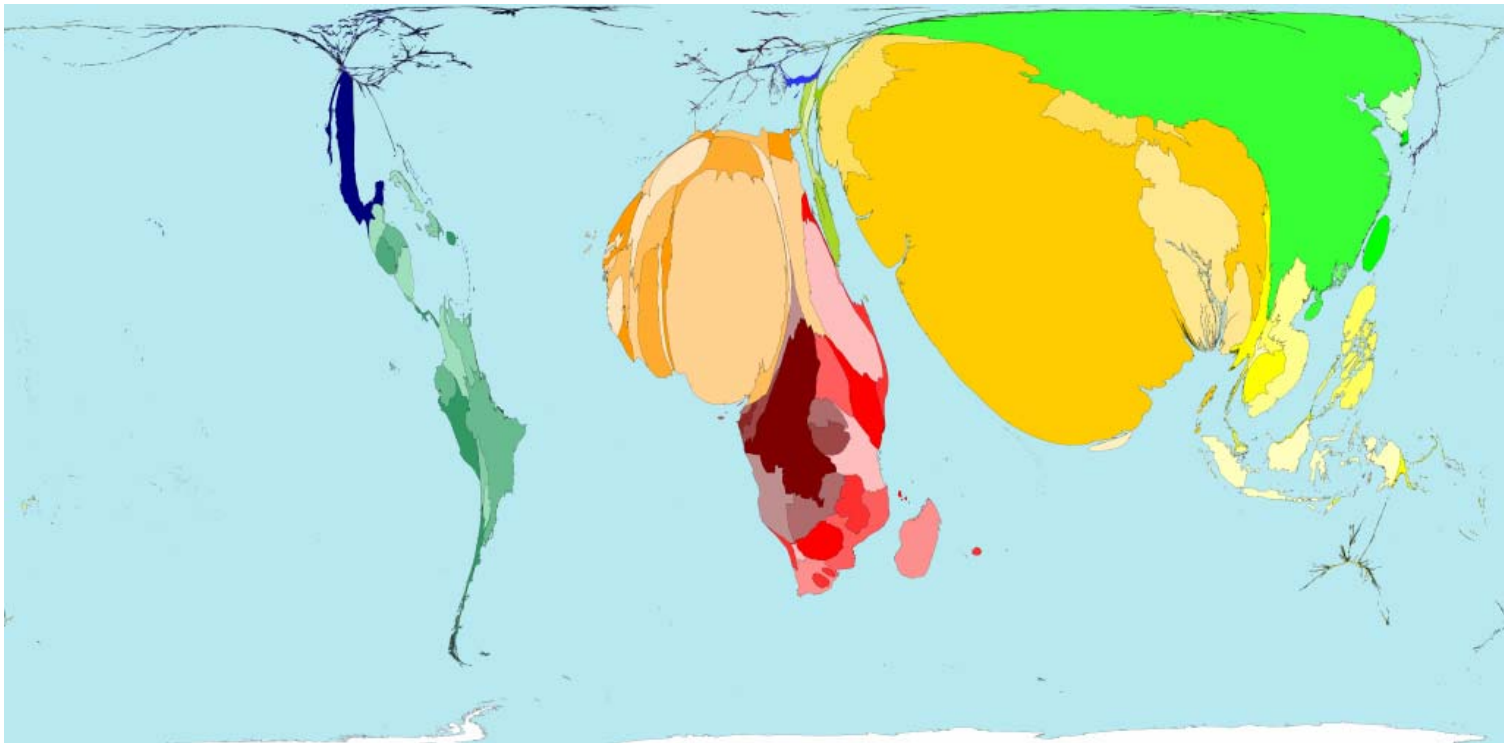
- Globally **20%** live on less than **\$1** per day
- **<1%** in developed countries
- SSA: **43%** of live on less than **\$1 per** day
- **225** richest control wealth equivalent to annual income of poorest **2.5 billion**

Annual per Capita income



WHO IS THE DEVELOPING WORLD?

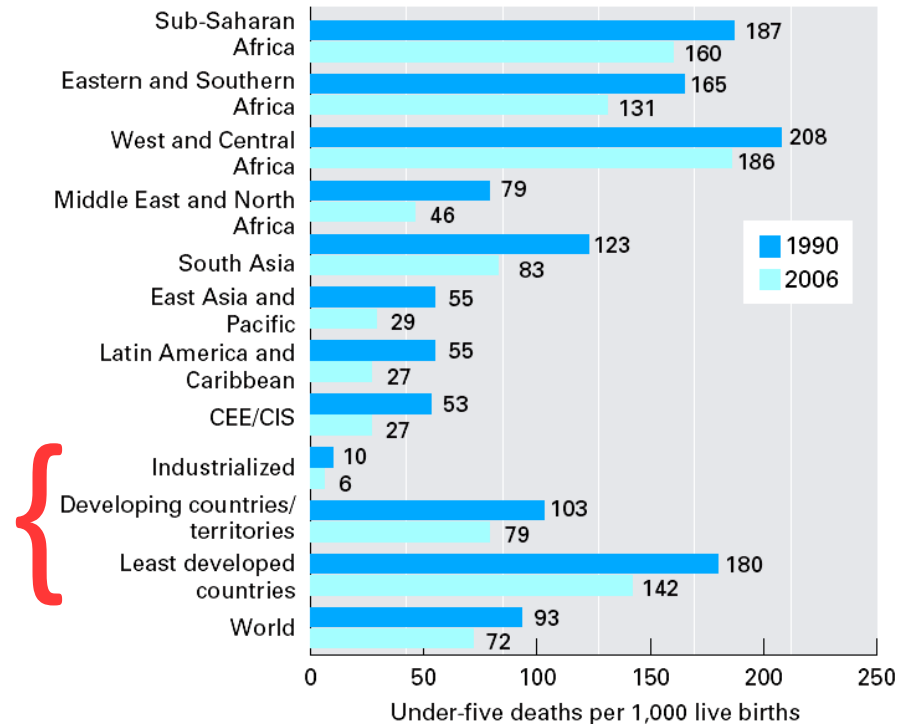
Proportion of people living under \$1/day



WHO IS THE DEVELOPING WORLD?

- Mortality: **0.6 vs 8 & 14%**
- Developing world (>80% of pop) spend **13%** of global healthcare
- Life expectancy:
79 Developed
66 Developing
55 Least developed

Infant mortality rate

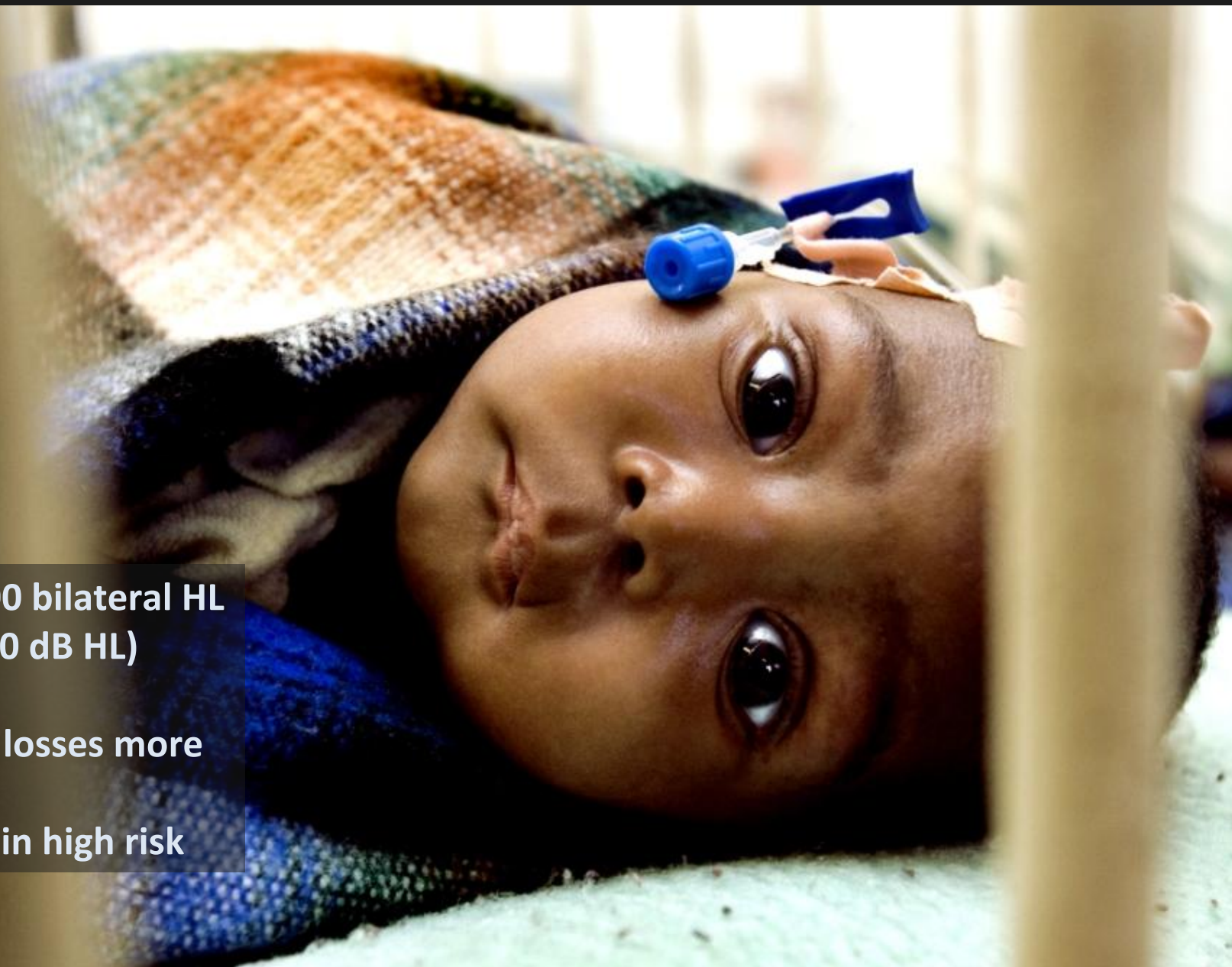


PREVALENCE OF INFANT HL

4-6/1000 bilateral HL
(>40 dB HL)

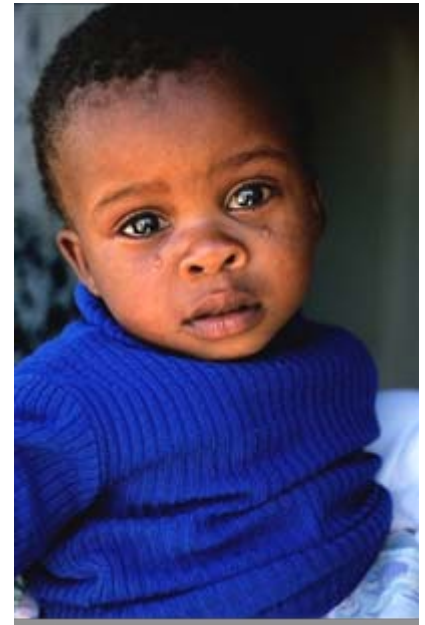
+ mild losses more

2-5% in high risk



PREVALENCE OF INFANT HL

- Disabling HL (>40dB) prevalence:
 - **120** mil in 1995
 - **278** mil in 2005
 - **642** mil in 2005*
**(including mild HL, 26-40dB)*
- **25%** from childhood
- More than **62** million children younger than 15 years
- Mild and greater – **160** million children



PREVALENCE OF INFANT HL

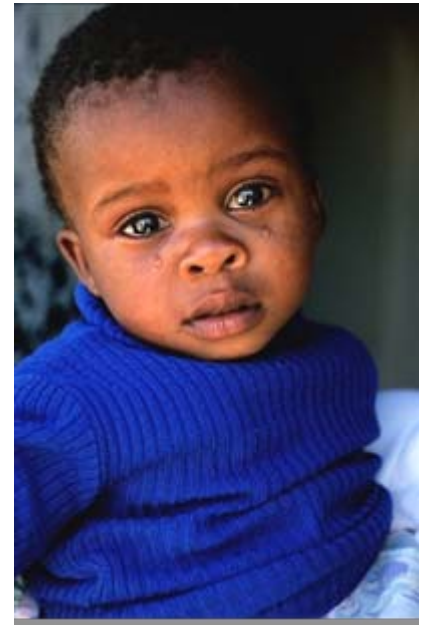
- **120 million** annual births in developing world
- **798 000** - permanent bilateral HL (25% from SSA)
- **53 150** - permanent bilateral HL in all developed countries (**Ratio 1:14**)



PREVALENCE OF INFANT HL

Global Situation

- Everyday **2 118** born with significant permanent SNHL:
 - **1 972** born in developing world (6/1000)
 - **146** born in developed countries (4/1000)
- **>90%** born in developing world



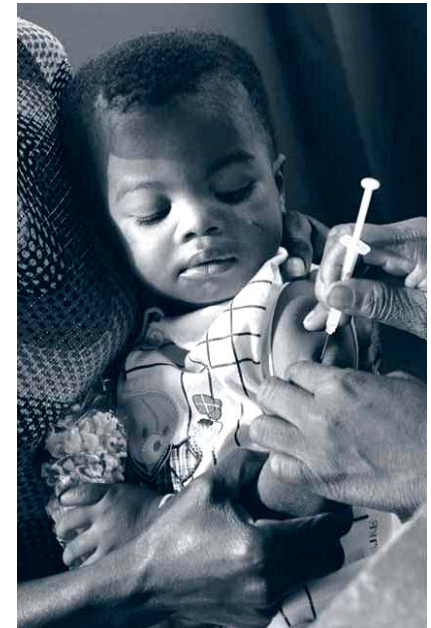
CAUSES OF HEARING LOSS

Developed countries

- **54%** of HL genetic at 4 years

Developing countries

- Risks **abundant, complex & varied**
- Poor **maternal-child** health care
- Adverse **peri- & postnatal** conditions
- **Consanguinity**
- Infectious **disease** burden



RISK PROFILE

APPENDIX 2: RISK INDICATORS ASSOCIATED WITH PERMANENT CONGENITAL, DELAYED-ONSET, OR PROGRESSIVE HEARING LOSS IN CHILDHOOD

Risk indicators that are marked with a “§” are of greater concern for delayed-onset hearing loss.

1. Caregiver concern§ regarding hearing, speech, language, or developmental delay.⁶²
2. Family history§ of permanent childhood hearing loss.^{24,140}
3. Neonatal intensive care of more than 5 days or any of the following regardless of length of stay: ECMO,§ assisted ventilation, exposure to ototoxic medications (gentamicin and tobramycin) or loop diuretics (furosemide/Lasix), and hyperbilirubinemia that requires exchange transfusion.^{64,131}
4. In utero infections, such as CMV,§ herpes, rubella, syphilis, and toxoplasmosis.^{64–67,125,126}
5. Craniofacial anomalies, including those that involve the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies.²⁴

6. Physical findings, such as white forelock, that are associated with a syndrome known to include a sensorineural or permanent conductive hearing loss.²⁴
7. Syndromes associated with hearing loss or progressive or late-onset hearing loss,§ such as neurofibromatosis, osteopetrosis, and Usher syndrome¹³¹; other frequently identified syndromes include Waardenburg, Alport, Pendred, and Jervell and Lange-Nielson.⁷²

NICU?

-LBW (<1500g)

-Birth Asphyxia (1min Apgar <4, 2min Apgar <6)

-Mechanical ventilation for 5 days or more

-Unskilled birth attendant*

-Maternal hypertension*

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5. **HIV/AIDS related opportunistic infections?
Undernourishment?***
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8. Neurodegenerative disorders,§ such as Hunter syndrome, or sensory motor neuropathies, such as Friedrich ataxia and Charcot-Marie-Tooth syndrome.¹³¹
9. Culture-positive postnatal infections associated with sensorineural hearing loss,§ including confirmed bacterial and viral (especially herpes viruses and varicella) meningitis.^{130,131,141}
10. Head trauma, especially basal skull/temporal bone fracture§ that requires hospitalization.^{127–129}
11. Chemotherapy.§¹³²

RISK PROFILE

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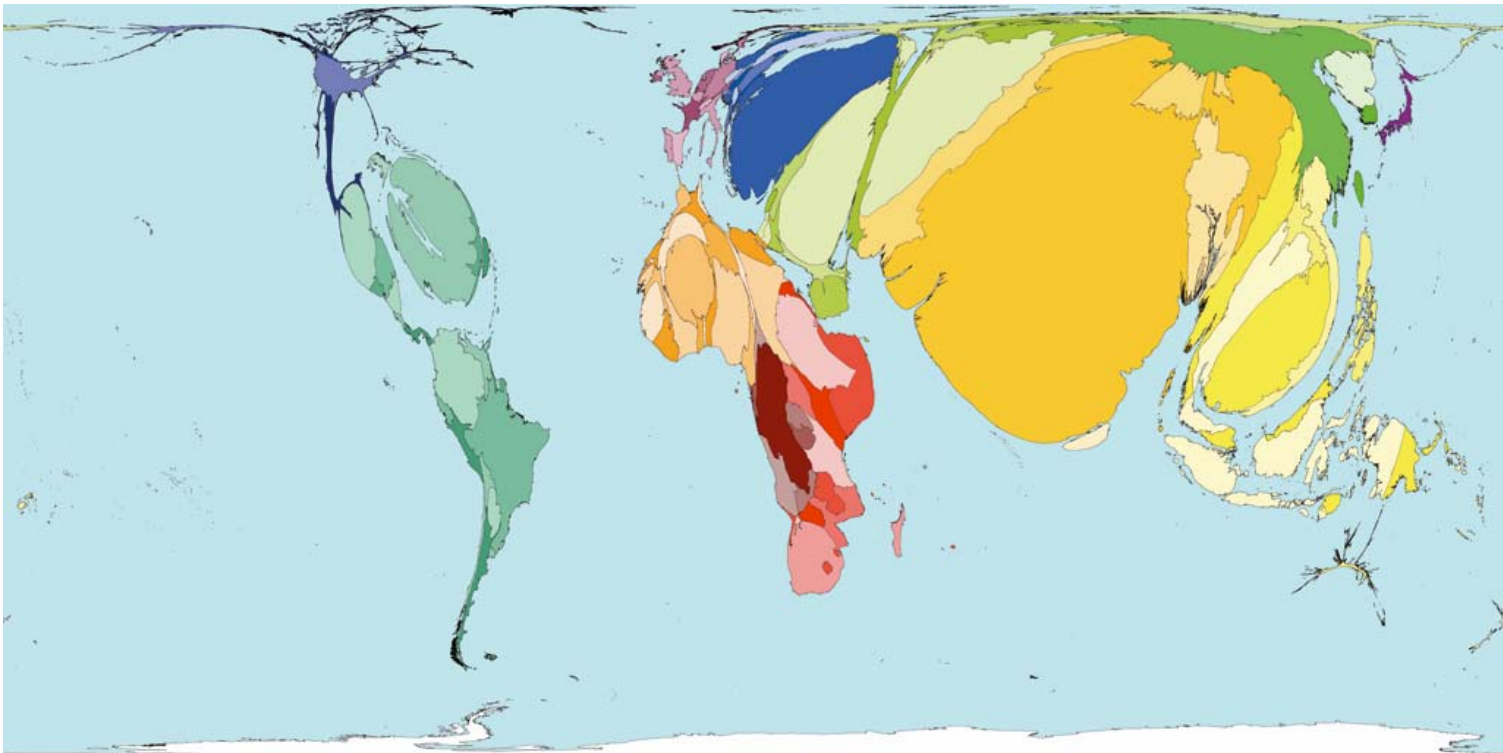
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Malaria
Measles
HIV/AIDS

RISK PROFILE

Meningitis deaths



RISK PROFILE

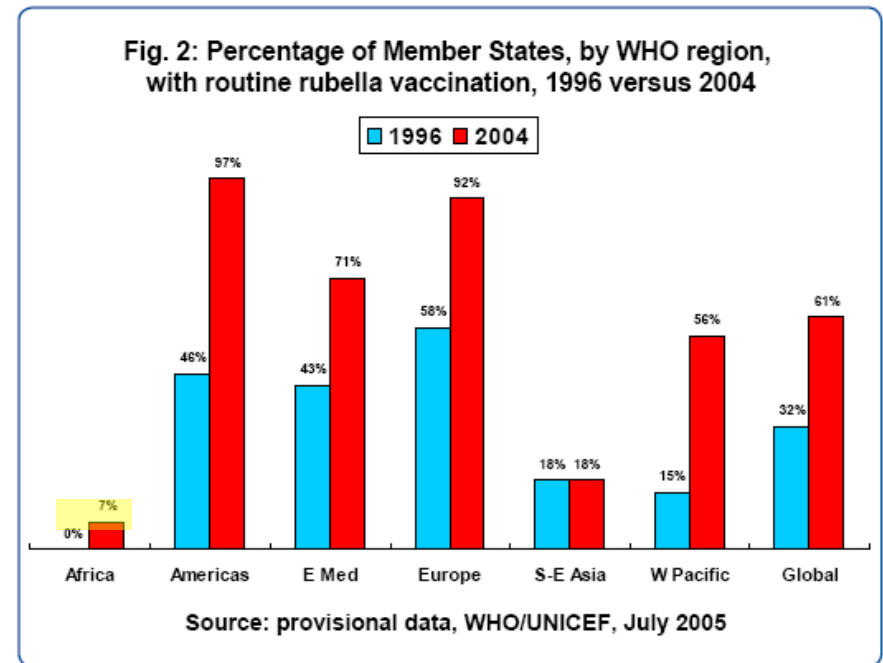
Meningitis

- **Most common** cause
- Incidence **~10 times higher** in developing world
- **350 000 – 560 000** annual child deaths in Africa
- Majority survive; Of those **1 in 3** to **1 in 5** have HL

RISK PROFILE

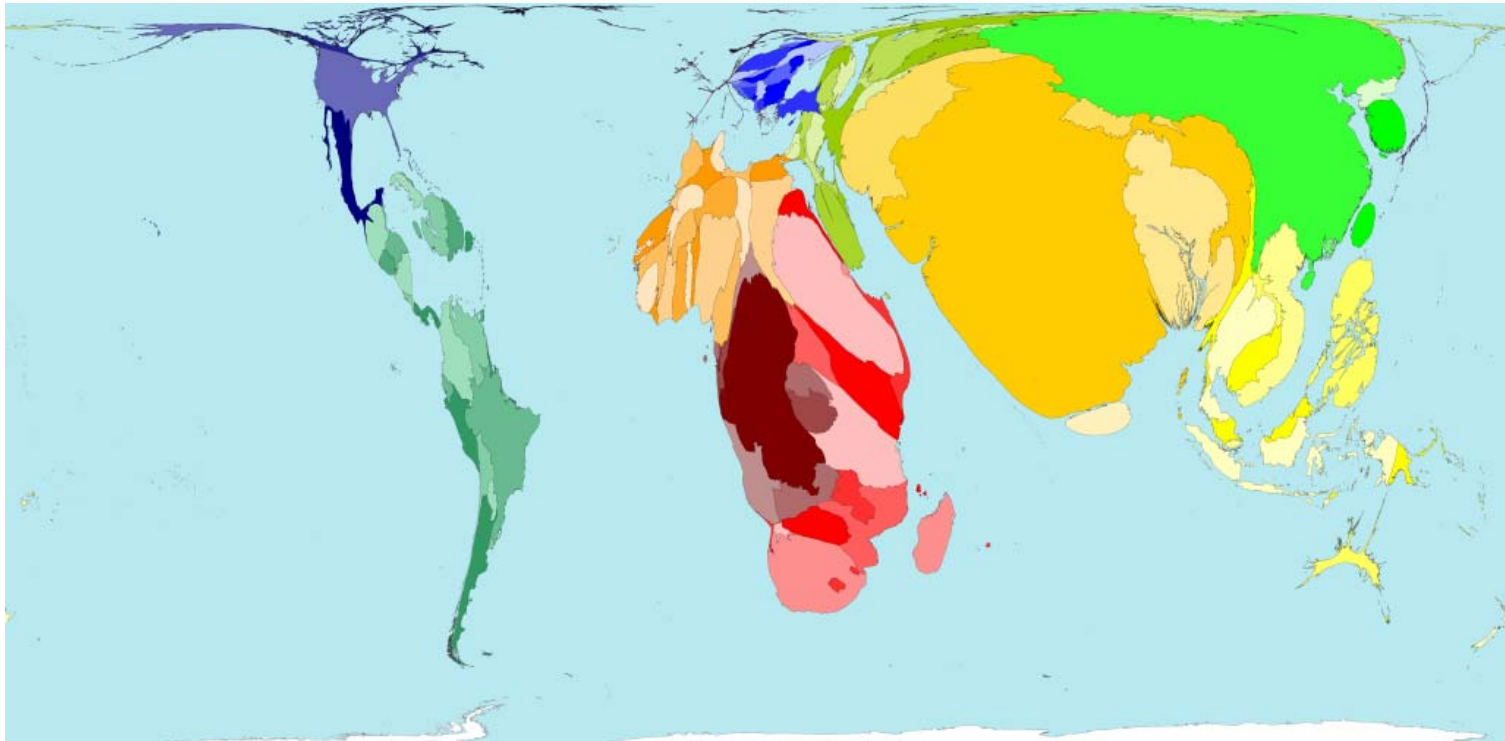
Rubella

- Worldwide CRS – **110 000** annual cases
- **70 – 90%** of CRS cases - hearing loss
- HL most common (**50%** only symptom)



RISK PROFILE

Undernourishment



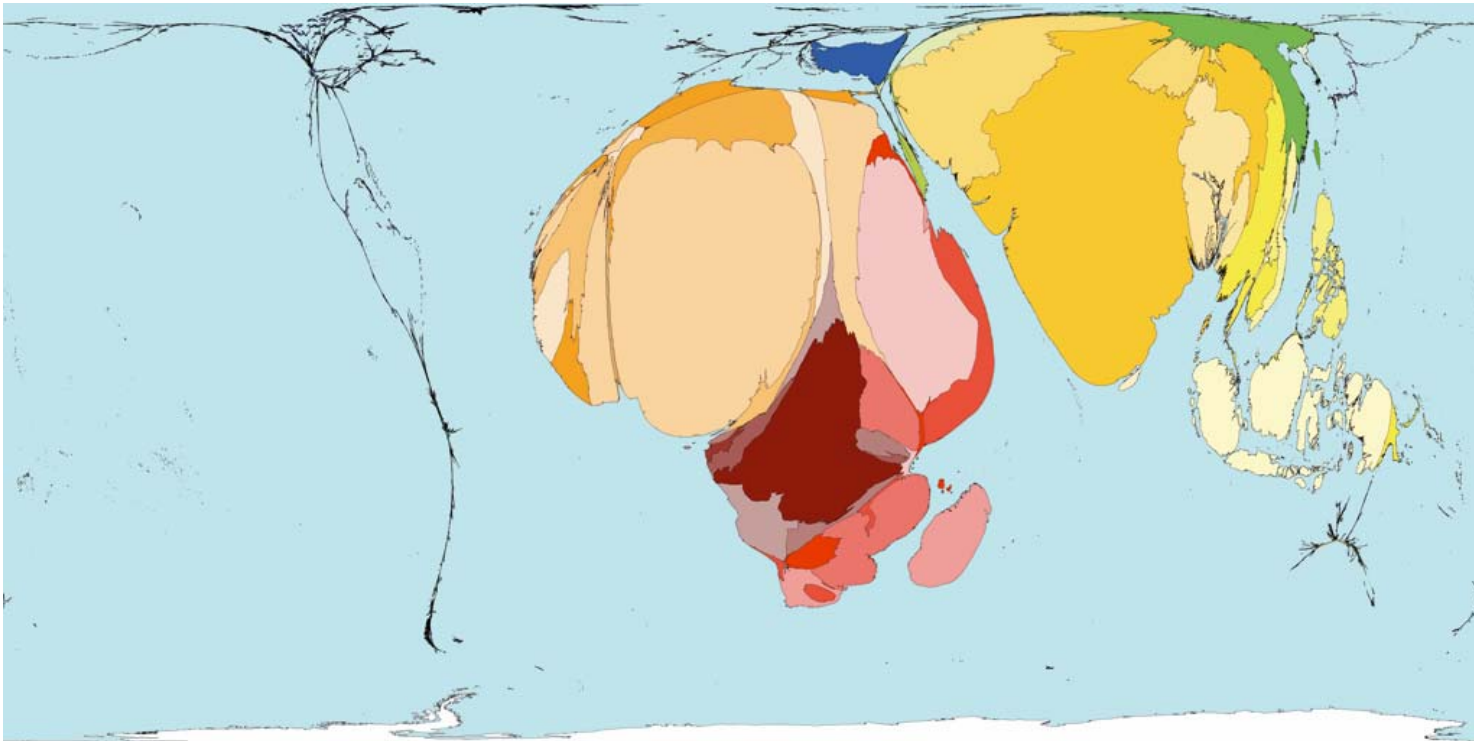
RISK PROFILE

Undernourishment

- **80%** of world's undernourished children live in **20** countries
- Recent study first to **link** undernourishment in infants to HL (Olusanya, 2010).
- Infants significantly (**1.7%**) **more likely** to have HL and of a **severe-to-profound** degree
- Mechanism? May be due to **intra-uterine growth** retardation, **maternal problems** (including mothers nutritional status) or insults arising from **infectious disease** at or soon after birth

RISK PROFILE

Proportion of Measles deaths



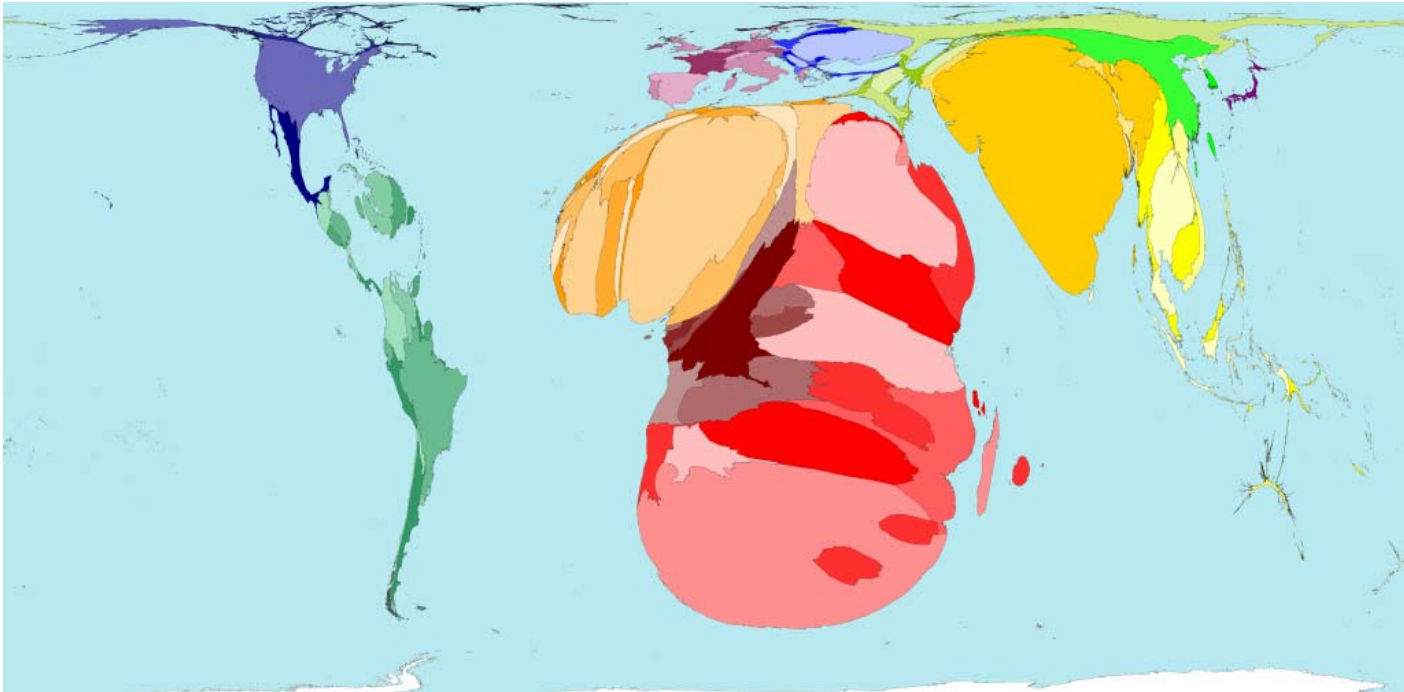
RISK PROFILE

Measles

- Vaccine 1968 - But still **rife** in developing countries
- **345 000** deaths in 2007 (875 000 in 2001)
- **25 – 30 million** children infected annually
- Significant % at risk of SNHL (specific to these regions)

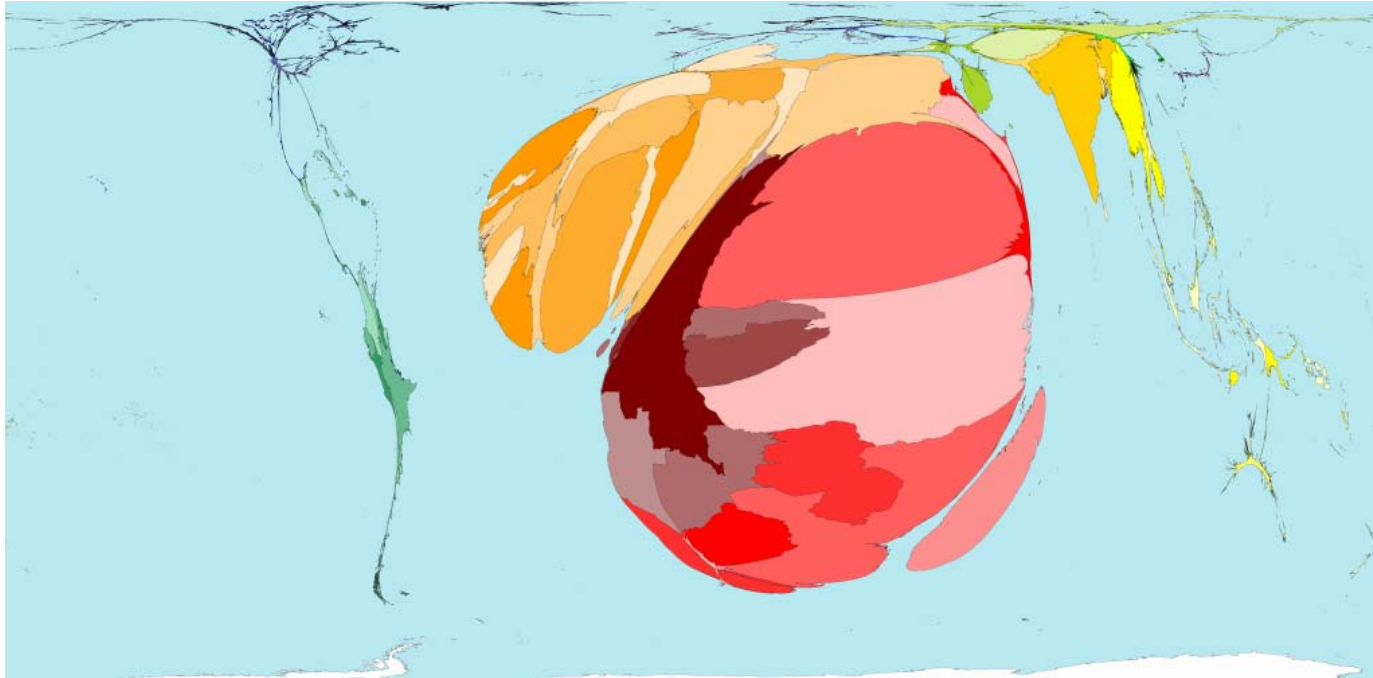
RISK PROFILE

HIV prevalence



RISK PROFILE

Malaria

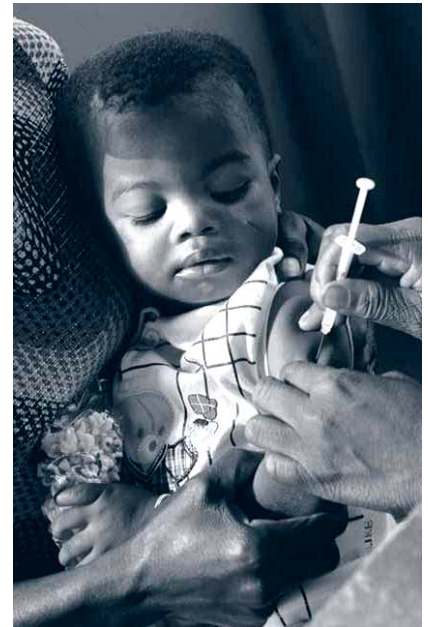


RISK PROFILE

Reducing risks important **primary prevention** strategy

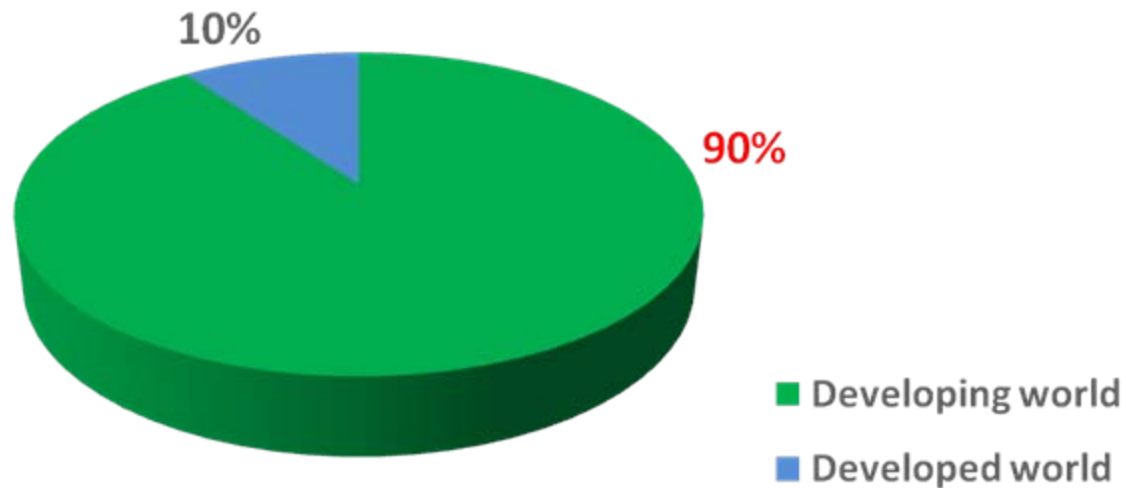
BUT... an upper limit of **50%** of cases will be prevented this way

Infant Hearing Screening – Important secondary prevention



STATUS OF EARLY IDENTIFICATION

Distribution of Infants with Hearing Loss



EARLY IDENTIFICATION?

- CA, 7 year 10 month old girl
- 1st diagnosis
- Profound bilateral sensorineural hearing loss

EARLY IDENTIFICATION?

- SM- 4 year 10 months old
- 1st Diagnosis with HL
- AN – no behavioral response to sound at 95 dB
- Parental suspicion? 3 years
- Thought child was “rude”

EARLY IDENTIFICATION?

- NZ, 6 years, 4 months of age
- First diagnosis
- Severe- bilateral SNHL
- No spoken language

EARLY IDENTIFICATION?

Nigeria (n=363) (*Olusanya et al. 2005*)

- **12%** suspected in 6 months; **4%** after 5 years
- Age of suspicion **12–24m**
- **18** month delay suspicion to confirmation
- **80%** no hearing aids provided
- **Only 6%** enrolled in school for deaf by **6 years**

EARLY IDENTIFICATION?

Kenya (n=122) *(Omondi et al. 2007)*

- First detection **5.5** years (mean age)
- **57%** detected after 2 years
- **27%** visited healthcare provider for assessment
- Only **9%** received counsel on HL
- None received a hearing aid



EARLY IDENTIFICATION?

South Africa *(Van der Spuy & Pottas, 2008; Venter & Viljoen, 2008)*

- Urban samples

	Western Cape	Gauteng
Ave age of diagnosis	23 months	31 months
Ave age of initial HA fitting	28 months	39 months
Ave age of enrollment into EI	31 months	43 months

STATUS OF EARLY IDENTIFICATION

- >90% of babies born with HL - no prospect of EI
- Detection primarily **passive**:
 - *Complications of OM*
 - *Speech & language delays*
 - *Unusual behavior*
- Exacerbate impact of HL - consigns to **seclusion, limited access & quality of life**



WAY FORWARD?

“Although the world is full of suffering, it is also full of the overcoming of it”

Helen Keller



WAY FORWARD?

CHALLENGES

- Shortage of Hearing Healthcare **Professionals**
- Limited **Audiological/Otological** Health Infrastructure
- **Awareness & Perceptions** – Public and Professional
- **Priority on Global and National Health Agendas**
- **Costs** within restricted resource environment
- **Contextual** challenges (*birthing patterns, cultural & environmental challenges*)

1 : 20000
VS
1 : 1000000



WAY FORWARD?

CONTEXTUAL SOLUTIONS

- **Contextually relevant** programs for developing countries
- **Immunization clinics***:
 - *effective for babies born outside hospitals*
 - *valuable platform for community-based UNHS*
 - *long-term performance comparable to hospital-based UNHS*
 - *risk factors can be addressed within primary healthcare settings*
- EHDI must be **integrated** in **Maternal & Child Health** initiatives - in line with **WHO, UNICEF, World Bank** priorities



WAY FORWARD?

COST EFFECTIVE SOLUTIONS

- **Cost effectiveness** of programs for developing countries
- Recent study from Nigeria*
- **UNHS** cost per child identified (PCEHL)
 - *Hospital-based: \$ 2 765*
 - *Community-based: \$ 602*
- **UNHS** more cost-effective than **TNHS**
- Initial evidence +



WAY FORWARD?

PRIORITIES

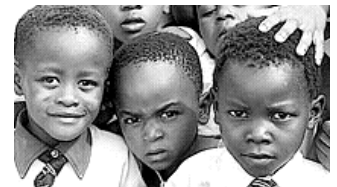
- Priority - **Global alliance** of professional groups and NGO/NPO's
- Reduce **costs** by global **partnerships** (private/public) through **economies of scale** (*Equipment, HA's, disposables, batteries*)
- **Pilot programmes** at various levels – different systems
- **Education** programmes for non-specialist personnel
- **Telemedicine, e-Health, m-Health** models – training, quality control, diagnosis and intervention



WAY FORWARD?

MORAL OBLIGATION

- Moral obligation **to extend benefits** of EHDI
- Narrowing avoidable **disparities** - important pressing imperative – Global attention to silent, invisible epidemic
- *“Better hearing for persons of ALL nations is an achievable, important goal” - Morton & Nance, 2006*
- Urgency for **most vulnerable**– infants and children with HL



A SOUND FOUNDATION - FOR **ALL** CHILDREN