New Mexico USA

Biomedical Engineering and Health Technology Management Training in Namibia: A Critical Need

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KIWI
BLACK

Bioengineering Definitions

- **Bioengineering: Applying engineering principles to biological systems - beer.**
- **Biomedical Engineering: Applying bioengineering principles to medical systems - design and devices.**
- **Biotechnology: Applying engineering and material science principles to cell/molecular biology - DNA.**
- **Clinical Engineering: Applying biomedical engineering to clinic/hospital arenas - hardware.**
- **Health Technology Management: Applying management principles to clinical engineering - optimize outcomes.**

WHY ARE WE IN THE PROFESSION?

- **To minimize morbidity and mortality**
- **To increase quality life-years, not just lives**
- **To FAIRLY distribute cost effective care and education**
- **To increase public wellness, social justice and fairness**

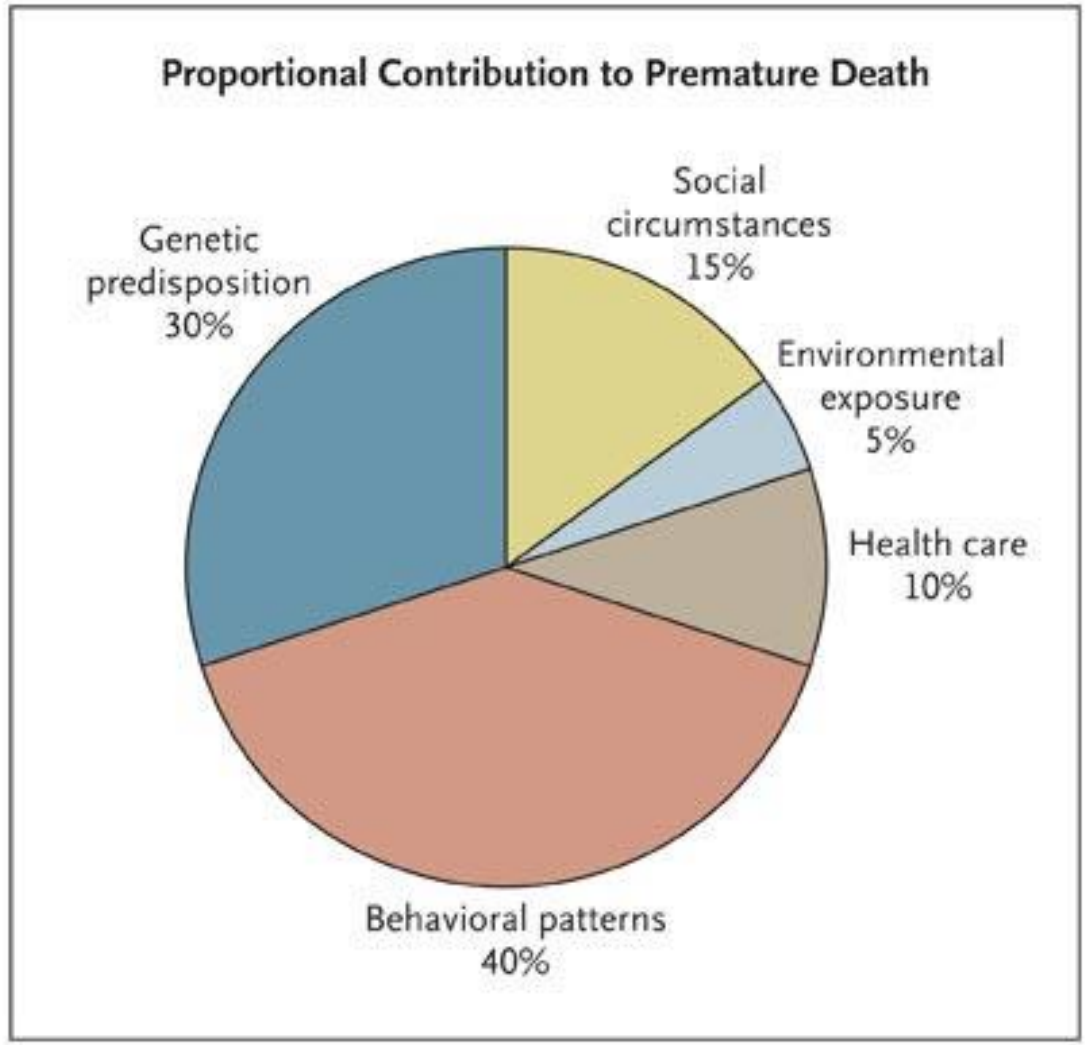
PLEASE REMEMBER

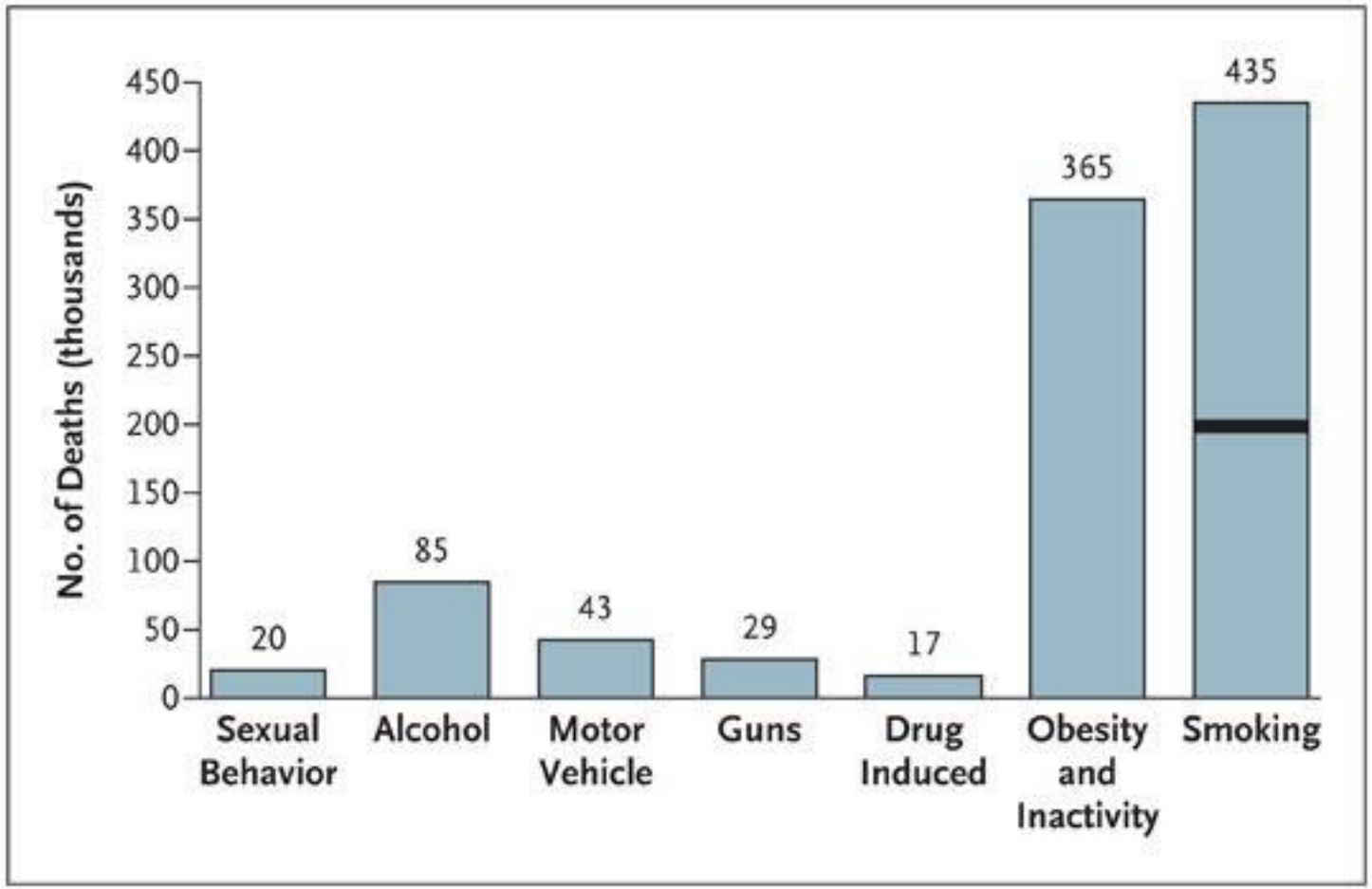
- **DIAGNOSTIC HEALTH CARE GUIDES, BUT NEVER DIRECTLY PREVENTS OR CURES DISEASES.**

- **PERSONAL CHOICES, EVIDENCE BASED THERAPIES AND VACCINES CAN.**

How you die or become disabled ?

It depends largely on your parents and where/how you live.


Proportional Contribution to Premature Death
Social circumstances 15%
Environmental exposure 5%
Health care 10%
Behavioral patterns 40%
Genetic predisposition 30%


No. of Deaths (thousands)
450
400
350
300
250
200
150
100
50
0
20
85
43
29
17
365
435
Sexual Behavior
Alcohol
Motor Vehicle
Guns
Drug Induced
Obesity and Inactivity
Smoking

Healthcare in Developed Countries: High cost for Low gain

Irrelevant in low resource developing countries:

Can be high gain for low cost

Current Reality and Paradox

- Worldwide morbidity and mortality (M&M) are caused equally by overconsumption as underconsumption
- With under consumption, largely infectious diseases
- With over consumption, largely chronic diseases
- With high M&M and poor education, birth rates go up
- With low M&M and good education, birth rates go down
- Strong evidence suggests that decreasing M&M, impowering women, and educating the masses will stabilize the earth’s population to sustainable levels.

Overview of Namibia

- German SW Africa -1800's- Lutherans
- South African – 1916- Apartheid
- Namibia – 1990
- Size ~2.4M (>94% native)
- Stable Democracy; literacy rate >90%
- GDP/capita ~ $10K
- High Gini Index 60- large inequities

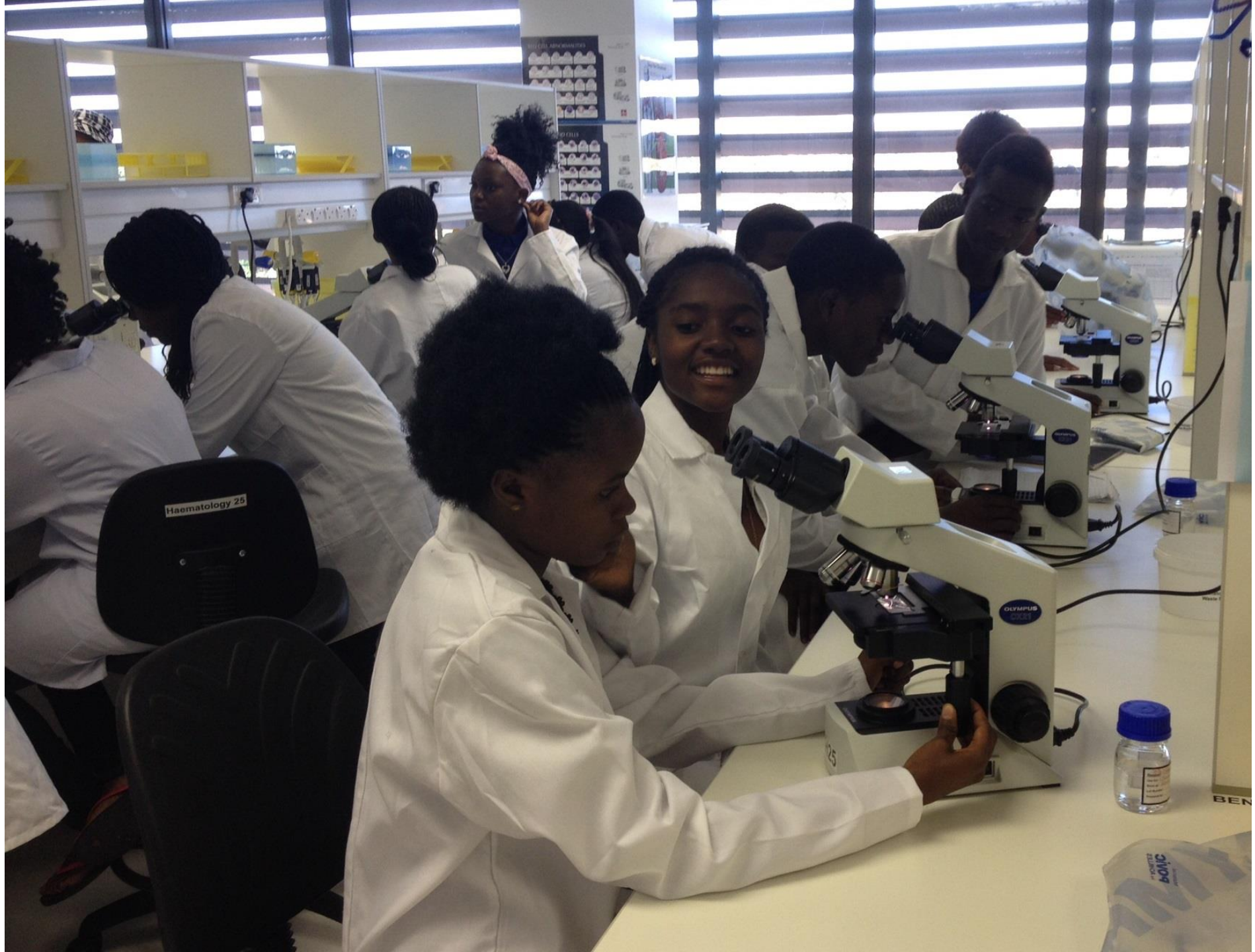
Healthcare in Namibia

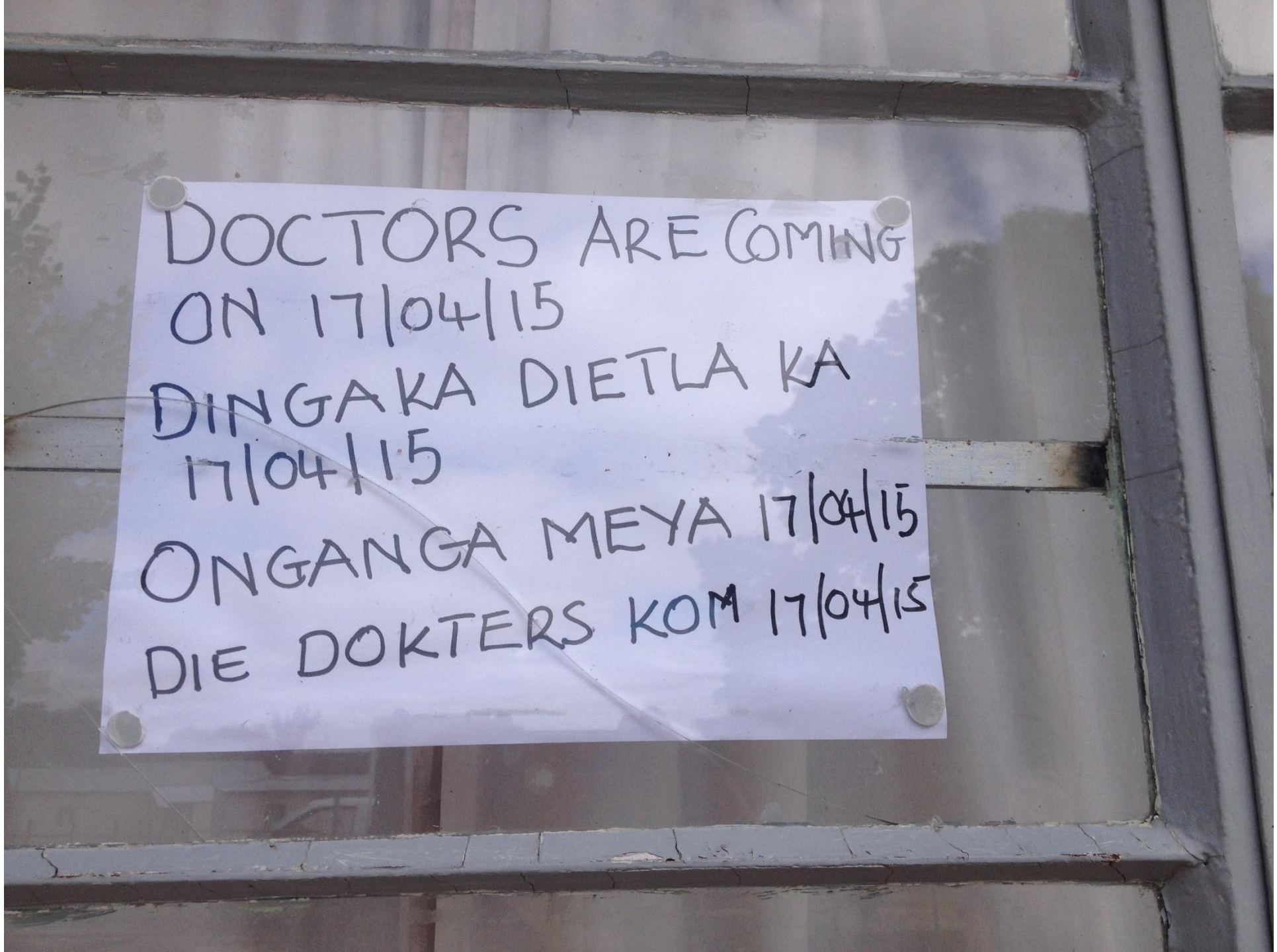
- Dual sector: public and private
- ~1000 private physicians/serve ~0.2M white
- ~200 public physicians/serve ~2.0M black
- Diseases of poverty: HIV, Malaria, TB, OB, Trauma
- ~220 POC clinics/14 regional/2 central hospitals
- ~1 doc/clinic/1day/month-minimal DX/RX -TRIAGE
- ~1 CT, 1 MRI, 2 US devices (central hospitals)
- ~15 medical equipment techs (mostly unfilled)

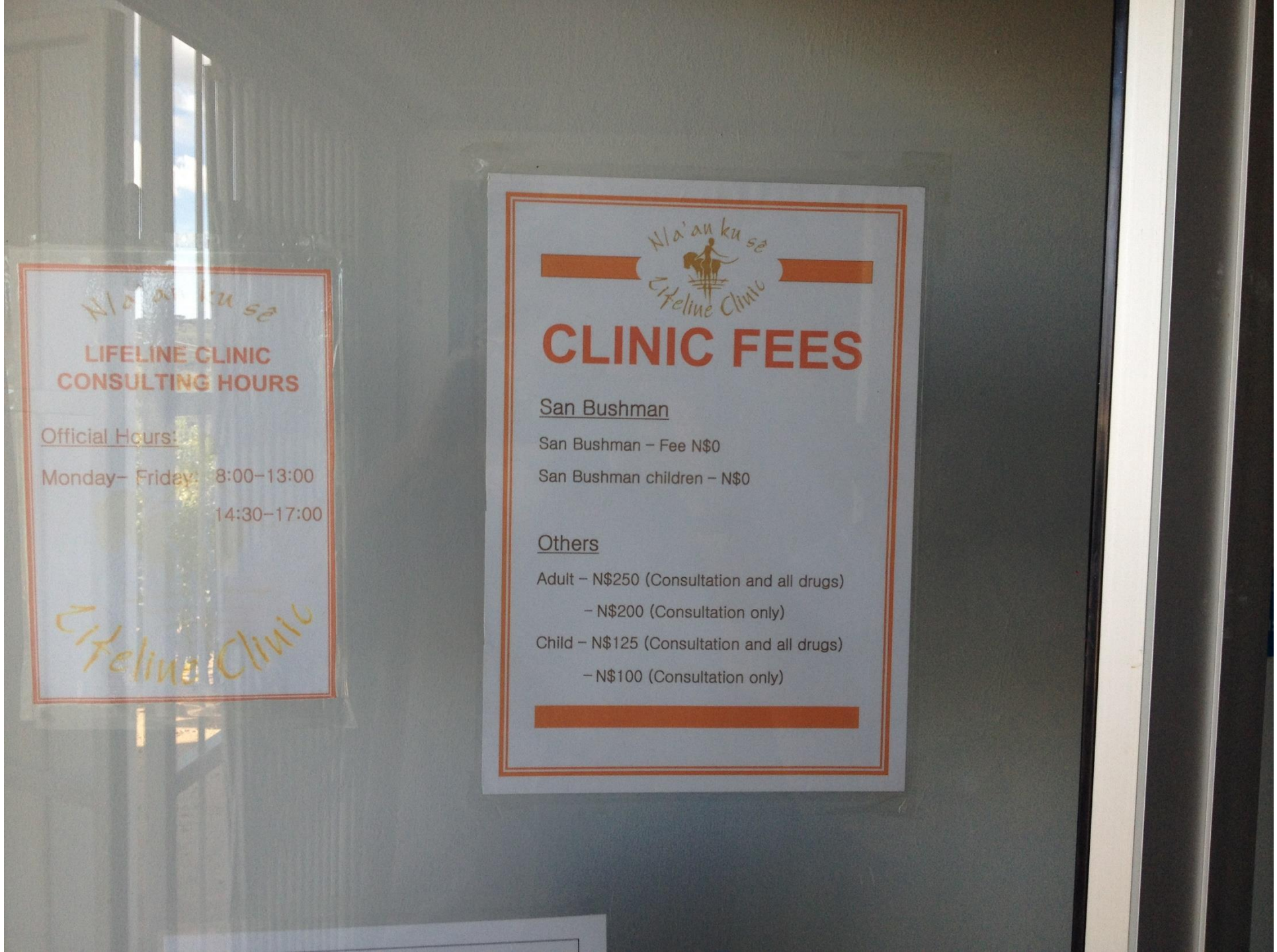
Healthcare Training in Namibia

- Historically in South Africa, Russia, etc.
- Many doctors from other African nations
- University of Namibia School of Medicine 2010
- First graduates December 2015 (n=44)
- Many assigned to district hospitals
- Initial Q/C suggests solid performance
- Medical equipment severely limited/unmanaged
- Great demand for Clinical Engineers and Health Technology Management


UNIVERSITY OF NAMIBIA
SCHOOL OF
MEDICINE
In Pursuit of Health for All


Haematology 25
OLYMPUS


DOCTORS ARE COMING
ON 17/04/15
DINGAKA DIETLA KA
17/04/15
ONGANGA MEYA 17/04/15
DIE DOKTERS KOM 17/04/15


N!a'an ku se
LIFELINE CLINIC
CONSULTING HOURS
Official Hours:
Monday– Friday: 8:00–13:00
14:30–17:00
N!a'an ku se
Lifeline Clinic
CLINIC FEES
San Bushman
San Bushman – Fee N$0
San Bushman children – N$0
Others
Adult – N$250 (Consultation and all drugs)
– N$200 (Consultation only)
Child – N$125 (Consultation and all drugs)
– N$100 (Consultation only)

Engineering in Namibia

- Historically trained in South Africa- difficult
- Minimal native students
- Highest level at B Tech at Polytechnic of Namibia
- First BS in ME, EE, and Mining entered 2009 (n~500)
- > 95% on government loans
- Graduated 2014 (n~50), mostly employed (mines)
- PON/NUST selective, quota driven, and accredited
- No BME or Clinical Engineering training in Namibia

Request from MOHSS 2014

- **Official letter from Andrew Ndishishi, Permanent Secretary of MOHSS to PON/NUST Rector Tjama Tjvikua 25Nov2014**
- **Subject: “Request for clinical engineering training”**
- **“The greatest challenge MOHSS is facing is the lack of Biomedical and Clinical Engineers and Engineering Technicians for the general management, maintenance, and repairs of medical equipment throughout the country”**

Request continued:

“Establish a training program for Clinical Engineers and Engineering Technicians as long term solution to this challenge”

Unsuccessful/Unfunded BME and HTM Attempt 2014-15

- 15 Namibian PON/NUST BSME and BSEE graduates to be contracted
- 6 months classroom and hospital training in SA
- Post Graduate Diploma in Healthcare Technology Management from University of Cape Town, BME
- To be assigned to national and district hospitals

POCUS Diagnostic Imaging 2015-2022 Modestly Successful/Ongoing

- Completed on site diagnostic imaging needs assessment at 2 central and 14 regional hospitals (16 data points)
- Completed similar sample of 5 point of care rural clinics within each of the 14 districts (70 data points)
- Determined that POCUS will provide ~80% of imaging requirements for optimal triage and treatment
- Highest need in OB, infectious diseases, and trauma. Specially lung damage with TB and now C19

New BME/HTM Proposal in Namibia

- **Train and deploy 30 BSME and BSEE Engineers with BME and HTM training by 2026.**

- **Deploy (with training) handheld, robust, low wattage, multiuse, and inexpensive point of care, smart phone based, ultrasound devices (POCUS) to all public clinics (~220)**

Approach: Requires 1 faculty Starting Semester 1, 2023

- **New BME/HTM "Concentration" within BSME and BSEE degrees. Similar to those in USA, Europe, etc.**

<u>Four Required Courses and Senior Project</u>

1. Human Anatomy, Physiology, and Pathophysiology for Engineers (BME)

2. Biomechanics and Biosensors (BME)

3. Clinical Instrumentation (Clinical Engineering)

4. Health Technology Management (HMT)

POCUS Equipment Acquisition

Ongoing

- GE, HP, and Butterfly
- Donations and loaned equipment
- Grants (Gates, WHO, UNICEF, etc)
- Annual budget within MHOSS of Namibia
- Collaboration with Rice University Center of Biomedical Engineering
- Rice 360 Degrees: Institute for Global Health, Dr Rebecca Richards- Kortum (see Ted Talk)


Silly Faces

POCUS: Imaging “smart phone stethoscope” ~$1K USD

POCUS replaces these $100K USD unused imaging machines

Technological Challenges Outlined in 2017/18 - 2021/22 MOHSS 5 Year Strategic Plan: Challenge Remains

- **“Unreliable and outdated technology.”**
- **“Lack of required technology and equipment.”**
- **“Technological skill deficit”**
- **“Poor maintenance”**
- **“Poor/absence of network coverage in remote areas”**

High Country 3000M