

Investing in Data for Alzheimer's Disease in LMICs

Sam Clark

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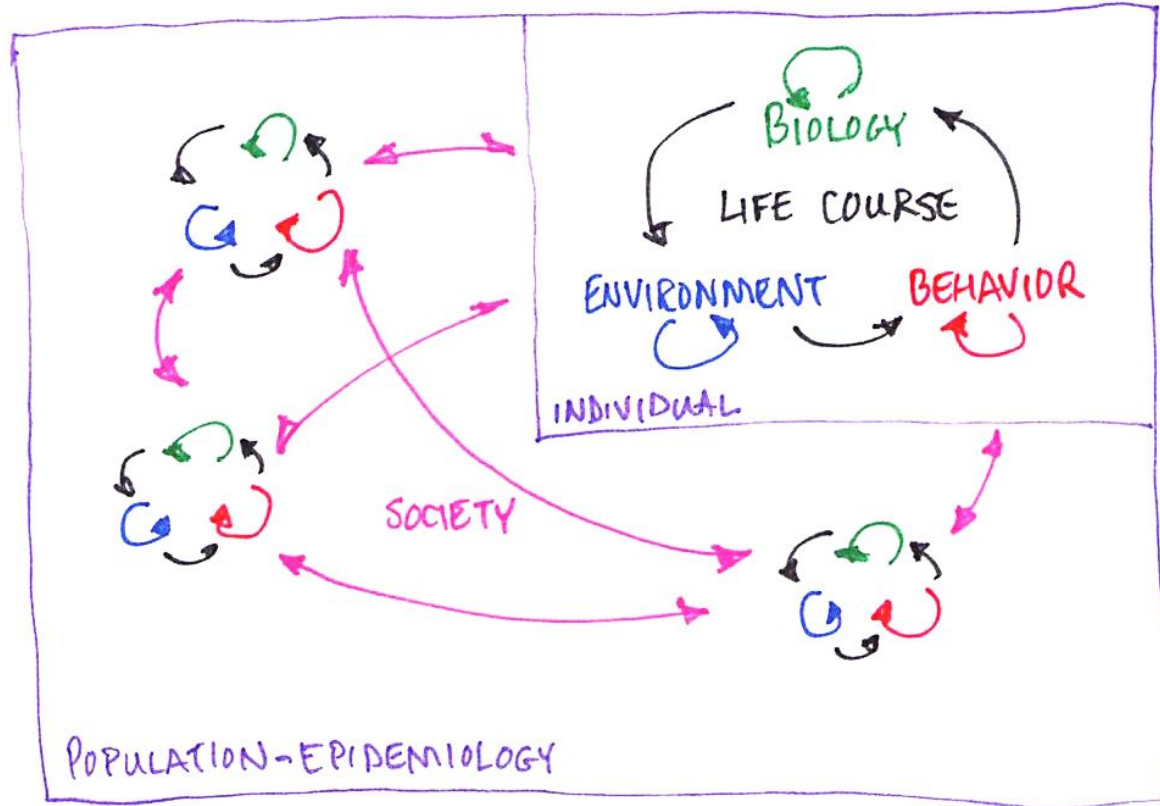
Critical global health

- High-income country – Low-income country relationship reflects long, complicated history of colonialism, slavery, exploitation, etc.
- Work involving HIC and LMIC scientists should acknowledge this and strive to improve things
- Lots of work being done on this set of issues, e.g.
 - [When People Come First](#)
 - [Critical Epidemiology and the People's Health](#)
 - [Epidemiological accountability: philanthropists, global health and the audit of saving lives](#)
 - [Time to take critical race theory seriously: moving beyond a colour-blind gender lens in global health](#)
 - [Decolonizing global health: what should be the target of this movement and where does it lead us?](#)

My perspective

- Training: biology, engineering, and demography
- About 20 years working closely with health and demographic surveillance systems in Africa, mostly on data and system design
- About 10 years working with team to update and redesign population estimation and forecasting methods for UN Population Division
- Created group to improve global estimation of U5MR using existing survey data ⇒ led to UNICEF's current method for small-area, longitudinal estimates
- Verbal autopsy to estimate the population *burden of disease*
 - Global standards via WHO - [VARG](#)
 - Automated methods - [InSilicoVA](#)
 - Robust, generally usable software - [openVA](#)
 - Verbal autopsy and minimally-invasive tissue sampling
 - Reference Death Archive

Alzheimer's (and many other) Disease - complicated



Biology

- **Objective:** *biological mechanisms*
- **Level:** molecules, individual humans, and population genetics
- **Cause/effect** established through experiments
 - Few human experiments; mostly cell lines or animal models
- Genetics - important alleles of apolipoprotein E (*APOE*) gene that confer significant risk
- Largely generalizable and transferable, i.e. all humans have very similar biology, with nuances
- Often effectively deterministic
- *Biology interacts with behavior and the environment over the lifecourse to create individual disease outcomes*

Behavior

- **Objective:** *behavioral effects +/- on risk of disease, disease progression, and disease outcomes*
- **Level:** individual humans, and groups of humans
- **Cause/effect** established through observational studies and various forms of randomized study
- *Sometimes* generalizable and transferable, i.e. in some circumstances humans share behavior, but in many there are nuanced differences
- Measurement affected by circumstances and quality of human interactions, e.g. interviews, participant observation, etc.
- *Behavior interacts with biology and the environment over the lifecourse to create individual disease outcomes*

Environment

- **Objective:** *describe physical environment and its effects on disease dynamics and individual disease outcomes*
- **Level:** physical environment experienced by individual humans and populations of humans
- **Cause/effect** established through combination of observational studies and experiments, both intentional and accidental
- Generalizability depends on exact nature of environmental factor, e.g. biology-level or socio-cultural
- Measurement both deterministic/precise and statistical (estimates, distributions, uncertainty/confidence)

Population - epidemiology

- **Objective:** *population-level description of burden of disease, disease dynamics, and cause/effect*
- **Level:** well-defined (large-ish) populations of human beings
- **Cause/effect** established through observational and various forms of randomized study
- Essential measures:
 - Burden of disease
 - Disease dynamics: incidence, prevalence
- Identify and rank important health challenges
- Describe/infer how many, where, when, and who at various levels of granularity (disaggregation)
- Usually population/circumstance-specific and often difficult to completely generalize
- Most often statistical, i.e. estimates of distributions, uncertainty/confidence

Society - behavior sciences

- **Objective:** *group-level behavioral effects on burden of disease, disease dynamics, individual disease progression, and individual disease outcomes*
- **Level:** *connections* between individual humans, groups of humans
- **Cause/effect** established through *observational* studies and various forms of randomized study
- *Maybe* generalizable and transferable, but often context-specific
- Measurement affected by circumstances and quality of human interactions, e.g. interviews, participant observation, etc.
- How to individual humans affect each other's behavior?
- Effects of social institutions on disease processes, e.g. *government interventions*

Where are we now in LMICs?

Biology

- Biology is essentially universal
- We can largely borrow what we know from HIC settings
- *However*, need to replicate and check key findings in LMIC populations and ensure that original work included all types of people, e.g. both sexes
- **Need:** biomarkers, biobanks, labs, animal models, cell lines, etc.

Behavior

- Lots of work still necessary in HICs
- Because behavior is circumstantial/cultural, behavioral results are not necessarily generalizable or transferable
- Behavioral studies must be done in LMIC settings, accounting for the socio-cultural, contextual circumstances of LMICs
- Cultures and languages must be handled carefully; western medical concepts cannot be directly transferred to many LMIC contexts
- There's **a lot** to do

Environment

- Most environments in LMICs have not been described or investigated with respect to Alzheimer's or other diseases of aging
- This is particularly true for people who live in rural communities or informal urban areas - i.e. a great many people
- **Need:** to initiate this work in most areas
- Much to do!

Epidemiology

- Some work done on people who live in urban areas and are accessible
- Very little done in rural areas or informal settlements
- Population burden of cognitive disorders of aging not directly measured in most LMICs
- Only direct measurements for special populations
- **Need:**
 - Describe basic burden of disease
 - Increase coverage to whole populations
 - Create measurement systems with ability to operate at fine(r) levels of granularity - subpopulations, disaggregation
 - Longitudinal surveillance
 - Routine, population-scale, continuous monitoring

Society

- Variety of work done at this level
 - General assessments based on fragmentary and flawed data
 - Intervention design and testing/monitoring
 - Monitoring of accessible subpopulations, mainly in context of research
- **Need:**
 - Research to define what to focus on here?
 - Do HIC concepts translate to LMICs?
 - I'm not sure!

Ideas for how to proceed

- Agree on what we want to do
 - Research (only?)
 - Create improvements in Alzheimer's and other cognitive disorders: *improve exactly what, for who exactly, where, and when?*
- General framework
 - What do we want to change - who, what, where, when ?
 - Measure current status
 - Understand drivers, causes, etc.
 - Intervene
 - Measure effects of interventions
 - Iterate
- Are we interested in any of the rest, apart from cause and effect ?

Ideas for how to proceed

- To improve and increase research in LMICs
 - **TRAINING**
 - **Decolonize global health** → will lead more context relevant research with better chance of driving change
 - **Public funding**, 'open-access' funding for researcher-initiated projects, prioritize mutual partnerships between HIC and LMIC scientists, and LMIC scientists in general
 - **Avoid foundation-driven work** that narrowly adheres to foundation's view of what to do → help foundations move to more open-access, researcher-initiated approaches
- **New data, methods, approaches** adapted to LMIC settings

Training

- **Survey, trial, and research design**
- Electronic data capture
- Data management
- Data ethics
- **Bayesian statistics**
- Machine learning
- General (frequentist) statistics
- Emphasize **sampling design, generalizability**
- **Longitudinal** research design, data management, analysis, etc.
- *General programming*, not just stats packages

Training

- Socio-cultural systems and language - **human interaction**
 - Interviewer effects
 - Interview design
- **Translation** - policy, implementation, sustainability
- Conduct training in LMICs as much as possible
- Utilize existing field sites/stations/laboratories to build in apprenticeships
- Aim for wider cross-field training, at least including
 - Biology
 - Behavior
 - Methods
 - Culture/Society

Data & Methods

- Whole population and subgroup burden of disease
- Build basic surveillance into routine administrative systems
 - Civil registration and vital statistics
 - Regularly occurring, standard surveys that represent whole population and important subgroups
- Lots of data already exist, use them, invent new ways of using them!
 - Example is new [small-area methods](#) for traditional DHS surveys → [UNICEF U5MR estimates](#)
- Explore use of unanchored data streams (aka 'big data')
 - Develop approaches to calibrate or ground truth
 - Potentially very valuable longitudinal monitoring, possibly very cheap too
- Build on health and demographic surveillance systems
 - Hawthorne effect
- Build and strengthen vital statistics

Data & Methods

- Build and maintain high performance computing centers
- Incorporate traditional healers to develop effective interventions
- ***Design and build hybrid vital statistics + survey + health and demographic surveillance longitudinal monitoring systems***
 - Potentially much more efficient and accurate
 - See [Hyak](#) for a start on this idea
 - Potential for routine monitoring at all important levels/aspects of the Alzheimer's/cognitive disease system: individual, group of individuals, biology, behavior, environment, whole population, etc.
- ***New, creative methodological thinking that goes beyond traditional statistics and data sources: requires cross-trained individuals and interdisciplinary teams***

Interesting initiatives/organizations - Africa

- [African population cohort consortium](#)
- [DS-I Africa](#)
- [APHRC](#), Kenya and Senegal
- [AHRI](#), South Africa
- [Regional Institute for Population Studies \(RIPS\)](#), Ghana
- Many more!

End