Introduction to LiST

<Location>
<Date>
Background and history
Learning Objectives

- Understand methods, assumptions, and sources of data used in LiST to calculate impact of scaling up interventions
- Recognize the strengths and limitations of LiST
- Explore potential uses of LiST
LiST: A multi-cause model of mortality

- Uses inputs
  - Baseline description of health status of a country
  - Effectiveness of interventions
  - Changes in the coverage of proven MNCH interventions

- Projects outputs or impact
  - Lives saved
  - Number of deaths
  - Mortality rates
LiST objectives and goals

- **Objective**
  - Estimate lives saved when introducing or scaling up MNCH interventions

- **Goals**
  - Promote evidence-based decision making
  - Aid in planning or prioritization of scale-up of MNCH interventions
LiST background and history

To estimate impact of scaling up community-based interventions on child survival

- Facility-based interventions
- Neonatal mortality as an outcome
- Risk factors

Incorporated into Spectrum, available in the public domain

- New outcomes
  - Birth outcomes and stillbirths
  - Maternal mortality
  - Pneumonia, diarrhea, and meningitis morbidity

- Subnational level modeling
- Sensitivity and uncertainty around outputs
- Costing

- Adolescent mortality as an outcome
- Utilization and service availability / quality of interventions

2003
How LiST can be used

**Prospective analysis**
- Strategic planning
- Projecting lives saved

**Retrospective analysis**
- Program/project evaluation
- Attribution of lives saved to interventions

**Advocacy**
- Global, national, or subnational level
Who has used LiST?

International donors
- Bill & Melinda Gates Foundation
- Children's Investment Fund Foundation

International organizations
- Gavi: The Vaccine Alliance
- World Health Organization
- UNICEF
- PAHO-WHO
- World Bank

NGOs
- Save the Children
- MSH
- Jhpiego

Development and aid agencies
- Canada
- USAID

Country governments
- DRC
- Malawi
- Mali
- Nigeria
- India
- Peru
- Mozambique
- Tanzania

Academic institutions
- Johns Hopkins Bloomberg School of Public Health

How is impact calculated in LiST?
Basic modeling structure of LiST

- Linear
  - Fixed relationships between inputs and outputs

- Mathematical
  - Assumes casual pathways of interventions reducing cause-specific mortality via reducing risk factors are correctly defined

- Deterministic
  - Tool will produce the same outputs each time the model is run with identical inputs.

- Population, not individuals

- Age cohorts

How is impact calculated in LiST?

Cause-specific mortality \times Intervention coverage change \times Affected fraction \times Effectiveness = Lives saved
Cause-specific mortality \times \text{Intervention coverage change} \times \text{Affected fraction \times Effectiveness} = \text{Lives saved}
Cause-specific mortality and data sources

- Cause-specific mortality = births x mortality rates x % deaths due to causes
  - Neonates <1 months
  - Children 1-59 months
  - Women 15-49 years
  - Stillbirths
- Mortality rates
  - UN Inter-agency Group for Child Mortality Estimation (IGME)
- Causes of death
  - WHO Maternal and Child Epidemiology Estimation (MCEE)
Cause-specific mortality \times \text{Intervention coverage change} \times \text{Affected fraction x Effectiveness} = \text{Lives saved}
What is coverage?

\[
\frac{\text{numerator}}{\text{denominator}} = \frac{\text{All who received intervention}}{\text{All who needed intervention}}
\]
Which interventions are in LiST?

**Proximate interventions**
Distal variables improves coverage of proximate interventions

**Feasible in low income countries**
±80 countries with the highest MNC mortality

**Work through health programs**
Both community and facility-based

**Cause-specific evidence of effect**
Systematic reviews, meta-analyses, RCTs, Delphi method
Updated frequently
How are interventions organized in LiST?

Periconceptual → Pregnancy → Childbirth → Breastfeeding → Preventive → Vaccines → Curative
LiST impact model

http://listvisualizer.org/
Intervention coverage data sources

- Most MNCH interventions
  - Demographic and Health Surveys (DHS)
  - Multiple Indicator Cluster Survey (MICS)
- Water and sanitation
  - WHO-UNICEF Joint Monitoring Program
- Vaccines
  - WHO-UNICEF Joint Reporting Process
- User-entered data
Cause-specific mortality $\times$ Intervention coverage change $\times$ Affected fraction x Effectiveness = Lives saved
Affected fraction of an intervention

Proportion of cause-specific deaths that CAN be averted by a specific intervention

For example:

Diarrhea deaths by pathogens

Of all deaths due to diarrhea, 20% are due to pathogen A (Rotavirus). The rotavirus vaccine, which can only avert rotavirus diarrhea deaths, has an affected fraction of 20%
Effectiveness of an intervention

Proportion of pathogen-specific, cause-specific deaths that are averted by a given intervention

Total rotavirus diarrhea deaths

Rotavirus vaccine effectiveness 50%

Note: the effectiveness presented is for each intervention individually
Affected fraction x effectiveness

Rotavirus vaccine

- Affected fraction = 20%
- Effectiveness = 50%

Of 10 children with diarrhea deaths, 2 are due to rotavirus diarrhea

If all 10 children with diarrhea deaths are vaccinated with rotavirus vaccine, **1 life** will be saved by the vaccine
Effectiveness data sources

- Systematic reviews, meta-analyses, Delphi method, randomized control trials
- Global and regional
- Published in 5 supplements
  - IJE April 2010
  - BMC Public Health 2011
  - BMC Public Health 2013
  - Journal of Nutrition 2017
  - BMC Public Health 2017
Cause-specific mortality $\times$ Intervention coverage change $\times$ Affected fraction $\times$ Effectiveness = Impact e.g. Lives saved
Results available in LiST

**Lives saved**
- Total
- By cause
- By intervention
- By age group

**Number of death**
- Total
- By cause
- By intervention
- By age group

**Risk factors**
- Stunting
- Wasting
- Birth outcomes

**Mortality rates**
- Neonatal mortality rate
- Under 5 mortality rate
- Maternal mortality rate or ratio
- Stillbirth rate

**Visualize by:**
- Tables, graphs, pie charts
- Single/multiple countries
- Single/multiple scenarios
How does Spectrum work?

- Essentially a demographic projection (Demproj)
- Normally, demographic projections use trends in mortality and fertility to project population growth and structure

- However, within Spectrum, three modules alter this relationship:
  - AIM, for impact of interventions on HIV/AIDS mortality
  - FamPlan, for impact of family planning on fertility
  - LiST, for impact of interventions on maternal and child mortality
How other modules relate to LiST

- **Demproj** – underlying population and births
  - Gives LiST population size and births

- **AIM** – scale up HIV treatment
  - Gives LiST child deaths due to HIV/AIDS

- **Famplan** – scale up family planning
  - Change fertility trend and births in Demproj →
    - Change number of deaths in LiST
    - Change distribution of birth by risk categories → change birth outcomes
    - Change abortion incidence → change maternal deaths due to abortion
How to run a LiST analysis

- Basic approach in LiST is to establish a baseline projection of a country or region. This includes:
  - Demography: population structure, fertility, contraceptive prevalence
  - Mortality rates
  - Cause of death structure
  - Current levels of risk factors and exposure
  - Current level of coverage of interventions
How to run a LiST analysis

- Scale up coverage of interventions
- Re-computes all inputs
- Compare to a counterfactual
  - Default: no coverage scale up
- Outputs include all of the inputs from baseline
How are lives saved calculated?
How are lives saved calculated?

- **Single intervention**
  - Lives saved = (Cause-specific deaths) * (Change in coverage) * (Intervention effectiveness * affected fraction)

- **Two or more interventions**
  - Process prevention first, then curative
  - Interventions impacting same cause of death:
    - Total lives saved: process interventions in any order, but impact only on deaths not averted by previously applied interventions
    - Total lives saved by interventions (attribution): process each intervention by itself, then normalize intervention impacts to sum to total from step 2
Modeling approach: single intervention

Intervention A
(preventive)

Baseline # of diarrhea deaths = 10,000

Intervention A is introduced, reaches coverage of 50%

Effectiveness of the intervention in reducing diarrhea mortality = 10%

Mortality impact = 10,000 x 0.50 x 0.10 = 500 diarrhea lives saved
Modeling approach: two interventions

Intervention A (preventive)
- 10,000
- 50%
- 10%
- 500

Intervention B (preventive)
- New baseline # of diarrhea deaths = 10,000 - 500 = 9,500
- Intervention B is introduced, reaches coverage of 20%
- Effectiveness of the intervention in reducing diarrhea mortality = 50%
- Mortality impact = 9,500 * 0.20 * 0.50 = 950 diarrhea lives saved
Modeling approach: two interventions

Intervention A (preventive)  ∆  Intervention B (preventive)

Intervention A first, B second
- 10,000 × 50% × 10% = 500
- 9,500 × 20% × 50% = 950
Total = 1,450

Intervention B first, A second
- 10,000 × 20% × 50% = 1,000
- 9,000 × 50% × 10% = 450
Total = 1,450
The same approach is used to calculate the proportion of impact attributable to B.
Modeling approach: two interventions

Intervention A (preventive)  Interventions B (preventive)

Impact A

Proportion of impact attributable to A

Total impact

50%  1  10%

0.05

0.05 + 0.10

50%  1  10%

20%  1  50%

33%
Modeling approach: two interventions

Intervention A (preventive)

Intervention B (preventive)

Proportion of impact attributable to A: 33%

Proportion of impact attributable to B: 67%

Number of lives saved attributable to A: 1,450 \times 33\% = 483

Number of lives saved attributable to B: 1,450 \times 67\% = 967
Modeling approach: two interventions

Intervention A (preventive)
Intervention B (preventive)
Intervention C (curative)

For interventions at a different stage along the continuum of care, order does matter. Impact is calculated on residual deaths only.
LiST limitations

- Data availability
- Data quality
- Sensible coverage scale-up targets
  - Feasible
  - Acceptable
  - Cost
- Interventions not included in LiST
  - Some interventions not included because not enough data available to support including them
  - Interventions that are feasible in LMICs
LiST can NOT be used for:

**As the final answer**
Outputs are only as good as inputs
Also must consider cost, feasibility, acceptability

**To decide HOW to do anything**
For program implementers to decide
Context MUST be considered
Advantages of LiST

- Ability to look at multiple interventions’ impact on multiple disease causes
- Evidence-based
- Validated
- Published
- Regularly updated and maintained
- Free and available in the public domain
Advantages of LiST

- Default data sources are all high quality data
- Highly flexible tool
  - Accommodates user-entered data
  - Accommodates user-created interventions
- Quickly identify intervention impact pathways using http://listvisualizer.org/
- Visualize the highest impact using the missed opportunities
- Can tailor the tool to look at the impact of:
  - One single intervention
  - A package of interventions
  - Multiple countries at once
Additional features of LiST

- Subnational Wizard*
- Missed Opportunity Tool*
- Equity Tool*
- LiST Costing*
- Uncertainty Analysis

*recorded webinar available on LiST website