

IUSSP/MPIDR Workshop on Mortality Monitoring  
in the Era of the SDGs

Supported by the Hewlett Foundation, IUSSP, and MPIDR

December 11-13, 2018  
MPIDR, Rostock, Germany

# 1 Workshop Report

The primary aim of this workshop was to create a space for creative discussion that will lead to a focused set of recommendations for future work to improve mortality monitoring in the framework of the SDGs, specifically SDG 3: Ensure healthy lives and promote well-being for all at all ages. Emerging mortality and cause of death measurement methodologies, especially for subpopulations and small-areas, need to be reviewed, refined and shared more broadly across the international research community. Assessing the state of global mortality monitoring, developing, ranking, and articulating a small set of focused, high priority, feasible initiatives to transform mortality monitoring in the context of the SDGs and ongoing efforts to strengthen CRVS systems, and then devise a plan for how to proceed in their implementation were the goals of the workshop.

Three main topics of the workshop were:

1. Coverage, Granularity/Disaggregation, and Timeliness,
2. Uncertainty, Aggregation, Interpolation, and Communication of Derived Values, and
3. Models: Statistical and Traditional Demographic Models.

Starting with an Overview Introduction of the meeting's goals and agenda from Sam Clark (IUSSP), followed by Welcoming remarks by Emilio Zagheni (MPIDR), a total of 18 participants actively engaged in discussions over 16 different presentations.

## 1.1 UNFPA, UNICEF, and Bill & Melinda Gates Foundation

**UNFPA Perspective** *Romesh Silva, UNFPA*

- In order to achieve SDG goals, timely and reliable country data, better estimation methods, and capacity building programs are essential.
- Creating grand challenges or competitions, capacity building programs and software, and partnerships can be directions going forward to make progress.

**SDG Monitoring and Reporting on Child Mortality Targets: Challenges and Opportunities at Global, Regional and Country Level** *Lucia Hug, UNICEF*

- UN IGME's (UN Inter-agency Group for Child Mortality Estimation) data sources, models, and challenges were introduced
- Country missions and regional workshops are examples of capacity building activities and continuous engagement with countries are important.

**Mortality Monitoring: CHAMPS and COMSA** *Kathryn Banke, Bill & Melinda Gates Foundation*

- Primary goal of CHAMPS and COMSA are to get better primary data, for countrywide integrations, and to improve global modeling for decision making.
- U5MR is the main area of focus.

## 1.2 Coverage, Granularity/Disaggregation, and Timeliness

### Current Developments in Vital Rate Estimation From Standard Demographic Data

*Carl Schmertmann*

- “State of the art” for estimation of vital rates are mostly probabilistic, granular, eclectic and deal with prior distributions.
- Example 1: Small-area mortality in Brazil using TOPALS
- Example 2: TFR from Age Pyramid
- Example 3: Bayes + Indirect Brass Method for Child Mortality

### Spatial Risk Modeling for Infectious Disease Surveillance Using Population Movement Data and Brass in the Computer Age

*Renato Assuncao*

- Using Twitter data for modeling spatial risk of an infectious disease
- Introduction of Bayesian space varying parameter models

### Recent and Near-Future Developments in Mortality Modeling in the Context of SDGs

*Monica Alexander*

- Using Bayesian models to track progress of mortality in the context of SDGs
- Though MCMC can take long and it may be hard to understand, the Bayesian model is flexible, treats data errors well, and can be ran with little or no data.

### Using Network Reports to Estimate Death Rates

*Dennis Feehan*

- Measuring adult mortality using a scale-up method of the ‘meal network’
- Frequent surveys (phones) combined with high quality data collection to adjust for parameters can be useful moving forward.

## 1.3 Uncertainty, Aggregation, Interpolation, and Communication of Derived Values

### Which Countries Can Expect to Meet the SDG Under-5 Mortality Goals?

*Roland Rau*

- Tracking and evaluating the countries that will meet the SDG goals in time using the “equivalent time” measurement.
- Simple number outputs can be effective for communicating with policy makers

### Towards Better Understanding of Cause of Death Assignment Using Verbal Autopsies

*Richard (Zehang) Li*

- Introduction of Verbal Autopsy and its algorithms
- There is still room for method development, for more data collection, and for efforts in broader collaborations.

### **Verbal Autopsy in CRVS: The OpenVA Pipeline** *Samuel Clark*

- Introduction of the OpenVA pipeline, where fully automated assessment of cause of deaths are possible
- Preparing materials accordingly for the audience and developing new ways of communicating to the policy makers is important.
- Moving forward, real time data collection and analysis in real time is important.

### **Challenges Assessing Levels and Trends of Health Indicators in Nigeria** *Laina Mercer*

- Some of the challenges in Nigeria are in big fluctuations in national coverage and uncertainty in weights and distributions in the data.
- More transparency in the data, integrating analysis into existing pipelines, generating sub-national population projections are potential ways of overcoming the challenges.

## **1.4 Models: Statistical and Traditional Demographic Models**

### **The Human Mortality Database: Challenges and Opportunities** *Dmitri Jdanov & Domantas Jasilionis*

- How can high-quality data compete with “quick” data solutions
- Extending the HMD approach in developing countries by extrapolating highly accurate data and methods with problematic population statistics to fill data and knowledge gaps.

### **Challenges in Determining Aggregate Mortality Indicators** *Trifon Missov*

- Modeling and statistical strategies to handle irregularities in high-quality data.
- These smoothing corrections provide new values of mortality measures in several countries and regions.

### **Beyond $e_0$ - Assessing the Value of Other Mortality Indicators From the Age-At-Death Distribution** *Alyson van Raalte*

- Monitoring lifespan variability (inequality) and the modal age at death
- Lifespan variation and life expectancy are highly correlated and lifespan variation could be seen as an indicator sensitive to premature mortality.

### **Space-Time Modeling of Mortality Data in a Low- and Medium-Income Countries Context** *Jon Wakefield*

- Introduction and overview of space-time modeling, temporal models, spatial modeling, space-time interactions, covariate modeling and the Brass method

### **DemoTools: Ease the WPP Work Flow** *Tim Riffe*

- Introduction of the R package DemoTools

- DemoTools is a tool that can be utilized by demographers to deal with evaluating, adjusting, and standardizing life tables.
- Provides a tool that makes reproducible research possible

## 1.5 Overview

On the last day of the workshop, there was an extended discussion on topics regarding the following topics:

### **Data Quality and bias**

- There are plenty of methods and models, but the problem is in the data
- Ensuring data transparency and reducing bias is important moving forward

### **(False) Granularity**

- Being able to produce granular outputs, especially in the form of pixel level maps, is great but should be cautious of false granularity of uncertainty and assumptions

### **Use of Social Media and online data for Mortality Research**

- Integrating online data with scale-up methods can provide promising data for future research
- Can especially be useful in measuring natural disasters and catastrophes

### **Better Engagements with countries**

- For better data and less uncertainty/bias in data, engaging with and learning the needs of the country is important
- Working with UNICEF or WHO regional offices can be a good start in country engagement

### **Engagements/Collaborations with data scientists**

- Data scientists need to be involved in these discussions
- Developing a platform for collaboration can be a potential solution
- Working with insurance companies, especially in developing countries, is a good idea to get connected with the real data
- Kaggle competition for Verbal Autopsy cause of death assignments, can be a good Grand Challenge to spark interest and engagement

Overall, there was a consensus on:

- Use of Bayesian models (6 of the presentations)
- Hybrid models of research: High quality accurate data + scale up approach
- Country engagement as a solution to solving data bias problems

## 2 Appendix

### Participants

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## Day 1: December 11

### Session 1: 9:00 – 10:30

1. **Brief Introduction to the Meeting**

*Samuel Clark for IUSSP*

2. **Welcoming Remarks**

*Emilio Zagheni for MPIDR*

3. **UNFPA Perspective**

*Romesh Silva, UNFPA*

**Abstract.** TBA

4. **SDG Monitoring and Reporting on Child Mortality Targets: Challenges and Opportunities at Global, Regional and Country Level**

*Lucia Hug on behalf of UNICEF*

**Abstract.** TBA

### Coffee

### Session 2: 11:00 – 12:30

1. **Current Developments in Vital Rate Estimation From Standard Demographic Data**

*Carl Schmertmann*

**Abstract.** I discuss the “state of the art” for estimating vital rates from standard demographic data, including some new approaches for estimating age-specific mortality schedules. I also present ideas about how to use Brass-style indirect estimates in Bayesian models with demographic priors.

2. **Spatial Risk Modeling for Infectious Disease Surveillance Using Population Movement Data and Brass in the Computer Age**

*Renato Assuncao*

**Abstract.** This talk will cover two topics. In the first one, we present three recently proposed subset scan methods for spatial disease surveillance that use movement data from case and control individuals, rather than a single location per individual, in order to identify areas with a high relative risk of infection. We illustrate the use of these methods to detect spatial clusters of dengue infection risk using geo-located data from Twitter classified into infected cases and non-infected controls.

In the second one, we discuss some possibilities for updating the Brass techniques to deal with incomplete or defective data considering the present day tools and methods. We start by reviewing some previous attempts and end by discussing the challenges and difficulties ahead.

## Lunch

### Session 3: 13:30 – 15:00

#### 1. Recent and Near-Future Developments in Mortality Modeling in the Context of SDGs.

*Monica Alexander*

**Abstract.** With the introduction of the MDGs and the subsequent SDGs, there has been increased focus on being able to track progress in mortality indicators at the global scale. As data collection and availability has improved over time, the goals of mortality modeling have shifted towards producing more timely and granular estimates. In this talk I will discuss the history of mortality modeling in the context of the development goals; how modeling strategies have changed; issues to be mindful of; and future priorities.

#### 2. Which Countries Can Expect to Meet the SDG Under-5 Mortality Goals?

*Roland Rau*

**Abstract.** According to the Sustainable Development Goals, Under-5 mortality should be reduced to a level of 25 per 1000 livebirths by 2030. The goal implies a time horizon in which the specific mortality level should be reached. We argue that neither an assessment based on the pace of improvement nor the assessment based on differentials are sufficient to evaluate whether a country can expect to reach the goal. Instead, we propose a new measurement perspective, labeled “equivalent time” (ET), that allows to judge achieved and potential future progress in a single number. ET translates the gap between a countrys population and a reference population into a time lag. We argue that ET has the potential to become a standard procedure for assessing survival progress, complementing classical approaches.

## Day 2: December 11

### Session 1: 9:00 – 10:30

#### 1. Towards Better Understanding of Cause of Death Assignment Using Verbal Autopsies

*Richard (Zehang) Li*

**Abstract.** In regions without complete coverage of civil registration and vital statistics systems, verbal autopsy (VA) is a widely-used survey based approach to infer cause of death and cause-specific mortality rates in the population, using signs and symptoms reported by a person close to the decedent. Over the last ten years, several algorithms and statistical models have been proposed and gained popularity in the field to classify causes of death using the information from VA surveys. However, with the typically poor quality of VA data, many challenges remain to assess and improve the accuracy and generalizability of statistical models, as well as to understand and identify the optimal resolution of the inferential goals. In this talk, we will discuss recent progress in probabilistic cause-of-death assignment algorithms and implementations, and propose new directions for future research to address some of the key challenges.

#### 2. Verbal Autopsy in CRVS: The OpenVA Pipeline

*Samuel Clark*

**Abstract.** Civil registration and vital statistics (CRVS) systems cover roughly one third of the global population. Consequently, the majority of global deaths are unrecorded and their cause is unknown. This severely limits direct knowledge of the burden of disease and makes public health planning and monitoring difficult. The openVA pipeline is software to fully automate processing verbal autopsy data from Open Data Kit (ODK) electronic data capture forms through to the District Health Information System (DHIS) health information system with causes assigned along the way by algorithms implemented by the openVA R package. The pipeline allows verbal autopsy to be conducted at scale in CRVS systems with cause-coded deaths available to district, regional, and national public health officials in near real time.

### Coffee

### Session 2: 11:00 – 12:30

#### 1. The Human Mortality Database: Challenges and Opportunities

*Dmitri Jdanov & Domantas Jasilionis*

**Abstract.** There is no perfect data in the world, but it is enough to have high-quality data. Data are of high quality if they are Fit for Use in their intended operational, decision-making and other roles (Juran and Godfrey, 1999). This is why the understanding of problems hidden in the data is important in any demographic estimation, forecast or study. This idea should be used as a fundamental principle for any modern demographic database.

The Human Mortality Database (HMD) is the world's leading data resource on mortality in developed countries. One of the main advantages of the HMD is quality of provided data and their comparability across time and space. The constructed and updated series are carefully checked and reviewed for internal and external consistency before publication. Every data series in the HMD have to meet strong requirements. But the HMD provides not only the high-quality data but also a rich set of metadata for every data series. Thus, HMD users get not only the data but also enough information to decide if the data are fit for use. This is a new standard in the presentation of demographic data.

During the last few years, the Human Mortality Database (HMD) met two new challenges: decreasing quality of official population estimates in developed countries and the possibility to adopt a unique HMD approach to produce mortality estimates for some developing countries. The first one is related to the inability of statistical agencies to produce reliable statistics on international migration (Willekens et al. 2016), methodological problems by building of intercensal population estimates in case of deficit data (Klusener et al. 2018; Jdanov, Shkolnikov, and Jasilionis 2016), decreasing quality of population estimates at old ages (Jdanov et al. 2008; Cairns et al. 2016). Unfortunately, standard demographic methods which are used to produce rough mortality estimates for developing countries or historical data are often not applicable to problematic data from countries with functioning modern statistical systems. Such data lead to new challenges and new problems. To solve these problems more laborious approaches in combination with the use of additional and alternative data sources are needed. The country-specific approach should be combined with certain general principles that are applied in all countries to ensure comparability of data series across time and space.

The second challenge is linked to growing needs for reliable population-based mortality estimates for developing countries including China and India. Since population in low- and middle-income countries constitutes the majority of the global population, monitoring of global and regional health trends needs reliable and internationally comparable data. Although there are numerous statistics based on indirect methods and surveys, they often hardly rely on heavy modeling assumptions which differ between countries and cannot always ensure representation of real national mortality patterns (Boerma, Victora, and Abouzahr 2018). From the other side, the number of countries included in the HMD has been approaching its limits due to strict requirements for coverage and reliability of population statistics. There are several possibilities for further development of the HMD project. One way to go forward is to extend the HMD approach to developing countries by creating a special sister database under the HMD umbrella containing data for selected developing countries. In this light, the extrapolation of highly accurate and methodologically advanced HMD approaches based on using of all available data in combination with a standardized set of methods on countries with problematic population statistics shows a strong potential to fill the data and knowledge gaps on population-based mortality estimates for developing countries. This unique dataset would provide comparable mortality estimates built using the country-specific data-intensive approach in combination with standardized methods and new uniform principles for less statistically developed countries. China and India would be priority countries because of their impact on global mortality trends and the newly emerged data resources. Although both countries do not have a full coverage of population and vital statistics, available census and functioning sample registration systems covering millions of population in both countries provide solid grounds for producing nationally representative

mortality estimates.

## 2. Mortality Monitoring: CHAMPS and COMSA

*Kathryn Banke*

**Abstract.** The Bill & Melinda Gates Foundation is investing in two complementary programs for innovative mortality surveillance in high mortality countries. The CHAMPS (Child Health and Mortality Prevention Surveillance) Network is a global surveillance system that aims to provide timely and accurate tracking of infectious and preventable causes of death for children under five years of age through a network of surveillance sites in sub-Saharan Africa and South Asia. CHAMPS gathers information on stillbirths and deaths in children under five years, and asks families to consent for the deceased to undergo minimally invasive tissue sampling (MITS), which is used to help determine a more specific cause of death. MITS data plus medical records and verbal autopsy interviews are reviewed by a panel of specialists to determine the most likely cause of death. Countrywide Mortality Surveillance for Action (COMSA) operates in two countries where CHAMPS is implemented, Mozambique and Sierra Leone. COMSA is a sample registration system where all births and deaths are continuously identified and reported from a representative sample of the population. Verbal autopsy interviews are completed for all deaths in the population under surveillance, and additional MITS are completed among a sample of under five deaths identified by COMSA outside of the CHAMPS catchment area. The national cause-specific mortality fractions are then calibrated using paired MITS and verbal autopsy data from CHAMPS and COMSA, leading to a more accurate understanding of causes of death nationally. Both CHAMPS and COMSA make mortality surveillance data rapidly and continuously available to the public and national and international stakeholders, with the aim of ensuring those data are used to take concrete actions to reduce under five mortality.

## Lunch

### Session 3: 13:30 – 15:00

#### 1. Challenges in Determining Aggregate Mortality Indicators

*Trifon Missov*

**Abstract.** Distortions or erratic fluctuations in the trajectory of death rates affects the calculation accuracy of aggregate mortality indicators such as life expectancy, life disparity, entropy, the Gini coefficient, as well as complementary measures such as the Human Development Index. This study proposes modelling and statistical strategies to handle irregularities at infant, middle, and old-age mortality and suggests corrected values of aggregate mortality measures for a number of countries and regions.

#### 2. Beyond $e_0$ - Assessing the Value of Other Mortality Indicators From the Age-At-Death Distribution

*Alyson van Raalte*

**Abstract.** Globally population health is assessed on the basis of a select group of indicators of average mortality level typically life expectancy and levels of infant and/or child mortality. However there is a growing recognition that populations can differ in the degree of premature mortality decline, and progress in reducing non-communicable diseases, which are poorly captured by these indices. In this presentation I will examine the utility of alternative metrics of all-cause mortality including indicators of lifespan variability and the modal age at death in a global perspective.

## Day 3: December 11

### Session 1: 9:00 – 10:30

#### 1. Space-Time Modeling of Mortality Data in a Low- and Medium-Income Countries Context

*Jon Wakefield*

**Abstract.** In this talk I will give an overview of space-time modeling, discussing both discrete and continuous spatial models, and how they may be extended to space-time models. Then modeling over other factors such as age and gender will be described. Flexible formulations that allow different aggregations of the input data over time and space will be described, along with computation, model assessment and visual presentation of results. The topics will be illustrated using U5MR estimation as an example, including the combination of full and summary birth history data.

#### 2. Challenges Assessing Levels and Trends of Health Indicators in Nigeria

*Laina Mercer*

**Abstract.** Annual surveys are being run in Nigeria to assess progress in key health indicators. However, these frequent, but noisy, measurements present challenges in estimating rates and trends as well as detecting differences within and between areas. I will discuss these issues and address the impact of the substantial heterogeneity in population growth on sub-national and national rates.

### Coffee

### Session 2: 11:00 – 12:30

#### 1. Using Network Reports to Estimate Death Rates

*Dennis Feehan*

**Abstract.** TBA

#### 2. DemoTools: Ease the WPP Work Flow

*Tim Riffe*

**Abstract.** The DemoTools R package aims to capture the full set of methods used to evaluate, adjust, and standardize data required to produce life tables for countries with working but deficient vital registration. This work has traditionally been carried out by individual analysts with personal and non-standard tool kits. This work has been artisanal, laborious, and it is typically not reproducible. The objective for DemoTools utilities is to standardize the work flow, offering default methods selection and application such that analysts can easily visualize alternative methods paths and their consequences. In this way, analyst effort is directed primarily to difficult cases. I will demonstrate some basic functionality and discuss the proximate vision.

## **Lunch**

### **Session 3: 13:30 – 15:00**

- Review, discuss, and prioritize promising next steps.
- Decide on possible product(s) of the meeting - a paper?
- Any other next steps?