A Comparison of UN and IHME Maternal Mortality Estimates

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September 21, 2012

ABSTRACT

In this paper, we will analyze differences in maternal mortality estimates published by the UN and the IHME since 2010. First, we will break down differences into components attributable to three aspects of the estimation process: (1) models for predicting the proportion maternal among deaths to women aged 15-49; (2) levels of all-cause adult female mortality; and (3) choices in the treatment of AIDS-related maternal deaths. We will decompose differences in estimates for each country, region, and the world into these three parts to identify the relative importance of each factor. Second, we will explore and compare the performance of statistical models used by the UN and the IHME for predicting the proportion of maternal deaths. After fitting both models to the UN dataset, we will document differences in goodness-of-fit and predictive accuracy. We will also explore the practical and theoretical tradeoffs between estimation procedures that rely on simple versus complex models.

Global estimates of maternal mortality have been produced by various agencies of the United Nations since the 1990s (WHO and UNICEF 1996; WHO *et al.* 2001, 2004; WHO *et al.* 2007, 2010, 2012). More recently, the Institute for Health Metrics and Evaluation (IHME) has published alternative estimates of levels and trends in maternal mortality (Hogan *et al.* 2010; Lozano *et al.* 2012). Differences between the various sets of estimates published since 2010 have created confusion, but there has been little discussion or explanation of why such differences exist (Abouzahr 2011).

In a previous paper we have documented two major sources of difference between the UN and IHME estimates published in 2010 (Wilmoth *et al.* 2012). At the global level, UN estimates indicated higher levels of maternal mortality for 1990 but also a faster rate of decline over the next two decades, resulting in similar estimates from both sources for 2010. Our earlier analysis suggested that much of the difference in the 1990 levels was due to large differences in estimates of adult female mortality from all causes, which are a critical input for the estimation of maternal mortality.[1] The different rates of decline in this instance were caused primarily by different choices for the treatment of AIDS-related maternal deaths (i.e., deaths from AIDS with complications of pregnancy).

Another source of disagreement between UN and IHME estimates is differences in the manner of modeling the proportion of maternal deaths among all female deaths at ages 15-49. Since the IHME has not shared its data with other researcher, it has been more very difficult to assess this component of the difference. In an unpublished report prepared for UNICEF, we have replicated the 2010 IHME model of the proportion maternal using UN data (Brazil, 2012). That work seems to confirm the claim by the IHME that their model has some advantages in terms of predictive validity. We suspect, however, that the differences in final estimates due to predicted proportions maternal are relatively small compared to the differences caused by other data inputs (i.e., all-cause female mortality) and by choices in the treatment of AIDS-related deaths.

In this paper we propose to broaden and deepen our analysis of these topics, focusing on the most recent sets of estimates from both groups. First, we will outline major reasons for the differences between estimates. Using data that are now publicly available, we will break down these differences into components attributable to three major aspects of the estimation process:

- Model of the proportion maternal among deaths to women aged 15-49;

- Estimated levels of adult female mortality from all causes (the "envelope");

- Choices in the treatment of AIDS-related maternal deaths.

It should be possible to decompose the difference in estimates for each country, region, and the world into these three parts, and thus to identify the relative importance of each factor in the overall difference. The remainder of our analysis will be guided in part by what we

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[1] For countries lacking reliable data from civil registration, both the UN and the IHME derive estimates of maternal mortality by modeling the proportion of maternal deaths among all female deaths at ages 15-49, and then multiplying that proportion by a separate estimate of all-cause female mortality at the same ages.

discover in this initial phase of the study.

Second, we intend to explore and compare the performance of the statistical models used by the UN and the IHME for predicting the proportion of maternal deaths. We will follow our earlier technique of fitting both kinds of models to the UN dataset, documenting differences in goodness-of-fit and predictive accuracy. Since the IHME model is more complicated, it can be expected that it will yield advantages by these criteria. However, we will also explore the practical and theoretical tradeoffs between an estimation procedure based on a simpler, more parsimonious model and another using a more complex model with greater predictive power.

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