Changes in cause-specific neonatal and 1-59 month child mortality in India from 2000 to 2015: nationally-representative mortality study of 1·3 million homes

Frequently Asked Questions (FAQs) Sept 19, 2017

Disclaimer: The opinions expressed here are those of the authors and do not necessarily represent those of the Government of India, the World Health Organization or the United Nations. The aim of this document is to provide information, not recommendations to governments, organizations or individuals.

Q. What is this study? What is the study about?
A: This study relies on face-to-face interviews with nearly 100,000 households where children died in India. The study objective was to understand changes in cause-specific neonatal (first month) and 1-59 month mortality in India to guide further progress against child mortality.

Q. Which data were used in this study and how were they collected?
A. Most deaths in India and most other low and middle-income countries continue to occur at home and without medical attention at the time of death. So the causes of death are mostly unknown. To fill this gap, the Registrar General of India (RG) has, since 2001, implemented the Million Death Study (MDS) in over one million (M) homes in about 7000 randomly-selected areas of the entire country. 900 non-medical surveyors conduct structured verbal autopsies on deaths recorded in these homes. Each field report is assigned randomly to two of 400 trained physicians to classify the cause of death, with a standard process for resolving disagreements.

Q. What is a verbal autopsy? How valid is it?
A. The MDS relies on about 900 non-medical trained surveyors to interview over 1M households in randomly selected areas and complete a detailed 2-page structured list of symptoms and a half-page narrative of the family's story of the death in local language (which would also include any medical information, if the terminal illness was attended by a doctor). These reports are emailed independently and anonymously to two of the 400 trained study physicians to assign the probable underlying cause of death. The two physicians reconcile any differences, with third physician adjudication as needed. These "verbal autopsies" yield plausible and relatively reliable cause of death information in youth and middle age, although they are less reliable for deaths above age 70 years.

The MDS has provided for the first time for the whole of India reasonably reliable age-specific, cause-specific death rates up to age 70. It has also facilitated assessment of the effects of risk factors such as alcohol and tobacco far more reliably than before. The MDS yielded major findings that substantially changed previous mortality estimates and the relevance of particular risk factors.

Q. How did the study analyse trends in child mortality?
This study combined 2001 to 2013 MDS cause-specific proportions with the United Nations annual estimates of national births and deaths (partitioned across India's states and rural/urban areas). We then extrapolated estimated mortality rates backward to 2000 and forward to 2015. For India's big states, we calculated the rates of change in cause-specific mortality for three time periods corresponding to before the start of the National Health Mission, and during its early and full implementation.

Q. Who carried out the study, and who were the funders?
The RGI led the study and has already published the overall results on childhood and other age groups in reports for 2001-3, 2004-6, 2007-9 and 2010-13 (see LINK). Working with the RGI, the MDS was designed and conducted by a team of researchers at collaborating institutions, including: in Canada: the Centre for Global Health Research (CGHR, St. Michael's Hospital and Dalla Lana School of Public Health, University of Toronto, Canada) and in India: the Indian Council of Medical Research, International Institute for Population Sciences, Postgraduate Institute of Medical Education & Research, Department of Community Medicine & School of Public Health King George's Medical University. This childhood mortality study focuses on details of the data already published by RGI so as to better understand how future childhood deaths can be reduced.

External funding is from the Fogarty International Center of the US National Institutes of Health (grant R01 TW05991-01), Dalla Lana School of Public Health, University of Toronto, Maternal and Child Epidemiology Estimation Group, and the Disease Control Priorities. The funders had no role in writing the manuscript or in influencing the conclusions of the study.

Q. What were the key findings of this study?
A. The key findings were:

- About 1.2 million (12 lakh) children died in India in 2015, of whom 7 lakh were in the first month of life and 5 lakh were 1-59 months. Between 2000 and 2015, 29 million (2.9 crore) children died. Had the mortality rates of 2000 continued unchanged, a total about 39 million children would have died.
- Faster declines in the leading killers of children from 2005-15 indicate that India avoided about 1 million (10 lakh) more child deaths than it would have at 2000-2005 rates.
- However India could have avoided nearly 3 million child deaths if all of India reduced child mortality as fast as three of the better-performing states (Karnataka, Maharashtra and Tamil Nadu).
- The conditions prioritized under the National Health Mission had the greatest declines: pneumonia and diarrhea mortality fell by over 60%, mortality from birth-related breathing and trauma during delivery fell by 66%, and measles and tetanus mortality fell by 90%.
- These declines were greater in girls, so that now India has, remarkably, equal numbers of girls and boys dying, which is a big improvement from just a few years ago.
- By contrast, death rates from low birth weight (among babies delivering at full term) rose in the rural areas and poorer states of the country (but fell in urban areas and richer states,

indicating that they are avoidable). Malaria mortality among children did not fall nearly as fast as for other conditions, reflecting the relative neglect of childhood (and adult) malaria prevention and treatment.

Q. What does this study mean for the future?

- The Government has committed to the Sustainable Development Goals (SDGs), which call for India to halve child mortality rates (per 1000 live births) yet again from 47 in 2015 to 25 by 2030. The SDGs also call for reduction by more than half in the neonatal mortality rate from 27 in 2015 to 12 in 2030. (Global progress on the SDGs depends heavily on progress in India)
- Expanded funding for the National Health Mission to address priority conditions is essential to reach these goals.
- To reach the SDGs, India must maintain the current rapid decline of 1-59 month mortality but accelerate declines in neonatal mortality to more than 5% annually.
- The MDS identifies feasible health goals, such as reducing the 225,000 deaths at ages 1-59 months from pneumonia, diarrhoea, malaria and measles. This would involve adding newer vaccines (made in India) for pneumonia and diarrhoea, improving treatment coverage for malaria (for children and adults), particularly in hot-spot districts, and expanding measles vaccine coverage.
- Specific attention to babies born with low birth weight is required to reduce neonatal mortality, including in the new national newborn health program.
- Continued **direct** monitoring of changes in causes of death with the MDS is essential to documenting progress and flagging problems in reaching the SDGs

Q. How do the estimates from this study compare to those from previous studies?

A. The RGI-MDS is the only source of directly-measured causes of death at the national level. This study uses more current information, including updates to the UNPD World Population Projections (2016), which takes into account the Indian census 2011. Therefore, current estimates deaths in 2005 have also been updated from the estimates previously published cross-sectional study (Lancet 2010).

The current study measured changes in mortality rate estimates over time. This enabled us to observe a steeper decline among mortality for girls at 1-59 months which narrowed the girl-boy gap in mortality rates, which was prominent in earlier analyses of 2001-03 data.

Q. How is this study different from the Global Burden of Disease?

A. The MDS relies on direct interviews with 100,000 families who lost a child to disease or injury. It does not involve modelling or projections from small sample sizes. The Global Burden of Disease (GBD) mostly relies on complex econometric modelling which can be quite unreliable (and which works well only with good direct data on causes of death). In the past, the GBD has yielded quite unstable information. For example, one year it estimated about 900,000 deaths

from tuberculosis in India, but the next only 400,000. That was not due to the TB control program, but to a computer program. The MDS uses United Nations and WHO's estimates of the number of lived births and deaths for India. The UN provides the most reliable estimates of these totals, and these are consistent with India's 2011 census and the Sample Registration System data. Inexplicably, the GBD estimated 3.8 million fewer children born in 2016 than did the United Nations.

Q. What are the limitations of the study?
A. There are inherent uncertainties in classifying verbal autopsies and therefore we classify causes of death in broad categories. The use of dual physician coding, details on circumstances around death, as well as symptom patterns limited the misclassification between these causes. Nonetheless, there is inevitably some misclassification within the major neonatal causes but such error has likely not changed over time, even as more births occur in facilities. As an additional check on possible misclassifications, we compared the mortality trends using the strictest definition—when the two reviewing physicians immediately agreed on the cause of death—with trends using all of the data, and the results were similar. The proportion of "ill-defined" deaths, which is a good test of the performance of verbal autopsy, remained low for both neonatal and 1-59 months.

Q. How do the estimates relate to maternal and child health programmes in India?
A. The current study was not designed to assign attribution for declines in specific causes to the NHM or any other program. However, the declines in child mortality rates accelerated about the same time as the NHM and related programs expanded. The conditions prioritized under the National Health Mission had the greatest declines: expansion of effective treatment for pneumonia and diarrhea, a notable increase in births in occurring in hospitals, even in poorer states, and expansion of specialized immunization campaigns.

Our results enable cause-specific analysis to guide future efforts to meet the 2030 SDGs for child and neonatal mortality. The biggest target to reduce neonatal mortality is low birthweight deaths among term births, especially in poorer states. We provide evidence of avoidability of these deaths: these mortality rates fell in the richer and urban areas.

Immunization schemes added pentavalent vaccine in 2015, rotavirus in 2016, and pneumococcal vaccine in 2017 (all of these vaccines are made in India) and may enable continued progress against pneumonia and diarrhoea. Beyond the SDGs, our analyses suggest that the elimination of deaths from neonatal tetanus and measles is now achievable.

Additional materials are available at: www.cghr.org/child
Follow us at Twitter @CGHR_org and @countthedead