Mapping Neonatal Mortality in India: A Closer Look

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Abstract

Introduction: Fifty-three percent of Indian under-5 deaths occur during the neonatal age group. Recognizing that there is a lack of illustrated district-level data on neonatal mortality in India, we mapped this to visually highlight districts where neonatal health issues require the most attention. Methods: District-level estimates of 596 Indian districts were used to generate maps and to illustrate neonatal mortality rates (NMRs), absolute numbers of neonatal deaths; the best and worst performing districts (positive and negative deviants) in each Indian state; the neonatal female/male death ratio; and district lag in NMR reductions. Results: The NMR ranged from 4.3 (Kannur, Kerala) to 65.1 (Datia, Madhya Pradesh), with the mean NMR being 29.8. Almost two-thirds of the districts (n = 380, 63.7%) had NMRs between 20 and 40. The top third of neonatal deaths could be accounted for by just 71 districts of a total of 596. Conclusion: There is an urgent need for up-to-date data on district-level neonatal mortality in India.

Keywords: Child health, India, maps, neonatal mortality

INTRODUCTION

India has the highest number of neonatal mortalities in the world. As of 2015, 20% (1,201,000) of global under-five deaths occurred in India, meaning that in every five global child deaths occurred in India.[1] Over 50% of under-five deaths and 70% of infant deaths occur during the first 4 weeks of life.[2] The most recent estimates of neonatal mortality data for all 596 Indian districts are those calculated by Ram et al. for 2012, using data from multiple international and national surveys.[3] The authors used choropleth maps to powerfully illustrate under-five mortality estimates and 1–59-month female-to-male mortality ratios.[4,5] Presenting maps to specifically illustrate neonatal mortality in India is the express purpose of this study.

METHODS

The data for the present study come from Ram et al., whose authors calculated district-level estimates of neonatal mortality for 596 districts in India (for 2012) using multiple national and international surveys.[3] The following estimates from 2012 were used to create these maps: male and female neonatal deaths; neonatal mortality rates (NMRs), number of years lag behind millennium development goals’ (MDG) targets for NMR; and Indian districts with the largest number of absolute neonatal deaths (refer Tables 3, 4, and 8 of supplementary article by Ram et al). These estimates were entered into a spreadsheet (Microsoft Excel 2007) which was then input to ArcGIS 10.3 (ESRI, Redlands, CA, USA) to generate descriptive maps. We used these maps to identify sites from which to recruit respondents for a pan-India qualitative study of the neonatal healthcare system. The detailed protocol for the qualitative study will be available elsewhere soon.

RESULTS

We developed four maps of which two have been provided and detailed and two more briefly described here. Those interested in the other maps may contact the corresponding author.

Figure 1 shows the NMRs of 596 districts in India. The NMR ranged from 4.3 (Kannur, Kerala) to 65.1 (Datia, Madhya Pradesh), with a mean NMR being 29.8 [Figure 1]. We categorized the NMR into five groups (<20, 20–29, 30–39, 40–49, and ≥50) to provide a visual comparison of the mortality level across districts. The results are presented in Table 1. The top third of neonatal deaths could be accounted for by just 71 districts of a total of 596. We examined the interdistrict variations in NMRs and found that the NMR was much higher in the districts of central India compared to other regions of the country. The district lag in NMR reductions was also significant, with some districts showing no improvement over the past decade.

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Figure 1: Neonatal mortality rates in Indian districts, 2012

Figure 2: Districts with the most neonatal deaths each; together comprising one-third of national neonatal deaths
30–39, 40–49, >50), of which almost two-thirds of the districts (n = 380, 63.7%) had NMRs between 20 and 40.

Figure 2 shows the districts which contribute to one-third of the total neonatal deaths in India. Neonatal deaths in 71 districts in 11 states across six regions of India contribute to one-third (n = 259,194) of the nation’s neonatal deaths [Figure 2]. Two-thirds of these deaths and districts were accounted for by Uttar Pradesh (143,269 deaths, 55.3%; 35 districts, 49.3%) and Bihar (39,438 deaths, 15.2%; 12 districts, 16.9%) together.

The third map developed shows the two best (lowest NMRs) and the two worst (highest NMR) performing districts in each state/union territory. Regional classification of states was performed according to a previous study of neonatal mortality in India. Notably, worst performers tend to cluster together, and likewise, best performers also tend to cluster together.

The fourth map created gives the female/male neonatal mortality ratio. The majority of districts (277, 46.5%) had a female/male neonatal mortality ratio between 0.6 and 0.96. The ratio was highest in Theni (3, Tamil Nadu) and lowest in Suburban Mumbai (0.06, Maharashtra). The national ratio of female/male neonatal deaths was 0.77, suggesting an overall predominance of male neonatal deaths, as expected. [7]

Discussion

These maps offer a composite picture of the burden of neonatal mortality across the country and can inform scientist and policymakers alike for the development of further research strategies and policy. These enable easy comparisons of neonatal health status across states and districts to facilitate the design of effective strategies to improve neonatal health, particularly in areas of greatest need. Districts with the highest numbers of absolute deaths have regional hospitals with very high caseloads. The rich experience of these hospital staff (and community health/ASHA workers) should be captured to investigate the barriers faced in case management and to identify factors contributing to neonatal mortality; such information is essential to better design interventions which improve neonatal health. Comparing and contrasting a state’s own best and worst performing districts can highlight key factors which determine performance. A case study comparison of each district’s healthcare delivery system is encouraged. Furthermore, the phenomenon of clustering of the best performers together and worst performers together, as observed on the maps, also extended to districts at interstate boundaries, suggesting an investigation of geographical factors that might be related to NMR. Finally, in areas with a high female/male mortality ratio observed on the map of female/male neonatal death ratio, the possibility of female infanticide may not be ruled out: Aravamudan explains that some parents induce neonatal infections such as pneumonia or diarrhea, for which a medical certificate can be procured, thus attributing the death to a medical cause, avoiding prosecution. [9]

Up-to-date data on district-level neonatal health indicators in India are urgently required to comprehend the magnitude and severity of the problem. While indirect indicators of neonatal mortality are being addressed in the NFHS-4, direct numbers for neonatal mortality are absent. Unfortunately, the youngest age group whose mortality is reported in Indian national health surveys (e.g., Census, Sample Registration Survey, District Level Household Survey) is the infant age group (children aged 0–1 year). Until infant mortality is viewed as two distinct components (neonatal and postneonatal mortality), the true nature of the issue will persistently fail to surface. The little data which are available are also likely an underestimate as many newborns are born at home and do not receive hospital care and their births and deaths go unreported. Moreover, our upcoming review of neonatal databases revealed that many important Indian databases with neonatal data were either out of date or dysfunctional.

Conclusion

Here and now, the key to India’s childhood mortality issue clearly lies in curbing neonatal deaths. The importance of documenting details of neonatal births and deaths cannot be overstated that because without data that is both accurate and current, we continue to remain in the dark about the magnitude and severity of the problem. We hope that these maps serve to raise more questions about progress being made in addressing this issue and provide the impetus and direction to fuel further research into areas where the decline in neonatal mortality has been a persistent challenge.

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Conflicts of interest

There are no conflicts of interest.
REFERENCES

1. UNICEF. Committing to Child Survival: A Promise Renewed, Progress Report 2015. September 2015. New York, USA: UNICEF; 2015.
2. PHFI A. SC-State of India’s Newborns (SOIN) 2014 – A report. Public Health Foundation of India, All India Institute of Medical Sciences and Save the Children New Delhi, India. Available from: http://www.newbornwhocc.org/. [Last accessed on 2016 Mar 16].
3. Ram U, Jha P, Ram F, Kumar K, Awasthi S, Shet A, et al. Neonatal, 1-59 month, and under-5 mortality in 597 Indian districts, 2001 to 2012: Estimates from national demographic and mortality surveys. Lancet Glob Health 2013;1:e219-26.
4. Koua EL, Kraak MJ. Geovisualization to support the exploration of large health and demographic survey data. Int J Health Geogr 2004;3:12.
5. MacEachren AM, Brewer CA, Pickle LW. Visualizing georeferenced data: Representing reliability of health statistics. Environ Plann A 1998;30:1547-61.
6. Million Death Study Collaborators. Bassani DG, Kumar R, Awasthi S, Morris SK, Paul VK, et al. Causes of neonatal and child mortality in India: A nationally representative mortality survey. Lancet 2010;376:1853-60.
7. Pongou R. Why is infant mortality higher in boys than in girls? A new hypothesis based on preconception environment and evidence from a large sample of twins. Demography 2013;50:421-44.
8. Aravanudan G. Disappearing Daughters: The Tragedy of Female Foeticide. New Delhi, India: Penguin Books India; 2007.