ONE MILLION DEATHS

WHAT RESEARCHERS ARE LEARNING FROM AN UNPRECEDENTED SURVEY OF MORTALITY IN INDIA.

BY ERICA WESTLY

In 1975, when Prabhat Jha was growing up in Canada, his family received a report from India that his grandfather had died; the cause was unclear. Like many people living in rural India, Jha's grandfather had died at home, without having visited a hospital. Jha's mother was desperate for more information, so she returned to her home village to talk to locals. Years later, when Jha was at medical school, he reviewed his mother's notes and realized that his grandfather had probably died of a stroke. Now Jha, an epidemiologist at the University of Toronto, is nearing the end of an ambitious public-health programme to document death in India using similar 'verbal autopsy' strategies.

The Million Death Study (MDS) involves biannual in-person surveys of more than 1 million households across India. The study covers the period from 1997 to the end of 2013, and will document roughly 1 million deaths. Jha and his colleagues have coded about 450,000 so far, and have deciphered several compelling trends that are starting to lead to policy changes, such as stronger warning labels on tobacco.

Public-health experts need mortality figures to monitor disease and assess interventions, but quality mortality data are scarce in most developing countries. Seventy-five per cent of the 60 million people who die each year around the globe are in low- and middle-income countries such as India, where cause of death is often misclassified or unreported. Groups such as the World Health Organization (WHO) typically base mortality estimates on hospital data, but in many developing countries most people die outside hospitals.

As global health researchers increasingly turn to indirect computer models, many applaud the MDS's low-tech, on-the-ground approach and see it as a model for assessing true health burdens in the developing world. "For countries like India, there will almost certainly continue to be a role for verbal autopsy," said Colin Mathers, coordinator of mortality and burden of disease at the WHO. "It's a crucial source of information."

HOW THEY GATHER THE DATA

The Million Death Study (MDS) involved two phases, 1997–2003 and 2004–2013, each of which surveyed a different selection of more than 1 million homes.

800–900

government surveyors visit the homes every six months.

MAPPING MORTALITY

The project data show that cause of death is influenced by geography. Knowing which threats are greatest in which states informs policies and future studies.

ROAD-TRAFFIC INJURY:
Haryana
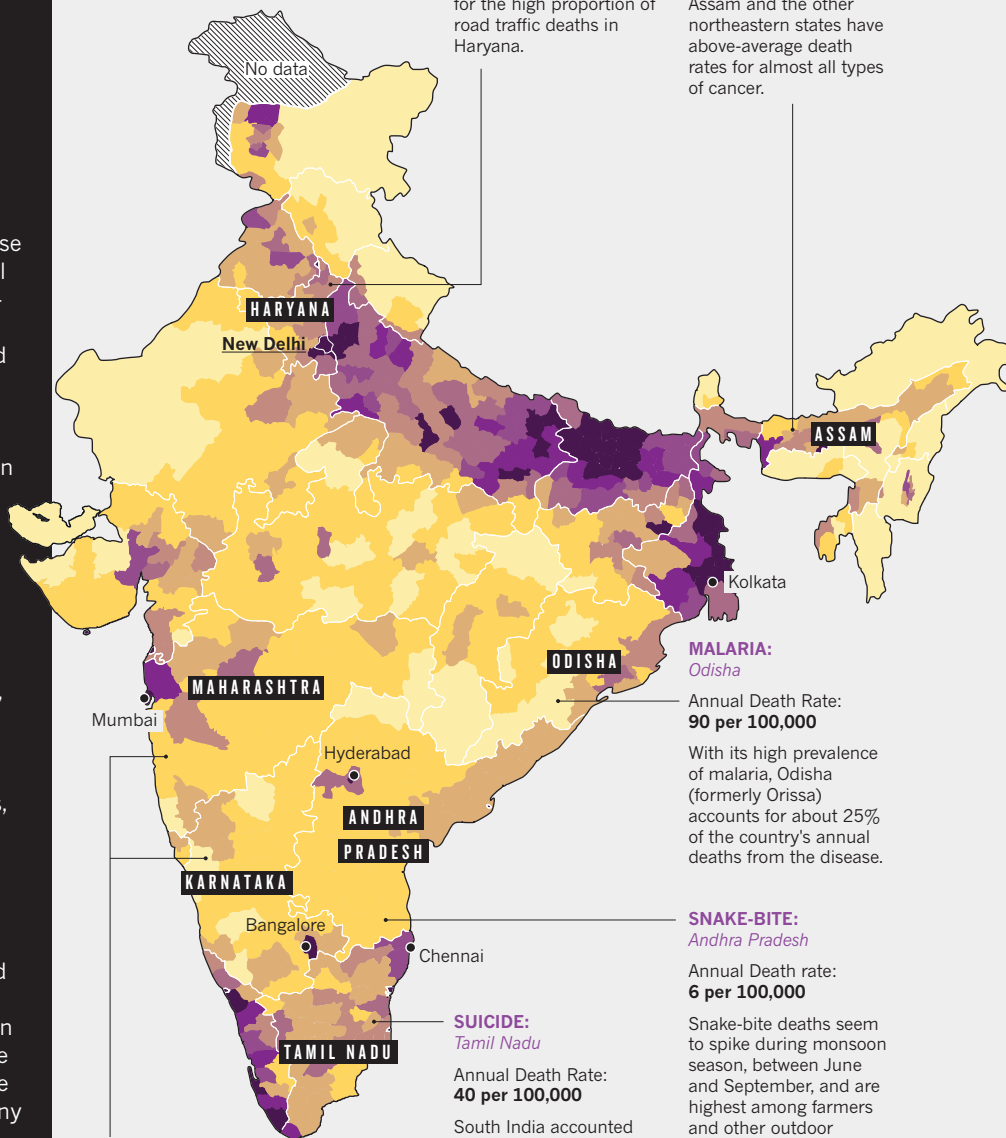
Annual Death Rate:
30 per 100,000

High-density trucking routes may be to blame for the high proportion of road traffic deaths in Haryana.

CANCER:
Northeastern States, including Assam

Annual Death Rate:
65 per 100,000

For reasons not yet clear, Assam and the other northeastern states have above-average death rates for almost all types of cancer.

MALARIA:
Odisha

Annual Death Rate:
90 per 100,000

With its high prevalence of malaria, Odisha (formerly Orissa) accounts for about 25% of the country's annual deaths from the disease.

SNAKE-BITE:
Andhra Pradesh

Annual Death rate:
6 per 100,000

Snake-bite deaths seem to spike during monsoon season, between June and September, and are highest among farmers and other outdoor labourers.

SUICIDE:
Tamil Nadu

Annual Death Rate:
40 per 100,000

South India accounted for more than 40% of India's suicides. The area has high education levels and unemployment, both considered risk factors for suicide in India.
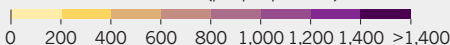
HIV:
Maharashtra/Karnataka

Annual Death Rate:
56 per 100,000

Rural areas around Mumbai, the capital of Maharashtra, have the highest concentration of HIV-related deaths in India.
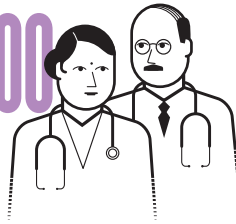
No data

HARYANA
New Delhi
ASSAM
Kolkata
ODISHA
MAHARASHTRA
Mumbai
Hyderabad
ANDHRA PRADESH
KARNATAKA
Bangalore
Chennai
TAMIL NADU

POPULATION DENSITY (people per km²)

0   200   400   600   800   1,000   1,200   1,400   >1,400

DESIGN BY **JASIEK KRZYSZTOFIAK**/NATURE
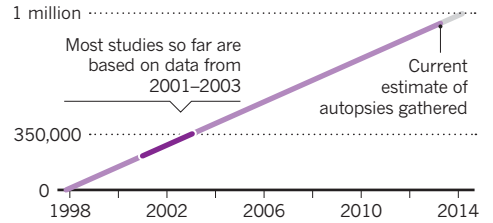
50,000–58,000

verbal autopsies are collected each year.

TWO

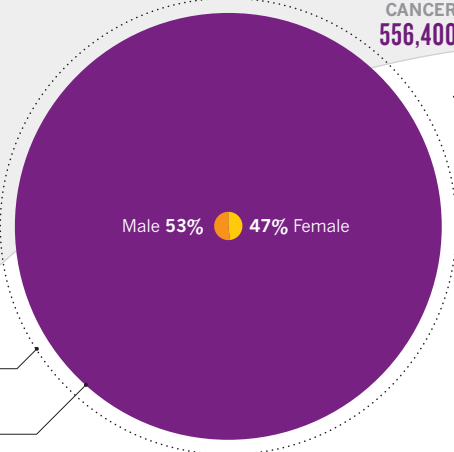trained doctors from a pool of 300 assign a cause of death on the basis of each autopsy.

REACHING 1 MILLION
Owing to some delays related to the 2011 national census, the researchers will not have data on all 1 million deaths for a few more years.

1 million

Most studies so far are based on data from 2001–2003

Current estimate of autopsies gathered

350,000

0

1998   2002   2006   2010   2014

PRECISION AND CONTROVERSY

Studies based on the MDS's data help to provide a detailed picture of death in India, particularly for adolescents and adults living in rural areas. The findings include some surprising deviations from World Health Organization estimates.

WHO estimate

MDS figure

TOTAL DEATHS IN INDIA PER YEAR
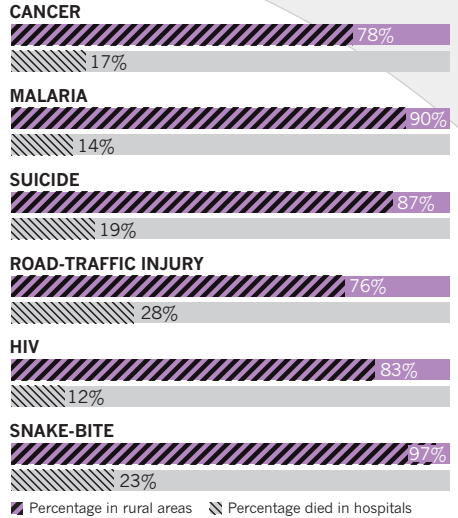9,500,000

CANCER
556,400

Male 53%   47% Female

CANCER
Rural areas had a higher incidence of deaths from infection-related cancers, such as stomach and cervical cancer. Cervical cancer was the top killer for women, suggesting that interventions such as screening and HPV vaccination should be increased.

MALARIA
205,000

49%   51%

MALARIA
Controversially, the MDS's estimate for malaria deaths was much higher than the WHO's. The MDS found that about 58% of malaria deaths occurred in people aged 15–69.

SUICIDE
187,000

60%   40%

SUICIDE
The suicide rate in Indian women of 15 years and older is more than 2.5 times that for women of the same age in high-income countries. Poisoning — often with pesticides — is the most common method for both sexes.

ROAD-TRAFFIC INJURY
Two-wheel riders and pedestrians accounted for some 65% of traffic deaths. And about 60% involved head injury, suggesting interventions such as increased helmet use, lower speed limits and protected walkways for pedestrians.

83%   17%

ROAD TRAFFIC INJURY
183,600

HIV
100,000

79%   21%

HIV
The prevalence of HIV in India is relatively low, but the country has the third-largest number of people living with HIV in the world owing to its large population.

SNAKE-BITE
Estimates based on hospital data may miss many such deaths because three-quarters of them occur outside hospitals. Community education and increased distribution of anti-venom to rural areas are the main interventions.

Previous estimate (not from WHO)

59%   41%

SNAKE-BITE
45,900

THE HIDDEN DEATHS

Most deaths are occurring outside of the hospital setting and in rural areas where they are often not registered. The MDS is starting to expose the hidden trends.
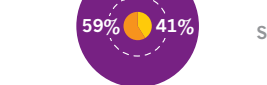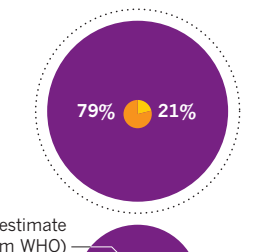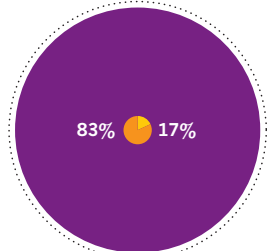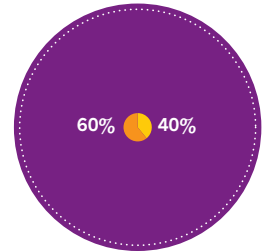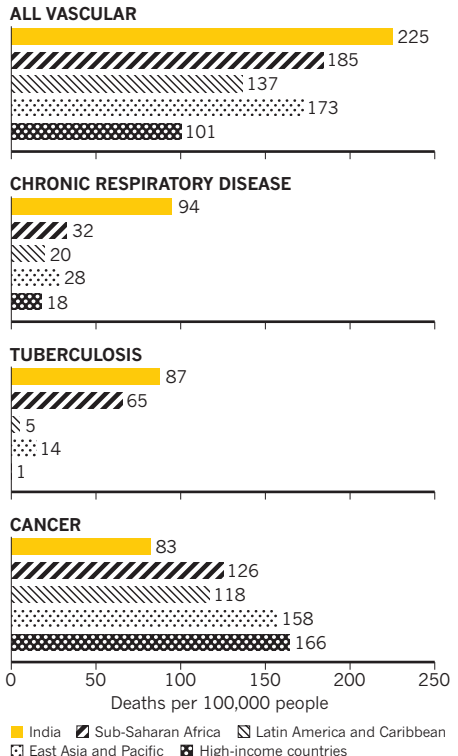
CANCER
78%
17%

MALARIA
90%
14%

SUICIDE
87%
19%

ROAD-TRAFFIC INJURY
76%
28%

HIV
83%
12%

SNAKE-BITE
97%
23%

▧ Percentage in rural areas   ▨ Percentage died in hospitals

TOP CAUSES OF DEATH

The MDS determined that the four most significant causes of death for Indians aged 30–69 are vascular disease, chronic respiratory disease, tuberculosis and cancer. Some of these burdens look very different in other regions of the world.

ALL VASCULAR
225
185
137
173
101

CHRONIC RESPIRATORY DISEASE
94
32
20
28
18

TUBERCULOSIS
87
65
5
14
1

CANCER
83
126
118
158
166

0   50   100   150   200   250
Deaths per 100,000 people

■ India ▧ Sub-Saharan Africa ◩ Latin America and Caribbean
▦ East Asia and Pacific ▨ High-income countries

SOURCE: P. JHA ET AL. PLOS MED. 3, E18 (2006); R. DIKSHIT ET AL. LANCET 379, 1807–1816 (2012); N. DHINGRA ET AL. LANCET 376, 1768–1774 (2010); V. PATEL ET AL. LANCET 379, 2343–2351 (2012); M. HSIAO ET AL. BRIT. MED. J. OPEN 3, E002621 (2013); P. JHA ET AL. BRIT. MED. J. 340, C621 (2010); B. MOHAPATRA ET AL. PLOS NEGL. TROP. DIS. 5, E1018 (2011).