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ABOUT THE AUTHORS

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Dr. Nandita Saikia is Assistant Professor of Population Studies at the Centre for Study of Regional Development, with six years of experience in teaching and research. Prior to this, Dr Saikia served as an assistant professor at the Institute of Economic Growth in Delhi. Dr. Saikia has written peer-reviewed research papers in internationally reputed journals in the area of population and health. She has also contributed chapters to several edited books. She has been guiding MPhil and PhD students at CSRD, JNU. Dr. Saikia has received a number of prestigious awards such as the Raja Rao Memorial award from Kolkata's Indian Statistical Institute, in 2014; Prof. P N Mari Bhat Gold Medal from IIPS, Mumbai in 2011; and Prof. K B Pathak Award from the Indian Association of Study of Population. She has also been awarded various scholarships such as the Max Planck-India fellowship, from the Max Planck Society, Germany, in 2012-2016; and visiting scholarships in Max Planck Institute for Demographic Research in Germany, Institut National d'etudes Demo-graphiques (INED) in Paris, Vienna Institute for Demographic Research, and John Hopkins Bloomberg School of Public Health. Currently, she is a member of the IUSSP expert panel in “Lifespan Extension with Varying Cause-of-death Trajectories”. Her research interests include health and mortality, migration, and disability.

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ABSTRACT

India's endeavour to achieve the Sustainable Development Goals (SDGs) in a well-defined and time-bound manner is critical for national and global development. This paper examines India's data availability to assess the SDGs related to health and nutrition. While India is still facing severe challenges of generating disaggregated information on mortality and cause-specific deaths, the desired data on nutrition and healthcare utilisation are largely available, enabling the computation of SDG indicators at the state or district level. However, indicators for socioeconomic groups cannot generally be obtained at levels of disaggregation below the state. There is scope to raise the preciseness of morbidity-related indicators in the current data systems. To address health and nutrition data issues, India should place emphasis on completing the Civil Registration System, modifying existing surveys in light of SDG indicators, strengthening the HMIS and Surveillance systems, and exploring application of indirect estimation techniques.

INTRODUCTION

By setting the eight Millennium Development Goals (MDGs) in the early 2000s, the United Nations galvanised unprecedented efforts to eradicate extreme poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality, improve maternal health, combat HIV/AIDS, malaria and other diseases, ensure environmental sustainability, and promote global partnership for

development. Overall, substantial progress was made in reaching these goals within the predefined timeline, particularly by the developing countries. MDGs were also successful in promoting global awareness, political accountability, improved metrics, social feedback, and public pressures to achieve the objectives.[1] Yet, for all the remarkable success, inequalities between and within countries have persisted, calling for the continuation of efforts beyond 2015. In September 2015 the international community, led by the UN, declared a set of 17 Sustainable Development Goals (SDGs) related to economic development, environmental sustainability, and social inclusion and to be achieved by 2030.

India's endeavour to achieve the SDGs in a well-defined and time-bound manner is critical not only for the nation's own development, but also that of the world—due to India's mammoth population size and the extreme inequalities in demographic and socio-economic indicators across the country. Despite being one of the largest emerging economies in recent decades, India's human development index is lower than that of other emerging countries such as China, Brazil, and Russia. India has been the single largest contributor to global under-five deaths since the 1970s.[2] The annual number of under-five deaths in India was as high as 1.2 million in 2015 and is more than six times higher than the number for another giant, China. Similarly, India is one of the top five countries where 60 percent of the world's one billion extreme poor people live.[3] The poverty head count ratio at the national level was as high as 21.9 percent in 2011-2012.[4] India continues to have widespread hunger, ranking a lowly 97 among 118 developing countries in the Global Hunger Index.[5]

What of India's health-related MDGs—were they achieved? It is found that India successfully achieved the MDG 6 of halting and reversing the HIV epidemic.[6] However, the country failed in the MDGs related to child and maternal health. First, though India is close to attaining the goal set for the under-five mortality rate, it has missed the targets for infant mortality (39 per 1000 births in 2014 vs. targeted 27 for 2015) and maternal mortality (167 for 2011-13 vs. target of 109 in 2015). India is also reported as

moderately off-track for the reversal of the incidence of malaria and other major diseases. Secondly, the national achievement in many of the indicators masks the poor performance of many populous districts from north-central and eastern India which have been lagging behind. Finally, although the level of mortality has reduced substantially in the MDG period, the absolute numbers of maternal and child deaths are massive.

Therefore, it is important for India to gear up for SDGs with well-thought out and systematic efforts especially at the local level. It is noteworthy that the SDGs are not only target-oriented but also inclusive, unlike the MDGs which emphasised on the overall attainment of goals. The battlecry for the SDGs—"No one is to be left behind"—means that for India, the overarching goal is to reduce inequalities across gender, region, class, and caste. An immediate imperative is an assessment of data availability for the precise estimation of health and nutrition metrics, at small geographical areas and for any disadvantaged socio-economic groups.

This paper examines India's readiness to assess its progress towards the SDGs related to nutrition and health (including reproductive, maternal, newborn and child health). The following section discusses relevant SDG indicators and sources of data in India, to be followed by an examination of appropriate strategies to track SDGs. The study concludes with specific recommendations for improving data systems in India for the short and long term.

SUSTAINABLE DEVELOPMENT GOALS, TARGETS AND INDICATORS IN HEALTH AND NUTRITION

The targets and indicators linked to health and nutrition are covered in SDG 2 and 3[7] (see appendix A). In all, there are 13 targets and 30 indicators: mortality (9), morbidity (5), nutrition (4), healthcare service utilisation (5), and the rest are in reproductive health (adolescent birth rate and met need for contraception), lifestyle factors (tobacco use), and substance abuse. Two

other indicators (3.b.2 and 3.d.1) which refer to development assistance and international regulations are not addressed in this paper.

In addition to the health and nutrition targets related to SDG 2 and 3, there are other indicators (often labelled as WASH) under SDG 6 (management of sanitation and water) which directly influence health; these will be discussed in this paper. Some indicators from SDG 5 (Gender equality), SDG 10 (reduce inequality), and SDG16 (peaceful and inclusive societies) also have an influence on health, but these are beyond the scope of this study.

The UN has decreed that SDG indicators should be disaggregated, wherever relevant, by income, sex, age, race, ethnicity, migratory status, disability status, and geographic location, or other characteristics (General Assembly resolution 68/261). Thus India needs to monitor all of these indicators by gender, geographical regions (districts or below districts, say, parliamentary constituencies), income groups, religions, castes, and disability condition. Moreover, these are to be obtained at a series of time points or for periods between 2015 and 2030, to facilitate continuous monitoring of the country's progress.

MAJOR SOURCES OF DATA ON HEALTH AND NUTRITION IN INDIA

India's legacy of collecting data on population and health goes back to the colonial period when the first modern Census was organised, culminating in 1872. This was followed soon by the passing of the Births, Deaths and Marriages Registration Act, 1886. Eventually, Independent India will have a long list of sources of data of various kinds, such as registration, large-scale sample surveys, and surveillance systems. Yet, due to lack of integration of these data systems, they have proved inadequate to precisely answer even some of the most basic questions in health and mortality.[8]

A Civil Registration System (CRS) is ideally suited to gather mortality information by age, sex, place, and basic socio-economic characteristics such as marital status, religion, occupation, cause of death, medical

certification and type of medical attention received. It is imperative that such a system be adopted universally.[9] CRS has been fully functioning in developed countries for a long time, and the emerging countries such as Brazil, China, South Africa too have reached complete coverage in recent decades.[10] India, meanwhile, has long had a CRS overseen by the Office of Registrar General, offering vital statistics. However, despite the provision of legal action in case of failure to register births and deaths, coverage of death registration is poor and varies widely by age, sex, state, and over time. Therefore, a Sample Registration System (SRS) was introduced in 1970 which follows a dual recording scheme in a sample of villages and urban blocks. Though meant as an interim measure until the coverage of the CRS reaches a satisfactory level, the SRS has continued for long and estimates derived from it have been, by default, widely accepted as reliable. The SRS, based on a population of about 7.5 million population, publishes a yearly bulletin, yearly report, and abridged life tables at regular intervals. For large states, the SRS gives estimates of age-specific death rates by sex and place of residence (rural/urban); for smaller states and union territories, only the crude death rate and the infant mortality rates are available. For large states, some key indicators are also given for natural divisions (which are groups of districts within states).

The major limitations of SRS include lack of district-level indicators, inadequate information for smaller states, absence of information on basic socio-economic characteristics, and non-availability of individual-level data in the public domain. With the introduction of MDGs, district-level demographic indicators became essential especially in the most populous and backward states of central, northern, and eastern India, popularly known as EAG states (Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh, and Uttarakhand), as well as Assam. Therefore, instead of emphasising on CRS or expanding the SRS to district-level disaggregation, the Office of Registrar General of India (ORGI) introduced the Annual Health Survey (AHS) in the EAG states and Assam in 2011. Unlike CRS or SRS, AHS provides data on other health indicators such

as morbidity prevalence and healthcare service utilisation, especially for maternal and child health.

Reliable statistics on the causes of death in India are still a faraway dream. The two major systems of data on causes of death–i.e., Survey of Causes of Death (SCD-Rural) and Medical Certification on Causes of Death (MCCD)—are unable to provide cause-specific death rates due to their unscientific sampling design, poor coverage, non-availability of the size of exposed population, and irregularities in publishing reports. The most recent 'Special Survey of Deaths', for example, conducted under SRS by the Office of Registrar General India, appears to be an improvement over the earlier data on causes of death; however, individual-level data is still not available, making it impossible for researchers to evaluate the nuances of cause-specific death rates across the country.

Much of this data vacuum in health and mortality was filled recently by several multi-purpose, large-scale surveys such as the National Family Health Survey (NFHS), District Level Household Surveys (DLHS), National Sample Survey (NSS), India Human Development Survey (IHDS), Rapid Survey on Children (RSOC), and WHO-SAGE. Many of these data sets allowed estimating the most important mortality indicators (infant mortality rate, child mortality rate, and in some cases, adult mortality rate) by demographic and socio-economic characteristics, at least at the state level. Some of these surveys also provide reported morbidity prevalence in India across population subgroups, though only a few diseases are covered and these have varied across survey rounds. While the NSS provided data on nutritional intake, surveys like NFHS, DLHS, IHDS, and RSOC did an impressive job by offering anthropometric measures of mothers and children in India. Finally, these data served as a rich source for information on healthcare service utilisation, particularly by women of reproductive age and children under five.

The biggest advantage of these surveys over SRS is that individual-level data are shared with researchers and policymakers, giving them more scope to

analyse the dynamics of mortality, morbidity, disability and healthcare service utilisation across the breadth of the Indian population. However, because of the limited sample size and uncertain periodicity of these surveys, they fail to meet the requirement of evaluation of target-oriented policies at the district or below-district level. Although the overall sample size in the surveys is huge, district sample size is not conducive for assessing mortality differentials due to large sampling errors.

Among all health management data tools, the most important one may yet be the Health Management Information System (HMIS), launched in 2008 by the Ministry of Health and Family Welfare. HMIS was introduced to meet the demand for micro-level data on population and health at the level of the health facility. It has been providing maternal and child health indicators at small geographical/administrative/health facility level. The HMIS seeks to capture all vital events and MCH indicators and transmit the information electronically to ensure quick collation and tabulation. It is supposed to be the most powerful source in tracking health programme's performance since data are available at health facility level and on a monthly or weekly basis.

However, the problems with HMIS begins with its structure: it does not provide any information on exposed population, and as a result, the calculation of mortality rate is not feasible. Overall, HMIS data are found to be incomplete and of poor quality; there are irregularities in report generation, data duplication and data inconsistencies at various levels of healthcare facilities.[11] There is also over-reporting of the positive indicators (for instance, maternal and child healthcare service utilisation), and under-reporting of the negative indicators (such as under-five deaths). A most recent evaluation shows that the quality of records in HMIS is sub-optimal and there is over-reporting in some MCH indicators.[12] HMIS data on mortality are grossly under-reported due to the following reasons: 1) under-reporting of deaths by government health facilities; 2) absence of reporting by the private health facilities; and 3) variation of coverage among states/districts.[13] These inadequacies in HMIS at the grassroots level may be attributed to a host of factors, including shortfalls in human resources, lack

of proper training, and deficiency in infrastructure (such as internet connectivity and power supply).

For morbidity indicators, another major source of information comprises the recorded incidence of specific diseases obtained from surveillance or notification. India has launched programmes to control/eradicate a number of diseases and as part of such programmes, the incidences (cases) of these are recorded. This has been done for malaria, tuberculosis, leprosy, and HIV/AIDS. Many diseases are covered by the National Vector Borne Disease Control Programs (now called Expanded Vector Borne Disease Control Programme-EVBCDP). An integrated system of recording incidence, the Integrated Disease Surveillance Programme (IDSP), has recently been established under the Ministry of Health and Family Welfare. The mission of this system is to detect epidemic-prone diseases early and take timely and effective public health action.[14] IDSP publishes weekly reports on outbreaks (malaria, viral hepatitis, food poisoning, and other neglected tropical diseases like dengue, chikungunya, and leprosy). There are, however, limitations in disease surveillance systems in India such as under-reporting of deaths and inadequate laboratory diagnosis.

Though notification of many diseases is mandatory, one is not sure how many patients who seek care in private healthcare institutions get covered. As a large proportion of the population obtain care from the private sector, completeness of the data based on reporting-recording is questionable. It is pertinent to note that according to the 71st round of the NSS, private doctors are the source of treatment for about half of all spells of illnesses treated.[15] For HIV/AIDS, Sentinel Surveillance has been in place for long and model-based estimation has been adopted.

MEASUREMENT READINESS FOR HEALTH AND NUTRITION GOALS IN CURRENT SYSTEM OF DATA

As noted in appendix A, a set of health and nutrition metrics has been finalised to track regularly the progress in the achievement of the SDGs. This

section discusses the availability of each of those indicators at disaggregated level. For this purpose, the indicators have been grouped according to: i) mortality; ii) morbidity; iii) health services utilisation, reproductive health, and substance use; iv) nutrition; and v) water supply and sanitation.(See Tables 1 to 5).

In general, most of the mortality indicators are available in India at the state level (See Table 1). However, except AHS (in Empowered Action Groups of states and Assam), none of the data sources provide district-level indicators of mortality. At the same time, mortality indicators are not available regularly by socio-economic characteristics at the district level or small state level. While such estimates can be obtained from unit-level data (the NFHS and DLHS data are in the public domain), relative sampling errors are quite large for small socioeconomic groups, preventing assessments of changes over short time intervals.

Data availability is much worse for cause-specific death rates. There is no published report by ORGI giving cause-specific death rates in India. The published reports on causes on deaths (2001-2003; 2004-2006 and 2010-2013) provide only the distribution of deaths by causes. Since these reports do not provide detailed information on the number of persons exposed and events by age, sex and causes of death, it is not possible for researchers to calculate SDG indicators related to cause-specific deaths. Besides, the age groups for which distributions are published are broad and for a large proportion of deaths, the cause of death is not known. Further, there is hardly any available data on mortality attributable to pollution and poor sanitation and hygiene.

Table 1: Availability of SDG mortality indicators at disaggregated level, India

Indicators	Sources of Data	Periodicity	Reference period	Lowest Geographical disaggregation	Availability of indicator for socioeconomic groups	Availability of Individual data	Comment
3.1.1 Maternal Mortality Ratio	NFHS, 1, 2, 4	Not regular	2 years before survey year	States	No	Yes	Relative Sampling error is large
	SRS	Every three year	3 years	Large States and groups of small states	No	No	Relative Sampling error is large
	AHS*	Annual	3 years	Only EAG states and Assam's districts	No	Yes	Only nine states covered
3.2.1 Under-five mortality rate and 3.2.2 Neonatal Mortality Rate	SRS	Annual	Yearly	States	Yes, at state level	No	Problematic data in small states
	NFHS 1, 2, 3, 4	Not regular	5 years prior to surveys	States; rural/urban	Yes, at state level	Yes	Relative Sampling error is large below state level
	DLHS 1, 2, 3, 4	Not regular	3 years prior to surveys	District	Yes, at state level	Yes	Relative Sampling error is large below state level
	AHS*	Yearly	3 years prior to surveys	Only EAG states and Assam's districts	No	Yes	Only nine states covered
3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease; Cause Specific Death Rate (CSDR)	SRS	Not regular	2-3 years	India	No	No	No published report on CSDR; small sample for states
3.4.2 Suicide Mortality Rate (SMR)	SRS	Not regular	2-3 years	India	No	No	No published report on SMR; small sample for states
3.6.1 Death rate due to road traffic Injuries (TIDR)	SRS	Not regular	2-3 years	India	No	No	No published report on TIDR; small sample for states
3.9.1 Mortality rate attributed to household and ambient air pollution	No	NA	NA	NA	NA	NA	NA
3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene	No	NA	NA	NA	NA	NA	NA
3.9.3 Mortality rate attributed to unintentional poisoning	No	NA	NA	NA	NA	NA	NA

*: The DLHS and AHS have now been discontinued.

Table 2. Availability of SDG morbidity indicators at disaggregated level, India

Indicators	Sources of Data	Periodicity	Reference period	Lowest Geographical disaggregation	Availability of indicator for socioeconomic groups	Availability of Individual data	Comment
3.3.1 Number of new HIV infections per 1,000 uninfected population, by sex, age and key populations	Integrated Biological and Behavioral Surveillance (IBBS), India/ HIV Sentinel Surveillance	Yearly	1 Year	National	No	No	Model based estimation
	NFHS 3	Not regular	1 Year	Some States/ group of states	Yes	Yes	Reliable for the areas covered
3.3.2 Tuberculosis incidence per 1,000 population	NFHS 3, 4	Not regular	1 Year	State	Yes	Yes	Lay reporting
	IHDS 1 & 2	Not regular	Prevalence at the time of survey	State	Yes	Yes	Lay reporting
	NSSO 71st round	Not regular	15 days prior to Survey	NSSO region	Yes	Yes	Lay reporting
	DLHS 4*	Not regular	1 Year	Districts of Non-EAG states and Assam	Yes	Yes	Lay reporting, Not nationally representative
	Revised National Tuberculosis Control Programme (RNTCP) and NIKSHAY	Regular	Yearly	State	No	No	Only reported cases get covered
3.3.3 Malaria incidence per 1,000 population	NFHS 2	Not regular	3 months prior to survey	State	Yes	Yes	Lay reporting, seasonal variations in Malaria
	DLHS 4*	Not regular	15 days prior to Survey	State and district excluding EAG states and Assam	Yes	Yes	Lay reorting,Nationally not representative
	National Malaria Eradication Programme (NMEP); now Expanded Vector Borne Disease Control Programme (EVBDCP)	Regular	Monthly	District	No	No	Only reported cases get covered
3.3.4 Hepatitis B incidence per 100,000 population	No data on population based information	NA	NA	NA	NA	NA	NA
3.3.5 Number of people requiring interventions against neglected tropical diseases	Integrated Disease Surveillance Programme (IDSP); Expanded Vector Borne Disease Control Programme (EVBDCP)	Regular	Weekly	District	No	Yes	Coverage likely to be poor

*: The DLHS has now been discontinued.

Table 2 presents the availability of SDG related morbidity indicators at disaggregated level. Majority of the morbidity indicators are available at national and state level through large-scale surveys. NFHS is an effective source for some selected morbidities such as HIV/AIDS and TB since questions are designed to estimate the prevalence of these diseases. DLHS, IHDS and NSSO also collected information on diagnosed morbidity. But surveys rely on reports by survey respondents (lay reporting) rather than by professionals and thus morbidity incidence/prevalence based on these surveys may not be correctly estimated. These indicators are also not available at district or below-district level. Further, as there is seasonality in incidence of some diseases, prevalence on the survey date or in a reference period (usually two weeks) prior to the survey may not give an accurate representation of the average prevalence level. Surveys with several rounds spread over the year can address seasonality and this was done in some rounds of the NSS but not in other surveys. As noted earlier, estimates based on reported incidence from the system suffer from incompleteness of coverage. Unless notification becomes universal, these are bound to underestimate the true incidence. Compliance of the private health sector to the requirement of notification is essential but difficult to achieve.

Most of the healthcare service utilisation indicators are available at the district level and by socio-economic characteristics within states from various surveys (See Table 3) and can be obtained within districts for large groups from the unit level data. In particular, most surveys capture information on maternal and child healthcare quite comprehensively. Unmet need for family planning is also estimated in the NFHS, DLHS, and AHS, though the criteria for ascertaining met needs have varied. Though estimates of adolescent birth rates are also available, the relative sampling errors can be large for this, given the small number of women in this age group. On the number of workers in the health sector, data are available from the Census, but as the Census is decennial, recent changes cannot be assessed. Government reports give the number of health workers in the public sector but it is difficult to get information on the number in the private sector which provides a major portion of curative services. The professional registries could serve the purpose provided these are updated regularly. Moreover,

there is no information from nationally representative surveys/Census on proportion of the population with access to affordable medicines and vaccines on a sustainable basis and on substance abuse.

Table 3: Availability of SDG Indicators on service availability, utilisation, reproductive health, and substance use at disaggregated level, India

Indicators	Sources of Data	Periodicity	Reference period	Lowest Geographical disaggregation	Availability of indicator for socioeconomic groups	Availability of Individual data	Comment
3.1.2 Proportion of births attended by skilled health personnel	NFHS 1, 2,3 & 4	Not regular	2-3 years prior to survey	State/District	Yes, for states	Yes	Relative sampling error is large below state level
	DLHS* 2, 3, 4	"	"	"	"	"	"
	AHS*	Yearly	"	"	Yes	"	Only 9 states covered
3.7.1 Proportion of women of reproductive age (aged 15-49 years) who have their need for family planning satisfied with modern methods	NFHS 1, 2, 3 & 4	Not regular	2-3 years prior to survey	State/District	Yes, for states	Yes	Relative sampling error is large below state level
	DLHS* 2, 3, 4	"	"	"	"	"	"
	AHS*	Yearly	"	"	Yes	"	Only 9 states covered
3.7.2 Adolescent birth rate (aged 10-14 years; aged 15-19 years) per 1,000 women in that age group	NFHS 1, 2,3 & 4	Not regular	2-3 years prior to survey	State/District	Yes, for states	Yes	Large relative sampling error
	DLHS* 2, 3, 4	"	"	"	"	"	"
	AHS*	Yearly	"	"	Yes	"	Only 9 states covered
3.8.1 Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population)	NFHS 1, 2, 3 & 4	Not regular	2-3 years prior to survey	State/District	Yes, for states	Yes	Reliable for maternal and child health care
	DLHS* 2, 3, 4	"	"	"	"	"	"
	NSSO	"	"	State	"	"	Relative sampling error is large below state level
	AHS*	Yearly	"	District	Yes	"	Only 9 states covered

Indicators	Sources of Data	Periodicity	Reference period	Lowest Geographical disaggregation	Availability of indicator for socioeconomic groups	Availability of Individual data	Comment
3.8.2 Number of people covered by health insurance or a public health system per 1,000 population	NFHS 4	Not regular	Survey period	State/District	Yes, for states	Yes	Relative sampling error is large below state level
	NSSO	"	"	State	"	"	-
	IHDS	"	"	"	"	"	-
3.a.1 Age-standardized prevalence of current tobacco use among persons aged 15 years and older	NFHS 4	Not regular	Survey period	State/District	Yes, for states	Yes	Relative sampling error is large below state level
3.b.1 Proportion of the population with access to affordable medicines and vaccines on a sustainable basis	No Data	-	-	-	-	-	-
3.c.1 Health worker density and distribution	Census	10 Years	Census year	District; below district	No	No	Late release of Census data on occupation
	DLHS Facility Survey 2, 3, 4	Not regular	At the time of survey	District	Yes	Yes	Reliable but covers only public service providers
	Professional Registries	Any time	Continuous	District; below district	Yes	Not publicly available	May not be updated for deaths, migration etc.
3.5.1 Coverage of treatment interventions(pharmacological, psychosocial and rehabilit ation and aftercare services) for substance use disorders	No Data	-	-	-	-	-	-
3.5.2 Harmful use of alcohol, defined according to the national context as alcohol per capita consumption (aged 15 years and older) within a calendar year in litres of pure alcohol	No Data	-	-	-	-	-	-

*: The DLHS and AHS have now been discontinued.

Table 4 presents the availability of SDGs' nutrition indicators at disaggregated level in India. As is clear from the table, India has anthropometric measures of nutrition available from NFHS and DLHS at district level and by socio-economic characteristics for states. The recent Rapid Survey on Children (RSOC) also provides state-level estimates and some socioeconomic differentials. So far, no large surveys have included questions related to Food Insecurity Experience Scale (FIES). In the past, the National Nutrition Monitoring Bureau (NNMB) also collected data on nutritional status and intakes. But the surveys were not regular and covered some states and that too for rural or tribal areas and the NNMB has now been phased out. The NSS consumer expenditure surveys provide data on food consumption at the household level but not at the individual level.

Table 4: Availability of SDG nutrition indicators at disaggregated level, India

Indicators	Sources of Data	Periodicity	Reference period	Lowest Geographical disaggregation	Availability of indicator for socioeconomic groups	Availability of Individual data	Comment
2.1.1 Prevalence of undernourishment; 2.2.1 Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age, and 2.2.2 Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight)	NFHS 1, 2,3 & 4	Not regular	Survey point	State/District	Yes, for states	Yes	Relative sampling error is large below state level
	DLHS*1, 2, 4	”	”	District	”	”	”
	RSOC	”	”	State	”	No	”
2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)	No data	NA	NA	NA	NA	NA	NA

*: The DLHS has now been discontinued.

Safe drinking water and availability of sanitation have a direct bearing on health. Indicators on the availability of safe drinking and toilets as well as on fuel used for cooking are available from the Census and various surveys (See Table 5). The Census is a useful source and allows disaggregation to the village and urban ward level but given its decennial nature, tracking changes between censuses is not possible. The SRS baseline survey gives state-level estimates but this is also conducted only once in 10 years. Various surveys capture these indicators quite well but tracking requires maintaining regular periodicity in surveys.

Table 5: Availability of SDG indicators on water supply, sanitation, and fuel for cooking at disaggregated level, India

Indicators	Sources of Data	Periodicity	Reference period	Lowest Geographical disaggregation	Availability of indicator for socioeconomic groups	Availability of Individual data	Comment
	Census 2011	Decennial	Survey point	Village, urban ward	No	Yes (5 % sample)	Available only once in 10 years
6.1.1 Proportion of population using safely managed drinking water services	NFHS, 1, 2, 3; 4	Not regular	Survey point	State; rural urban	Yes, for states	Yes	Relative sampling error is large below state level
6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water @	DLHS* 1, 2, 3, 4	Not regular	Survey point	District	Yes, at state level	Yes	„
7.1.2 Proportion of population with primary reliance on clean fuels and technology $	AHS *	Yearly	Survey point	Only EAG states and Assam 's districts	No	Yes	Only nine states covered
	NSS 68th, 69th rounds	Not regular	Survey point	State; rural, urban	No	Yes	Relative sampling error is large below state level
	SRS baseline survey 2014	Decennial	Survey point	State; rural, urban	No	No	Available only once in 10 years

@: The sources refer to access to toilet. $: The sources refer to fuel used for cooking.
*: The DLHS and AHS have now been discontinued

WHAT STRATEGY DOES INDIA NEED TO TRACK PROGRESS IN SDGS?

It is clear from the previous section that most of the SDG-related indicators either cannot be generated at all or are not available at appropriate level of disaggregation in the current population and health statistics. Some of the mortality indicators are available from surveys and sample registration at the state level, but estimates at lower geographic levels suffer due to large relative sampling errors. Complete coverage of deaths under civil registration would have enabled computation of indicators at district and even lower levels. Besides, indicators for socioeconomic groups are either not available at the district level or can be obtained only for large groups; for smaller groups, sampling errors become too large to detect differentials. The same holds true for indicators of reproductive health. Morbidity indicators obtained from surveys are normally based on lay reporting, bringing their validity into question. Inability to achieve completeness of reporting of diagnosed morbidity has been a major handicap. The existing notification systems are not well-equipped to ensure reporting by the private sector—which happens to play a major role in curative treatment. Healthcare utilisation indicators are available from surveys but lack of regular intervals of the surveys has been a hindrance for the continuous tracking of SDGs. Indicators on nutritional status of children have been well captured in various surveys but again, at lower than state geographic level and for socioeconomic groups, sampling errors are large. The Census does give detailed information on WASH indicators but there is expected to be only one more Census (in 2021) before 2030 if the decennial system is followed and the indicators derived from surveys face the deficiencies noted earlier. Given these shortcomings of the existing data systems to yield trackable SDG indicators, it is essential to find ways to improve the existing systems not only by fine-tuning and expanding these but also to introduce innovations. The following sections discuss four strategies to improve the population and health statistics in India.

A) Immediate emphasis on Civil Registration System

A complete registration of vital events in a country goes much beyond the narrow objective of data availability for demographers or statisticians. Indeed, it is a matter of *right of* the citizens. Detailed knowledge on birth, marriage and deaths at local level has become an essential part of contemporary societies and about 96 countries around the world have complete coverage of death registration.[16] There has been improved death registration coverage in some countries which had poor coverage in the past. For example, death registration in South Africa increased from 50 percent in 1990 to 90 percent in 2014 and in Turkey, from 50 percent in 2007 to 85 percent in 2013.[17] How many decades will India take to achieve complete civil registration and be part of modern world?

The advantage of CRS over surveys is that it gives scope for continuous assessment even at district, parliamentary, or subdivision level. The relevance of CRS is everlasting even if priorities are changed. For example, India still has a high level of under-five mortality and thus the focus of the government is on estimating under-five deaths. After a few years, under-five mortality is expected to reduce substantially and government may focus more on accidental deaths due to road traffic or adolescent deaths due to suicide. It is, therefore, imperative for the government to ensure universalisation of civil registration in the best interests of planning and execution, at local level for now and for the future. A complete CRS will be the solution for not just SDG indicators but also other countless health and civic issues.

A complete coverage of the CRS in India can be obtained through a strong political will combined with a budget allocation to strengthen the system by a) training and monitoring at appropriate interval, b)appointing part-time enumerator at village level and full-time coordinator at the district level to coordinate the work of enumerators and provide guidance and continuous feedback to the enumerators, and c) compilation of data through a technology-driven programme.

According to the most recent report of the CRS, 11 states/UTs (all southern states, Haryana, Mizoram, Nagaland and Punjab) of India have 100-percent coverage; another 11 states/UTs have 80-99-percent coverage; 10 states/UTs have 50 to 80-percent coverage; the other four states (Arunachal Pradesh, Bihar, Assam and Uttar Pradesh) have below-50-percent coverage of death registration.[18] Excluding Bihar and Uttar Pradesh (which have poor death registration coverage), death registration rises to 85 percent. Thus, a rigorous campaign along with the above mentioned measures particularly in poor performing states would increase death registration substantially, leading to availability of mortality data at local level. Besides, even in states which appear to show good coverage, registration of infant deaths is poor and special efforts are required to ensure that all deaths get registered.

Since only 40 percent of the deaths in India occur at home,[19] appropriate low-cost technology driven methodology needs to be used for assigning causes of death through verbal autopsy method. With incredibly faster mobile penetration and the government's mission on 'Digital India', one possible solution may be to develop smartphone applications on registration of vital events.

B) Modification of existing surveys in the light of SDG indicators

From the above analysis, it is clear that all large surveys provide valuable inputs for morbidity level and healthcare service utilisation. Yet, these remain inadequate to calculate indicators at small geographical area or population sub-groups due to large sampling errors. The surveys are also not conducted at regular intervals due to lack of funding or government support. Also, the morbidity indicators in these surveys are not as appropriate as desired.

In order to track the morbidity, nutrition, and healthcare indicators in India, it is important to conduct multi-purpose surveys at regular intervals. For this purpose, strong and long-term commitment from stakeholders, particularly from government and other funding agencies, is essential. It has been proposed that the NFHS will be conducted every three years to

produce district-level data that are comprehensive and robust. At the same time, some other large surveys such as DLHS and AHS will be discontinued. This is a welcome step since too many surveys with similar objectives lead to duplication and redundancies.

It is worth remembering that India lacks longitudinal (state/district level) data; therefore designing NFHS as a longitudinal survey will be adding value for precise evaluation of policies and programmes even at district level. Since FIES information is not available in current NFHS, questions on this should be included in the future rounds. Also, the indicators related to universal health coverage especially those on access to essential medicines and vaccines, financial protection/ health financing, Human Resources and International Health Regulations have to be collected more systematically.

One may raise the question of whether NSSO should continue to collect data on health when the NFHS gives district level indicators. Definitely, NSSO should continue to collect information on health and nutrition since the principal purpose of NSSO is to estimate consumption patterns. Consumption on health is an important component of social consumption and no other survey collects health expenditures in detail. Also, having another independent large-scale survey will give a scope to reconfirm the quality of data in NFHS and NSSO at district level. To facilitate analysis, NSSO data for public use should be organised in a more user-friendly format. In addition, NSSO's state samples should be pooled with central samples to allow deeper analysis at below NSSO regions. Besides, meticulous planning of survey instruments is needed in the light of SDG indicators. It is also important to use internationally accepted definitions of morbidity or disability in these surveys.

C) Strengthening the HMIS and Surveillance systems

The quality of HMIS and IDSP data can be improved through a set of measures such as increasing financing, infrastructure, human resources, proper training and independent monitoring at ground level. A recent detailed study[20] on surveillance system of chronic diseases also

recommended recruiting additional community health workers, inter-sectorial convergence and commitment of programme officials, managers and technical staff to improve efficiency of surveillance system. Both these data sets also need to give information on the size of the exposed population at facility level. The main challenge, however, is to obtain data from the private sector, which caters to healthcare demands of majority of Indian population. Some recent efforts in engaging the private sector in data sharing show promise.[21]

D) Application of techniques of indirect estimation

Often, defects such as incompleteness or errors in data sources prevent accurate estimation of indicators. This has been well recognised in literature and demographic techniques have been developed to estimate measures indirectly. The most common method is to estimate child mortality from questions on children ever born and surviving (Brass type methods). The data from the census have in the past been used for this purpose and these allow estimation for small geographic units as well as for socioeconomic classes. Though such estimation is possible only once in 10 years since the Indian Census is decennial, the information is massive and valuable. This calls for the Census organisation to tabulate the data soon after the enumeration and release the data for public use. India's Census organisation has made some efforts to provide access to unit level data with adequate safeguards for maintaining confidentiality and these should be taken forward.

The second set of methods to estimate adult mortality or maternal mortality rate at small geographical areas are based on information of survivorship of close relatives such as husband/wife (Widowhood method); sisters (Sisterhood method) parents (Orphanhood methods), and others. The application of these methods needs very few but appropriate questions at census or surveys.[22] Those questions should be included in Census or at the very least, in NFHS to cross-examine the quality of mortality data as well as for indirect estimation at small geographical area. Moreover, methods of

small area estimation can be employed to obtain indicators for small areas such as districts when the sample sizes are small.

CONCLUSION

High-quality, open, and transparent data are essential for creating a democratic, accountable system and for measuring success. Collecting accurate health and nutrition statistics at small geographical areas or for small population sub-groups is essential to improve the people's overall health and well-being. Given the inability of the existing systems to provide complete enumeration of vital events and morbidity incidents, India introduced several sets of surveys to meet immediate requirements of planning and programmes. These surveys have the limitation of small sample (and consequently large sampling error) or lack of coverage of specific items. Therefore, surveys cannot give mortality indicators at district level or for all age groups. Even if NFHS 4 gives district level indicators, it must be noted that 70 percent of districts in India have populations of more than a million. Further, there is huge diversity within districts by class, caste, geography and religion. Thus for a big and diverse country like India, a complete coverage is the only long-term sustainable solution. If CRS can achieve completeness of coverage in the near future and notification of morbidity becomes universal, large-scale surveys can focus more on other health indicators, which can be obtained with the relatively smaller sample at lower geographic levels.

Various systems in India do collect a huge amount of data on health and though there are inadequacies as pointed out above, it must also be recognised that the data are not being fully utilised. A limitation is that much of the data are not in the public domain and the users can only access the indicators provided in the published reports; surveys such as the NFHS, the DLHS, the NSS and the IHDS are notable exceptions. If the SRS data could be made available to researchers, taking care to protect the identity of respondents, it will be possible to obtain a number of indicators at low geographic levels and for socioeconomic groups. Of course, the users must be aware of sampling errors and use the indicators with caution. Similarly,

the data on causes of death could also be released in the public domain in a similar manner so that users can make the best of the available information.

There is also a need to strengthen the human resource component of the organisations involved in collection and compilation of data. Studies show that qualified health force in India is just one fourth of the WHO norm. According to a study based on the 2001 Census, the density of all doctors (allopathic, ayurvedic, unani, siddha, and homeopathic) in 2001 was 80 per 100,000 population and the density of nurses was 61 per 100,000 population. The ratios vary substantially by states and place of residence and are generally much lower than WHO prescribed norms. Burdening the health professionals with data collection and maintenance will cause the further deterioration of the situation and thus additional professionals need to be engaged for this work. Biostatisticians and demographers must be an integral part of the Census, CRS, SRS, NSS, and various surveys on health and nutrition. The professionals engaged in such organisations should also be assisted to upgrade their capabilities and get acquainted with best practices elsewhere in the world.

Finally, a national follow-up committee for these strategies should be formed to improve the data systems related to SDGs. In this direction, setting up a national data bank at the Office of Registrar General of India will be helpful to serve as a synchronising data platform for all major data sets in India.

Tracking the SDGs is a vital need and undoubtedly an onerous task. The present systems of data are clearly inadequate to provide India with the indicators required at the levels needed. No quick-fix solutions exist; rather, concerted efforts in various directions are required, if India's statistical systems are to help the country track its progress towards achieving its development goals. ORF

APPENDIX

A1. Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Targets	Indicators
2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round	2.1.1 Prevalence of undernourishment
	2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)
2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons	2.2.1 Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age
	2.2.2 Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight)

A2. Goal 3. Ensure healthy lives and promote well-being for all at all ages

Targets	Indicators
3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births	3.1.1 Maternal mortality ratio
	3.1.2 Proportion of births attended by skilled health personnel
3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births	3.2.1 Under-five mortality rate
	3.2.2 Neonatal mortality rate
By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	3.3.1 Number of new HIV infections per 1,000 uninfected population, by sex, age and key populations
	3.3.2 Tuberculosis incidence per 1,000 population
	3.3.3 Malaria incidence per 1,000 population
	3.3.4 Hepatitis B incidence per 100,000 population
	3.3.5 Number of people requiring interventions against neglected tropical diseases
3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease
	3.4.2 Suicide mortality rate
3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	3.5.1 Coverage of treatment interventions (pharmacological, psychosocial and rehabilitation and aftercare services) for substance use disorders
	3.5.2 Harmful use of alcohol, defined according to the national context as alcohol per capita consumption (aged 15 years and older) within a calendar year in litres of pure alcohol
3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents	3.6.1 Death rate due to road traffic injuries
3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programs	3.7.1 Proportion of women of reproductive age (aged 15-49 years) who have their need for family planning satisfied with modern methods
	3.7.2 Adolescent birth rate (aged 10-14 years; aged 15-19 years) per 1,000 women in that age group
3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	3.8.1 Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population)
	3.8.2 Number of people covered by health insurance or a public health system per 1,000 population

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	3.9.1 Mortality rate attributed to household and ambient air pollution
	3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)
	3.9.3 Mortality rate attributed to unintentional poisoning
3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate	3.a.1 Age-standardized prevalence of current tobacco use among persons aged 15 years and older
3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all	3.b.1 Proportion of the population with access to affordable medicines and vaccines on a sustainable basis 3.b.2 Total net official development assistance to medical research and basic health sectors
3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States	3.c.1 Health worker density and Distribution
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks	3.d.1 International Health Regulations (IHR) capacity and health emergency Preparedness

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