

Assessment of NSS data on morbidity: Is incidence appropriate for estimating the burden of disease?

Shewli Shabnam*¹ and Nandita Saikia²

Abstract: The aim of this study is to check the quality of morbidity data in two nationally representative sample surveys and their implication in estimating the burden of disease. We have analysed the reported morbidity data of NSS Round 60 (collected in 2004) and Round 75 (collected in 2017-18). We have checked the internal consistency of data by applying mathematical relationships. We found inconsistency between the reported status of ailment and the duration of ailment and between the life table estimates of the duration of ailment and the implied duration derived by mathematical relationship. The incidence approach is unsuitable in determining Years Lost due to Disability (YLD) using NSS data.

Introduction

According to the Commission on Social Determinants of Health (CSDH), the level of development of any society “can be judged by the quality of its population’s health, how fairly health is distributed across the social spectrum, and the degree of protection provided from disadvantage as a result of ill-health” (Commission on Social Determinants of Health, 2008, Para. 3). The fundamental requirement for this kind of analysis is the empirical statistics on health. Conventionally, we use infant mortality rate (IMR), under-five mortality rate (U5MR), and life expectancy at birth to understand the health status of the population. In the 20th century, a steady decline in mortality rates in industrial countries called for a serious re-examination of how we should measure health. It was observed that the increase in life expectancy was primarily caused by the mortality reductions from non-communicable diseases at older ages. Consequently, public health researchers became very concerned about the rise in chronic diseases and emphasised that morbidity conditions should be adequately reflected in health policy and setting priorities. These issues led to the development of “Summary Measures of Population Health (SMPH) that combines both mortality and morbidity data to represent overall population health as a single number” (Field and Gold, 1998, p. 4). Disability-Free Life Expectancy (DFLE), Active Life Expectancy (ALE), Disability-Adjusted Life Year (DALY) are some of the popular SMPH. As the life expectancy in India has reached 70 years and the burden of chronic diseases is also increasing with the growing elderly population, many researchers are using SMPH to depict the health status of India.

Most health measures are based on incidence rates or prevalence rates. While the incidence is the rate at which new events (e.g., ailments or deaths) occur in a population in a defined time period, the prevalence refers to the proportion of existing cases (rather than new cases) at a certain point in time

* Corresponding author

¹ Assistant Professor, Department of Geography, Bidhannagar College, Kolkata -700064, West Bengal, India. Email: shewlijnu@gmail.com

² Professor in Public Health and Mortality Studies, International Institute for Population Sciences, Mumbai – 400088, Maharashtra, India. Email: nanditasts@gmail.com

(known as point prevalence, say on the day of survey) or within a specific time period (known as period prevalence, say for a specific year) (Abramson, 2004).

Dempsey (1947), for the first time, proposed that premature mortality should be measured in units of time lost. The burden of disease in terms of DALY is also measured in terms of units of time lost. DALY combines 'healthy' Years Lost due to Disability and Years of Life Lost due to premature mortality. The mortality component of DALY entails the incidence perspective, as the death rate is an incidence rate. In contrast, both incidence and prevalence measures can be used to quantify morbidity. To calculate the aggregate time lived with a disability, one may use point prevalence measures of disability, adjusting for seasonal variation if present, and estimate the total time lived with the disability as prevalence *times* one year. Alternatively, one can measure the incidence of disabilities and the average duration of each disability; then, incidence *times* duration provides the total time lived with disability (Mathers et al., 2001). The Global Burden of Disease Study (GBDS) applies the incidence perspective for three reasons: "First, the method of calculating time lived with disability is more consistent with the method for calculating time lost due to premature mortality. Second, an incidence perspective is more sensitive to current epidemiological trends. Third, measuring incidence or deriving it from prevalence data and information on case-fatality and remission rates imposes a level of internal consistency and discipline that would be missing if prevalence data were used uncritically" (Murray and Lopez, 1996, p. 9).

Following the GBD study, we may consider applying the incidence perspective to estimate the Years Lost due to Disability (YLD) for the population of India. But before using the incidence perspective, we need to assess the quality of the data to check if consistency exists among incidence, prevalence, and duration of ailments and if incidence and duration of ailments can be used for this study.

Materials and methods

Our analysis is based on the 60th Round (January 2004 - June 2004) and the 75th Round (July 2017- June 2018) of the National Sample Survey (NSS) conducted in India. Information on the incidence rate and prevalence of diseases/conditions is available from both rounds. The morbidity and health care schedule (25.0) of the NSS Round 60 and the household social consumption on health schedule (25.0) of the 75th Round collected data about the 'spells of ailment' of household members during 15 days before the survey. In the 60th Round, information was collected up to five spells of ailment. After restructuring the data, we get the number of persons who reported at least one spell of ailment as 36510. Among them, the number of persons who reported to have experienced the second, third, fourth and fifth spell of ailment was 1889 (5.17 per cent), 347 (0.95 per cent), 49 (0.13 per cent), and 8 (0.02 per cent) respectively.

The 75th Round of NSS collected data up to eight spells of ailment. The restructured data shows that 39902 persons reported at least one spell of illness. Among them, the number of persons who

reported to have experienced the 2nd, 3rd, 4th, 5th, 6th, 7th, and 8th spell of ailment was 2648 (6.1 per cent), 550 (1.3 per cent), 107 (0.2 per cent), 25 (0.1 per cent), 5 (0.0 per cent), 2 (0.0 per cent) and 1 (0.0 per cent), respectively. Of those who suffered from any ailment within the reference period, 94.83 per cent suffered from only one spell of ailment in the 60th Round, and 93.36 per cent experienced only one spell of ailment in the 75th Round. While analysing both the 60th and the 75th Rounds of NSS data on morbidity, we have restricted our study to the first spell of ailment as most suffered from only one spell of illness in the reference period.

In both Rounds of the survey, questions were asked on the ‘nature of the ailment’, ‘status of ailment’, and ‘total duration of ailment’. During the survey, answers of the respondents on nature of ailment were recorded in coded form (e.g., Diarrhoea/ dysentery - code 01, in the 60th Round of NSS). Information on 40 types of diseases is available from the NSS Round 60. Besides, there are two more categories – ‘other diagnosed ailments’ and ‘other undiagnosed ailments’ (National Sample Survey Organization, 2006). The 75th Round of NSS provided 58 types of reported diagnosis and/or main symptoms (including ‘childbirth’) along with two additional categories – ‘symptom not fitting into any of the above categories’ and ‘could not even state the main symptom’ (National Statistical Office, 2019). However, following the official report of the 75th Round of NSS on health, we did not consider childbirth as an ailment because childbirth is a physiological process. All data on morbidity were reported data, not medically certified/tested.

The answers on the status of ailment in terms of the time of initiation and time of end/continuation till survey date has been grouped into four categories. These are:

Status 1: started more than 15 days ago and is continuing (on survey date)

Status 2: started more than 15 days ago and has ended (before survey date)

Status 3: started within 15 days and is continuing (on survey date)

Status 4: started within 15 days and has ended (before survey date)

Status 1 and 3 of any ailment are used to estimate point prevalence, and status 3 and 4 of any ailment have been used to calculate incidence. In our analysis, the incidence rate has been calculated as:

Incidence rate = (Number of persons reporting initiation of any ailment in the reference period of 15 days preceding the date of survey/ Total population) *100,000

The prevalence rate (point prevalence at the time of the survey) has been calculated as:

Prevalence rate = (Number of persons reporting any ailment at the time of survey/ Total population) *100,000

The answers of the respondents on the total duration of ailment were recorded in days. In the present analysis we have also computed average duration of ailments following the life table technique as given by Lee (1993). The life table model of Lee was based on both complete data (e.g. the number of deaths) and incomplete data (e.g. the number of patients lost to follow-up). In the present analysis

duration of an ailment that ended during the period of 15 days (whether it started more than 15 days ago or within 15 days) is complete observation, and the duration of an ailment continuing on the survey date is a censored observation. With the help of the above information, the average duration of each ailment can be estimated.

The column headings of the life table are given below:

1. Duration ($t_i - t_{i+1}$): The first column gives the duration/interval into which the censored or complete observations are distributed. $i = 0, 1, 2, 3, \dots, n$. The last interval is open.
2. Midpoint (m_i): Midpoint of the time period is calculated as $(t_i + t_{i+1})/2$.
3. Width (w_i): The width of each duration is $(t_{i+1} - t_i)$, and for the last interval, it is $t_k = \infty$.
4. Total observations (O_i): Number of persons reporting ailment with duration at the i^{th} interval.
5. Censored observation (E_i): Number of persons who reported that their ailment was continuing at the i^{th} interval. It is calculated by adding persons with status 1 and status 3. In Lee's life table survival analysis, this is similar to the number of individuals who are lost to observation and whose survival status is thus unknown in the i^{th} interval.
6. Complete observation (F_i): Number of persons who reported that their ailment had ended at the i^{th} interval. It is calculated by adding persons with status 2 and status 4. In the life table survival analysis of Lee, this is similar to the number dying in the i^{th} interval.
7. Number entering interval (G_i): The number of individuals entering the first interval is the total sample size. Other entries are determined as $G_{i+1} = (G_i - E_i - F_i)$.
8. Number exposed to risk (H_i): It is the number of individuals exposed to risk at the i^{th} interval. It is assumed that individuals continuing in the interval are exposed to the risk of ending for one-half the interval. $H_i = G_i - (E_i/2)$.
9. Conditional proportion ending: It estimates the conditional probability of ending illness in the i^{th} interval and is calculated as F_i/H_i .
10. Conditional proportion continuing (P_i): $1 - (F_i/H_i)$. Similar as conditional proportion surviving.
11. Cumulative proportion continuing (C_i): It is similar to cumulative survival rate, and the radix is 1. Other entries are determined as $C_{i+1} = (C_i * P_i)$.
12. $C*w$: As interval is not equal, it is necessary to multiply C (cumulative proportion continuing) with w (width). $\sum C*w$ gives the average duration of illness. If we want to estimate the average duration of illness taking the cut off as 15 days, then following the rule of trapezium, the formula will be written as:

$$0.5 * (C_0 + C_{15}) + \sum_{i=1}^{14} C_i * w_i$$

Results

(a) Inconsistency between “ailment status” and “duration of ailment”

We have estimated the incidence, point prevalence, and period prevalence for each disease using the information on the duration of illness and the status of illness. Ideally, the reported “status of ailment” should match with the “duration of ailment”. However, we have identified discrepancies in reporting these two variables in our analysis of the 60th Round of NSSO data. For example, in the case of diarrhoea/dysentery, it was found that 145 persons who reported their ailment status as 1 (and hence, the duration must obviously be more than 15 days), 58 persons also said their duration of illness was 15 days or less (Table 1). We find that except under-nutrition, a similar discrepancy where the ailment status does not match the duration of ailment exists for all other diseases. Similarly, we notice that there are a few cases who reported their status as 3 (started within 15 days and is continuing) or 4 (started within 15 and has ended) but the duration of illness as more than 15 days. For example, in Table 1, 1321 respondents stated their status as 3 or 4 (and hence, the duration must be less than 15 days), but 9 persons (4+3+1+1) also reported their duration of illness more than 15 days.

As a corrective measure, we may take any of the following two steps: (a) all the cases of status 1 (started more than 15 days ago and is continuing) can be considered as more than 15 days duration without specifying the exact duration. For example, suppose there are 7 cases where the duration of ailment is reported as 4 days and status as 1. In that case, these 7 persons will be counted under status 1. (b) A household member whose duration of ailment was 15 days or less but ailment status was reported as status 1 (started more than 15 days ago and is continuing), can be considered under status 2 (started more than 15 days ago and has ended). For example, if there are 7 cases where the duration of ailment is reported as 4 days and status as 1, these 7 cases will be shifted to status 2, and the duration of illness will remain 4 days.

Interestingly, a mismatch between the status and duration of ailments was also observed in the 75th Round of NSS data. For example, Table 2 shows a discrepancy between reported status and duration of heart disease. It is found that 287 persons reported their status as 1 (so, the duration should be more than 15 days), but 35 of them also said their duration of illness was 15 days or less. In the 75th Round of NSS data, apart from seven types of diseases/reported diagnoses (HIV/AIDS, other sexually transmitted infections, other metabolic and nutritional diseases including obesity, decreased hearing, poisoning, intentional self-harm, and assault), similar discrepancy where the status of ailment did not match with the duration of ailment was found for all other diseases/conditions. Besides, a few respondents stated their status as 3 or 4 but the duration of illness as more than 15 days. For example, in Table 2, among 2021 respondents who reported their status as 3 or 4 (and hence, the duration must obviously be less than 15 days), 4 persons also stated their duration of illness was more than 15 days.

Table 1: Cases of Incidence, point prevalence and period prevalence of diarrhoea /dysentery, NSS, 2004

Duration (in days)*	**Status of illness				Period prevalence	Point prevalence	Incidence
	1	2	3	4	1+2+3+4	1+3	3+4
1	1	4	13	38	56	14	51
2	3	19	51	195	268	54	246
3	2	30	48	241	321	50	289
4	7	37	44	151	239	51	195
5	7	23	39	130	199	46	169
6	3	11	27	62	103	30	89
7	7	11	26	59	103	33	85
8	2	12	20	39	73	22	59
9	0	1	4	5	10	4	9
10	4	12	38	34	88	42	72
11	0	2	2	5	9	2	7
12	2	1	8	5	16	10	13
13	0	1	0	2	3	0	2
14	1	4	3	3	11	4	6
15	19	11	14	6	50	33	20
1-15	58	179	337	975	1549	395	1312
16-30	50	18	2	2	72	52	4
31-60	16	4	1	2	23	17	3
61-180	7	0	1	0	8	8	1
>180	14	1	1	0	16	15	1
Total	145	202	342	979	1668	487	1321

Source: Computed from unit level data of NSS, Round 60, 2004

Note: Persons with age over 100 years has not been considered (<0.1 per cent of persons were reported to be over 100 years)

*Persons with missing duration are not included (<1 per cent of the sample)

**Status 1= Started more than 15 days ago and is continuing

Status 2= Started more than 15 days ago and has ended

Status 3= Started within 15 days and is continuing

Status 4= Started within 15 and has ended

Table 2: Cases of Incidence, point prevalence and period prevalence of heart disease, 2017-18

Duration (in days)	*Status of illness				Period prevalence	Incidence	Point Prevalence
	1	2	3	4	1+2+3+4	3+4	1+3
1	0	0	8	11	19	19	8
2	0	25	53	139	217	192	53
3	0	44	107	284	435	391	107
4	0	30	83	233	346	316	83
5	0	39	93	277	409	370	93
6	0	18	61	118	197	179	61
7	0	26	98	126	250	224	98
8	1	10	47	53	111	100	48
9	0	2	11	12	25	23	11
10	1	18	50	67	136	117	51
11	0	2	3	4	9	7	3
12	0	10	19	16	45	35	19
13	0	3	3	1	7	4	3
14	0	1	5	3	9	8	5
15	33	8	27	5	73	32	60
1-15	35	236	668	1349	2288	2017	703
16-30	79	23	2	1	105	3	81
31-60	30	3	0	0	33	0	30
61-180	29	0	1	0	30	1	30
>180	114	0	0	0	114	0	114
Total	287	262	671	1350	2570	2021	958

Source: Computed from the unit level data of NSS, Round 75, 2017-18

Note: *Status 1= Started more than 15 days ago and is continuing

Status 2= Started more than 15 days ago and has ended

Status 3= Started within 15 days and is continuing

Status 4= Started within 15 and has ended

The number of cases showing the mismatch between the reported “status of ailment” and the “duration of ailment” is lower in the 75th Round than the 60th Round of NSS, particularly in the case of incidence. In the 75th Round, the highest number of cases for any ailment, where the respondents reported their status as 1, but the duration 15 days or less, was 102 (for all other fevers including typhoid, fever with rash/eruptive lesions and fevers of unknown origin). In the 60th Round, the highest case of similar mismatch was 299, observed for ‘other diagnosed ailments’.

In the 75th Round, the maximum number of erroneous cases where the respondents stated their status as 3 or 4 but the duration as more than 15 days was only four (found in case of heart disease). In contrast, analysing the 60th Round of NSSO data, we found that the number of cases where the respondents stated their status as 3 or 4 but the duration as more than 15 days was as high as 77 for the category ‘other diagnosed ailments’. Also, 51 cases of a similar type of mismatch were recorded for disorders for joints and bones.

(b) Inconsistency in reported morbidity by sex

During the computation of prevalence or incidence rate, the denominators for prostatic disorders and gynaecological disorders should be total male and female populations, respectively. We have found that in the NSSO report (Report no. 507, Table 39, Appendix A, A-164), cases of gynaecological disorders are shown among males and prostatic disorders among females, and the denominator has been taken as total population (male + female) for these two ailments which are incorrect. We have reproduced some portion of a Table from the NSSO report (Report No. 507) to highlight the above-mentioned facts (Table 3).

Table 3: Selected data reproduced from Table 39, NSS Report No. 507

All-India				Rural + Urban				
Broad ailment type	Incidence rate of ailment during last 15 days			Average duration of ailment in days (0.0)			Persons reporting onset of ailment during last 15 days	
	male	female	persons	male	female	persons	estd. no. (00)	Sample
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
...
heart disease	18	21	19	66.4	113.6	91.0	1863	120
Hypertension	39	65	52	230.6	132.0	169.8	4961	200
...
prostatic disorders	3	1	2	22.3	6.5	18.6	190	12
gynaecological disorder	3	64	32	2.0	17.2	16.6	3124	148
...
Disability Speech	2	0	1	999.0	0	999.0	90	2
...
sample persons	196699	188356	385055	x	x	x	x	x

The report, “Key Indicators of Social Consumption in India: Health”, based on the 75th Round of NSS, did not provide the disease-specific tables for males and females. Therefore, we cannot check

if there is any inconsistency in reported morbidity by sex. However, while estimating the prevalence and incidence rates using the 75th Round of NSS data, we are careful enough to consider only the total female population as the denominator for the reported diagnosis of ‘pregnancy with complications before or during labour (abortion, ectopic pregnancy and hypertension)’ and ‘complications in mother after birth of child’.

(c) Inclusion of dead individuals in the calculation of incidence rates

While calculating the incidence rate, we have not considered the household members who died in the last 365 days because the question ‘whether ailing anytime in the last 15 days’ is related to household members only. Dead persons are not counted as present household members. However, the NSSO report shows that the household members who died in the last 365 days have been included in the denominator for calculating incidence rates (e.g. Table 39, Appendix A, A-165 of Report no. 507). The sample size of such persons was 1717, and the total sample size including such persons was 385055. Therefore, there are slight differences in incidence rates between the NSSO report and our estimation. The inconsistency that the dead individuals were included in the calculation of incidence rates was detected from the sample size used in the denominator for calculating the incidence rate provided in the report. Surprisingly, the information on sample size used to calculate the incidence rate is not available in the health report of the 75th Round of the National Sample Survey.

(d) Estimation of incidence and prevalence rates

Prevalence and incidence rates of ailments in India, 2004 (NSS, Round 60)

Our estimation of point prevalence and incidence rates are based on the status of ailment reported by the respondents. Persons who have declared their status but not the duration are included in the analysis because the proportion of such cases is very low (see Table 10). We have taken the total male and female populations, respectively, as denominators in our calculation of prostatic disorders and gynaecological disorders. Also, only male cases have been considered for prostatic disorders and female cases for gynaecological disorders. The household members who died in the last 365 days are excluded from the denominator for calculating incidence rates. We have also restricted our analysis for people aged 100 years or less because, according to the data, there were persons living more than 200 years which are an obvious recording error. However, among 383338 samples, only 50 were above 100 years (<0.1 per cent). Table 4 and 5 present the point prevalence and incidence rates of various ailments.

It is evident from Table 4 that among reported ailments in 2004, the prevalence was relatively high (above 300 per 100,000 persons) in case of hypertension (463.3), respiratory disease including ear/nose/throat ailment (343.5), bronchial Asthma (300.1), disorders of joints and bones (570.7) and diabetes mellitus (333.1). On the other hand, among the diagnosed illnesses, comparatively higher incidence rates (above 100 in 15 days per 100,000 persons) were found in case of diarrhoea/dysentery (382.8), gastritis/gastric/peptic ulcer (119.9), respiratory disease, including ear/nose/throat ailment

(444.9), Malaria (119.8), whooping cough (165.7) and accidents/injuries (139.4) (Table 5). For some diseases, both point prevalence and incident rates were considerably higher (1.5 times or more) among females than males, such as hypertension, disorders of joints and bones, anaemia, STDs, mumps, filariasis/elephantiasis and diseases of mouth/teeth/gum. In contrast, incidence rates and prevalence were found markedly higher (1.5 times or more) among males than females in the case of bronchial asthma, diphtheria, and accidents/injuries.

Table 4: Prevalence of ailments by ailment types in India, 2004 (Point prevalence at the time of survey)

Ailment types	Prevalence cases (Sample, unweighted) ^a	Prevalence per 100,000 ¹		
		Total	Male	Female
Diarrhoea/dysentery	497	127.6	129.6	125.5
Gastritis/gastric/peptic ulcer	1056	247.1	214.4	281.5
Worm Infestation	70	16.4	20.0	12.6
Amoebiasis	75	19.9	19.4	20.5
Hepatitis/jaundice	154	30.9	41.0	20.2
Heart disease	1442	244.0	261.9	225.3
Hypertension	2175	463.3	352.8	579.3
Respiratory disease including ear/nose/throat ailment	1380	343.5	352.9	333.6
Tuberculosis	648	108.6	127.1	89.1
Bronchial Asthma	1394	300.1	354.0	243.4
Disorders of joints and bones	2365	570.7	429.6	719.0
Diseases of kidney/urinary system	480	80.0	92.3	67.0
Prostatic disorders	53	14.3	14.3	NA
Gynaecological disorders	459	174.9	NA	174.9
Neurological disorders	937	174.1	156.5	192.5
Psychiatric disorders	294	62.0	58.5	65.7
Conjunctivitis	123	28.2	28.9	27.5
Glaucoma	93	23.7	20.2	27.4
Cataract	697	143.1	119.4	167.9
Diseases of skin	591	184.1	191.3	176.6
Goitre	42	9.5	4.5	14.8
Diabetes mellitus	1661	333.1	341.9	323.8
Under-nutrition	35	9.9	11.4	8.3
Anaemia	176	35.7	19.5	52.7
Sexually transmitted diseases	22	4.9	1.7	8.2
Malaria	202	56.8	51.3	62.6
Eruptive	48	21.9	19.8	24.0
Mumps	36	12.7	9.2	16.4
Diphtheria	15	4.6	5.9	3.2
Whooping cough	390	107.0	100.4	114.0
Fever of unknown origin	1799	535.0	492.8	579.3
Tetanus	13	2.3	2.9	1.8
Filariasis/Elephantiasis	52	10.7	5.3	16.4
Locomotor disability	772	167.2	178.1	155.7
Visual disability (excluding cataract)	442	100.2	87.3	113.8
Speech disability	76	25.1	30.8	19.0
Hearing disability	351	85.1	85.7	84.4
Diseases of mouth/teeth/gum	187	54.4	40.2	69.2
Accidents/injuries/burns/ fractures/poisoning	1019	190.9	255.6	122.8
Cancer and other tumours	359	47.1	42.4	52.1
Other diagnosed ailments	3353	784.5	663.1	912.0
Other undiagnosed ailments	628	169.8	153.2	187.3
Total	26661			

Notes: Computed from unit level data of NSS Round 60

¹Prevalence rate has been computed using sample weights

^a Person of age over 100 years has not been considered; NA = Not applicable

Table 5: Incidence rates of various ailments in India, 2004

Ailment types	Incidence cases (Sample, unweighted) ^a	Incidence rate in 15 days per 100,000 ¹		
		Total	Male	Female
Diarrhoea/dysentery	1326	382.8	386.6	378.8
Gastritis/gastric/peptic ulcer	455	119.9	85.4	156.3
Worm Infestation	93	28.4	27.2	29.7
Amoebiasis	82	21.4	19.4	23.4
Hepatitis/jaundice	60	14.2	16.4	11.8
Heart disease	119	19.4	18.1	20.8
Hypertension	200	51.7	38.7	65.4
Respiratory disease including ear/nose/throat ailment	1579	444.9	474.7	413.6
Tuberculosis	41	6.0	8.9	3.0
Bronchial Asthma	220	61.6	76.5	46.0
Disorders of joints and bones	363	91.3	64.1	119.9
Diseases of kidney/urinary system	94	18.8	19.2	18.4
Prostatic disorders	9	3.0	3.0	NA
Gynaecological disorders	146	63.7	NA	63.7
Neurological disorders	122	36.2	27.8	45.1
Psychiatric disorders	24	5.8	7.9	3.5
Conjunctivitis	61	18.4	19.0	17.9
Glaucoma	12	2.7	0.7	4.8
Cataract	40	6.2	6.0	6.4
Diseases of skin	206	68.0	63.1	73.1
Goitre	10	1.4	1.6	1.1
Diabetes mellitus	66	15.6	14.6	16.6
Under-nutrition	10	1.6	0.03	3.2
Anaemia	43	9.3	3.0	16.0
Sexually transmitted diseases	8	1.1	0.2	2.1
Malaria	370	119.8	115.4	124.4
Eruptive	70	34.7	25.0	44.8
Mumps	60	18.1	10.7	25.8
Diphtheria	29	10.7	15.0	6.3
Whooping cough	524	165.7	164.1	167.3
Fever of unknown origin	4642	1488.0	1400.2	1580.2
Tetanus	6	1.4	1.5	1.3
Filariasis/Elephantiasis	7	0.7	0.5	0.9
Locomotor disability	79	18.0	13.3	23.0
Visual disability (excluding cataract)	37	8.7	3.3	14.3
Speech disability	2	0.9	1.8	0.0
Hearing disability	37	11.1	14.4	7.6
Diseases of mouth/teeth/gum	199	60.9	48.1	74.4
Accidents/injuries/burns/ fractures/poisoning	468	139.4	194.3	81.7
Cancer and other tumours	41	8.1	11.7	4.3
Other diagnosed ailments	2348	727.1	685.7	770.5
Other undiagnosed ailments	396	113.7	108.3	119.3
Total	14704			

Notes: Computed from unit level data of NSS Round 60

¹Incidence rates have been computed using sample weights

^a Person of age over 100 years has not been considered; NA = Not applicable

Prevalence and incidence rates of ailments in India, 2017-18 (NSS, Round 75)

The report “Key Indicators of Social Consumption in Health: India, NSS 75th Round” did not provide detailed analysis and tables of disease-specific prevalence and incidence rates. In the report, the ailments were clubbed into seven broad categories: (i) infections, (ii) endocrine or metabolic, (iii) cardio-vascular, (iv) respiratory, (v) musculo-skeletal, (vi) psychiatric or neurological, and (vii) other

ailments (NSO, Government of India, 2019). However, it is crucial to know the disease-specific morbidity rate to identify the impact of a particular disease (say tuberculosis) and evaluate the benefits of policy interventions. Hence, we have estimated India's disease-specific prevalence and incidence rates using the 75th Round of NSS data.

We have calculated the point prevalence and incidence rate of various diseases based on the status of the ailment of household members. Among 555352 household members, 39902 persons reported their status of ailment and the duration of ailment. Our analysis included people aged 100+ as the highest reported age was 115, and only 26 persons (<.01 per cent) stated their age 110 years or above. The point prevalence and incidence rate of various diseases in India for 2017-18 have been presented in Table 6 and 7, respectively.

We observed that the prevalence rate was exceptionally high (above 1000 per 100,000 persons) for two chronic diseases – hypertension (1060.7) and diabetes (1000.6). Among other reported diagnosis/main symptoms, a relatively high (above 300 per 100,000 persons) prevalence rate was observed in joint or bone disease (457.8) and all other fevers, including typhoid, fever with rash/eruptive lesions and fevers of unknown origin (324.5).

Regarding incidence rate, the reportedly highest rate was observed in the case of all other fevers (1509.3 per 100,000), followed by acute upper respiratory infections (385.9 per 100,000) and fever with consciousness or altered consciousness (187.1 per 100,000). In case of change/irregularity in menstrual cycle and other gynaecological and andrological disorders including infertility, prevalence and incident rates were more than 100 times higher among females than males. As irregularity in menstrual cycle and other gynaecological disorders are more common and more reported than andrological disorders, an extreme gender difference in prevalence and incidence rates occurred in this case. Apart from it, both point prevalence and incident rates were considerably higher (1.5 times or more) among females compared to males for the diagnosis/symptom of worm infestations, anaemia, other endocrinal, metabolic and nutritional disorder including obesity, hearing loss, pain in abdomen due to gastric or peptic ulcers/acid reflux, back or body aches, and burns and corrosions. On the other hand, we observed that point prevalence and incidence rates were distinctly higher (1.5 times or more) among males than females in case of tuberculosis, illness in newborns, accidental injury, other sexually transmitted diseases and accidental drowning and submersion. Therefore, the policymakers should consider the gender dimension of disease prevalence during policy intervention.

Table 6: Prevalence of ailments by ailment types in India, 2017-18 (Point prevalence at the time of survey)

Ailment types	Prevalence cases (Sample, unweighted) ^a	Prevalence per 100,000 ¹		
		Total	Male	Female
"Fever with consciousness or altered consciousness	219	47.1	37.0	57.9
Malaria	90	21.4	24.4	18.2
Fever due to diphtheria, whooping cough	236	35.1	36.6	33.5
All other fevers, including typhoid, fever with rash/eruptive lesions and fevers of unknown origin	1787	324.5	313.7	336.0
Tuberculosis	249	32.8	50.5	13.9
Filariasis	36	3.2	3.1	3.3
Tetanus	4	0.1	0.2	0.0
HIV/AIDS	18	1.4	1.4	1.5
Other sexually transmitted diseases	8	1.3	2.2	0.3
Jaundice	100	11.1	10.2	12.1
Diarrhoea/dysentery/increased frequency of stools	121	17.9	22.8	12.7
Worms infestations	25	5.4	1.3	9.7
Cancers and occurrence of any growing painless lump in the body	396	25.9	27.4	24.0
Anaemia	241	38.9	25.9	61.3
Bleeding disorders	109	11.3	9.2	13.6
Diabetes	6538	1000.6	964.3	1039.5
Under-nutrition	30	6.1	6.0	6.3
Goitre and other diseases of thyroid	817	148.4	48.3	255.4
Other metabolic disorders, including obesity	180	25.0	13.5	37.3
Mental retardation	112	18.2	17.4	19.0
Mental disorders	283	39.0	45.2	32.5
Headache	257	62.3	32.4	94.3
Seizures or unknown epilepsy	175	19.0	19.7	18.2
Weakness in limb muscles and difficulty in movements	435	74.0	71.8	76.2
Stroke/hemiplegia/sudden onset weakness in half of body or loss of speech	393	49.2	55.0	42.9
Others including memory loss, confusion	94	16.7	15.4	18.0
Discomfort/pain in the eye with redness or swellings//boils	125	23.0	19.5	26.8
Cataract	93	12.2	5.0	19.8
Glaucoma	38	5.6	4.3	6.9
Decreased vision (chronic, not possible to correct with glasses)	65	8.6	7.1	10.2
Eye problem: Others (Strabismus, nystagmus, ptosis and adnexa)	56	11.6	6.5	17.1
Earache with discharge/bleeding from ear/infections	70	9.5	12.3	6.6
Decreased/loss of hearing	54	10.3	6.8	14.1
Hypertension	6321	1060.7	912.4	1219.3
Heart disease: Chest pain, breathlessness	1942	237.2	255.2	218.0
Acute upper respiratory infections	958	158.9	138.8	180.4
Cough with sputum with or without fever but not TB	263	43.5	46.7	40.1
Bronchial asthma/recurrent episode of wheezing and breathlessness	1205	209.9	203.0	217.4
Diseases of mouth, teeth, gums	108	19.9	18.0	21.9
Pain in abdomen: Gastric and peptic ulcers/ acid reflux	1006	181.5	149.0	216.2
Lump or fluid in abdomen or scrotum	171	26.9	24.0	30.1
Gastrointestinal bleeding	69	10.2	10.6	9.8
Skin infection (boil, abscess, itching) and other skin diseases	639	143.4	163.3	122.0
Joint or bone disease/pain or swelling in any of the joints	2315	457.8	298.6	628.0
Back or body aches	691	133.5	85.9	184.4
Any difficulty or abnormality in urination	356	39.4	43.0	35.5
Pain in pelvic region/RTI/Pain in the male genital area	106	17.3	20.7	13.9
Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders, including male/female infertility	130	26.5	0.5	54.4
Pregnancy with complications before or during labour (abortion, ectopic pregnancy, hypertension)	51	24.5	NA	24.5
Complications in mother after birth of child	37	4.2	NA	4.2
Illness in newborn/sick newborn	34	1.4	1.8	0.9
Accidental injury, road traffic accidents and falls	498	52.2	68.6	34.6
Accidental drowning and submersion	18	2.2	3.8	0.6
Burns and corrosions	32	3.3	1.8	4.9
Poisoning	6	0.5	0.7	0.3
Intentional self-harm	1	0.0	0.0	0.0
Assault	6	0.2	0.2	0.1
Contact with venomous/harm-causing animals and plants	12	2.3	2.4	2.1
Symptoms not fitting into any of the above categories	488	75.3	48.3	104.2
Could not even state the main symptom ^b	19	1.0	0.3	1.7
Total	30936			

Source: National Statistical Office, Government of India, 2019 (for types of ailments)

Notes: Computed from the unit level data of NSS Round 75; ¹Prevalence has been computed using sample weights; NA = Not applicable

Table 7: Incidence rates of various ailments in India, 2017-18

Ailment types	Incidence cases (Sample, unweighted) ^a	Incidence per 100,000 ¹		
		Total	Male	Female
"Fever with consciousness or altered consciousness	746	187.1	175.7	199.4
Malaria	195	45.1	53.6	36.0
Fever due to diphtheria, whooping cough	725	120.2	118.0	122.6
All other fevers, including typhoid, fever with rash/eruptive lesions and fevers of unknown origin	6210	1509.3	1449.9	1573.0
Tuberculosis	38	6.5	10.7	2.0
Filariasis	1	1.0	0.0	2.1
Tetanus	4	1.7	0.2	3.3
HIV/AIDS	0	0.0	0.0	0.0
Other sexually transmitted diseases	3	1.1	1.6	0.6
Jaundice	54	5.3	3.9	6.9
Diarrhoeas/dysentery/increased frequency of stools	462	97.9	86.7	109.8
Worms infestations	21	4.3	3.4	5.2
Cancers and occurrence of any growing painless lump in the body	10	0.2	0.1	0.3
Anaemia	43	17.4	12.8	22.4
Bleeding disorders	17	1.7	2.5	0.8
Diabetes	44	8.5	7.1	10.1
Under-nutrition	10	3.5	4.9	1.9
Goitre and other diseases of thyroid	10	1.6	1.8	1.4
Other metabolic disorders, including obesity	7	2.4	0.2	4.7
Mental retardation	1	0.0	0.0	0.1
Mental disorders	4	0.1	0.0	0.1
Headache	247	49.4	42.7	56.6
Seizures or unknown epilepsy	3	0.1	0.0	0.3
Weakness in limb muscles and difficulty in movements	49	13.9	6.6	21.8
Stroke/hemiplegia/sudden onset weakness in half of body or loss of speech	32	2.1	1.8	2.2
Others including memory loss, confusion	6	0.4	0.7	0.2
Discomfort/pain in the eye with redness or swellings//boils	95	27.4	21.8	33.4
Cataract	10	0.7	1.2	0.1
Glaucoma	0	0.0	0.0	0.0
Decreased vision (chronic, not possible to correct with glasses)	6	0.5	0.2	0.9
Eye problem: Others (Strabismus, nystagmus, ptosis and adnexa)	11	1.5	2.5	0.5
Earache with discharge/bleeding from ear/infections	70	13.1	10.8	15.5
Decreased/loss of hearing	4	0.2	0.1	0.3
Hypertension	64	19.5	18.0	21.2
Heart disease: Chest pain, breathlessness	103	19.6	21.5	17.5
Acute upper respiratory infections	2021	385.9	326.6	449.3
Cough with sputum with or without fever but not TB	399	90.7	66.1	117.0
Bronchial asthma/recurrent episode of wheezing and breathlessness	43	8.0	4.6	11.7
Diseases of mouth, teeth, gums	89	19.6	12.9	26.7
Pain in abdomen: Gastric and peptic ulcers/ acid reflux	397	104.2	71.5	139.2
Lump or fluid in abdomen or scrotum	21	1.9	1.7	2.2
Gastrointestinal bleeding	12	0.7	0.3	1.1
Skin infection (boil, abscess, itching) and other skin diseases	227	54.2	56.9	51.2
Joint or bone disease/pain or swelling in any of the joints	257	64.5	54.2	75.4
Back or body aches	182	39.3	29.9	49.4
Any difficulty or abnormality in urination	54	6.7	8.2	5.1
Pain in pelvic region/RTI/Pain in the male genital area	16	2.4	1.2	3.6
Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders, including male/female infertility	35	8.3	0.1	17.1
Pregnancy with complications before or during labour (abortion, ectopic pregnancy, hypertension)	19	5.4	NA	NA
Complications in mother after birth of child	10	0.6	NA	NA
Illness in newborn/sick newborn	40	2.1	2.7	1.4
Accidental injury, road traffic accidents and falls	252	38.9	60.6	15.7
Accidental drowning and submersion	8	1.6	2.9	0.1
Burns and corrosions	23	3.0	2.1	3.9
Poisoning	6	0.6	0.2	1.0
Intentional self-harm	0	0.0	0.0	0.0
Assault	2	0.0	0.1	0.0
Contact with venomous/harm-causing animals and plants	11	2.5	2.9	2.1
Symptoms not fitting into any of the above categories	104	20.6	11.2	30.6
Could not even state the main symptom"	6	0.6	0.8	0.5
Total	13539			

Source: National Statistical Office, Government of India, 2019 (for types of ailments)

Notes: Computed from the unit level data of NSS Round 75; ¹Incidence rates have been computed using sample weights; NA = Not applicable

(e) Computation of average duration of illness using life table method

One crucial variable for measuring YLD is the average duration of a disability. In the NSSO report (No. 507, Appendix A, A-160 to A-165), the average duration of ailments by broad ailment types is available. We have already highlighted that among those who reported their ailment status as 1 (started more than 15 days ago and is continuing), a few also said their duration of illness was 15 days or less. Also, how can the average duration of ailments be more than 15 days for those who reported the onset of ailments within 15 days prior to the survey date? It has also been found in the report that the duration of ailment has been calculated incorporating the value '999', which actually depicts the case where the duration of ailments has not been specified/mentioned. NSSO Report no. 507, Table 39, Appendix A, A-165, part of which has been reproduced in Table 3, clearly underlines this fact. Therefore, we should not use the average duration of ailment given in the NSS report. However, the average duration of ailment can be estimated following the life Table method of Lee. It has already been discussed in detail in the materials and method section. Table 8 shows the computation of the average duration of ailment for diarrhoea/dysentery using the data of NSS, Round 60. Similarly, we have estimated the average duration of other illnesses for 2004.

In the report "Key Indicators of Social Consumption in Health: India, NSS 75th Round", the disease-specific average duration of ailment has not been provided. However, in our analysis of the 75th Round of NSS data, we already observed that the "status of ailment" did not match with the "duration of ailment" for most of the reported diagnoses. Therefore, using the life table method of Lee, we have calculated the disease-specific average duration of ailment for the year 2017-18. Table 9 shows the computation of the average duration of ailment for diarrhoea/dysentery/increased frequency of stools using the data of NSS, Round 75. One of the major drawbacks of the NSS data on health is the reported duration of ailments. They are found to be very long for a few observations, which are increasing the value of $\sum C*w$ to an enormous extent. On the other hand, there is no exact limit up to which the duration should be considered. It can only be taken arbitrarily, and the average duration of ailment will differ for the same disease with truncation at 365 days, 180 days or 30 days.

The average duration for diarrhoea/dysentery truncated at 15 days, 30 days, 180 days, and 365 days was estimated at 7.2, 9.6, 28.5 and 51.3 days, respectively, in 2004 and 5.6, 7.2, 26.4 and 57.7 days, respectively, in 2017-18. It clearly depicts that the average duration of diarrhoea/dysentery has declined between 2004 and 2017-18 if the average truncated duration is taken as six months or less. If the cut off duration is conceived as one year, we observe a higher average duration of ailment in 2017-18. In fact, in 2004, the highest duration of ailment for diarrhoea/dysentery was reported as 700 days, whereas the reported duration was as high as 3650 days in 2017-18. There were four observations where the duration of diarrhoea/dysentery was reported more than 1500 days in 2017-18. As a result, the life table duration of diarrhoea/dysentery was found 70.99 days in 2004 and 353.21 days in 2017-18. The

highest reported duration of other ailments was also found much higher in the 75th Round than in the 60th Round.

Table 8: Computation of average duration of ailment from diarrhoea/dysentery using the life table method based on NSS data, Round 60, 2004

Duration (days)	Mid point	Width	Total observation	(Contd.)	(ended)	Number entering interval	Number exposed to risk	Conditional proportion ending	Conditional proportion continuing (P)	Cumulative proportion continuing (C)	Ci+1 = Ci*P	C*w
				Censored	Complete							
t	m	w	O	1+3	2+4	G	G - E/2 = H	F/H	1- F/H = P			
0	0.5	1	0	0	0	4492248	4492248.0	0.00000	1.00000	1.00000	1.00000	1.00000
1	1.5	1	127600	27857	99743	4492248	4478319.5	0.02227	0.97773	1.00000	1.00000	1.00000
2	2.5	1	667198	143555	523643	4364648	4292870.5	0.12198	0.87802	0.97773	0.97773	0.97773
3	3.5	1	879657	123536	756121	3697450	3635682.0	0.20797	0.79203	0.85846	0.85846	0.85846
4	4.5	1	622837	105153	517684	2817793	2765216.5	0.18721	0.81279	0.67993	0.67993	0.67993
5	5.5	1	598607	127959	470648	2194956	2130976.5	0.22086	0.77914	0.55264	0.55264	0.55264
6	6.5	1	293185	55361	237824	1596349	1568668.5	0.15161	0.84839	0.43058	0.43058	0.43058
7	7.5	1	249062	84656	164406	1303164	1260836.0	0.13039	0.86961	0.36530	0.36530	0.36530
8	8.5	1	180211	42223	137988	1054102	1032990.5	0.13358	0.86642	0.31767	0.31767	0.31767
9	9.5	1	24732	10459	14273	873891	868661.5	0.01643	0.98357	0.27523	0.27523	0.27523
10	10.5	1	242278	118716	123562	849159	789801.0	0.15645	0.84355	0.27071	0.27071	0.27071
11	11.5	1	30287	847	29440	606881	606457.5	0.04854	0.95146	0.22836	0.22836	0.22836
12	12.5	1	45400	29565	15835	576594	561811.5	0.02819	0.97181	0.21727	0.21727	0.21727
13	13.5	1	3040	0	3040	531194	531194.0	0.00572	0.99428	0.21115	0.21115	0.21115
14	14.5	1	45128	3158	41970	528154	526575.0	0.07970	0.92030	0.20994	0.20994	0.20994
15	15.5	1	170573	80565	90008	483026	442743.5	0.20330	0.79670	0.19321	0.19321	0.19321
16	16.5	1	10653	8395	2258	312453	308255.5	0.00733	0.99267	0.15393	0.15393	0.15393
17	17.5	1	20124	19578	546	301800	292011.0	0.00187	0.99813	0.15280	0.15280	0.15280
18	19.0	2	21482	20831	651	281676	271260.5	0.00240	0.99760	0.15252	0.15252	0.15252
20	20.5	1	66509	36006	30503	260194	242191.0	0.12595	0.87405	0.15215	0.15215	0.15215
21	21.5	1	8303	8303	0	193685	189533.5	0.00000	1.00000	0.13299	0.13299	0.13299
22	22.5	1	3009	3009	0	185382	183877.5	0.00000	1.00000	0.13299	0.13299	0.13299
23	23.5	1	156	0	156	182373	182373.0	0.00086	0.99914	0.13299	0.13299	0.13299
24	24.5	1	242	242	0	182217	182096.0	0.00000	1.00000	0.13287	0.13287	0.13287
25	26.5	3	8027	7949	78	181975	178000.5	0.00044	0.99956	0.13287	0.13287	0.13287
28	29.0	2	463	463	0	173948	173716.5	0.00000	1.00000	0.13282	0.13282	0.13282
29	29.5	1	0	0	0	173485	173485.0	0.00000	1.00000	0.13282	0.13282	0.13282
30	32.5	5	46894	26047	20847	173485	160461.5	0.12992	0.87008	0.13282	0.13282	0.13282
31	33.0	4	0	0	0	126591	126591.0	0.00000	1.00000	0.11556	0.11556	0.11556
35	37.0	4	3553	590	2963	126591	126296.0	0.02346	0.97654	0.11556	0.11556	0.11556
39	39.5	1	1811	602	1209	123038	122737.0	0.00985	0.99015	0.11285	0.11285	0.11285
40	42.5	5	6695	6600	95	121227	117927.0	0.00081	0.99919	0.11174	0.11174	0.11174
45	46.5	3	29684	23223	6461	114532	102920.5	0.06278	0.93722	0.11165	0.11165	0.11165
48	49.0	2	2883	2883	0	84848	83406.5	0.00000	1.00000	0.10464	0.10464	0.10464
50	55.0	10	54	54	0	81965	81938.0	0.00000	1.00000	0.10464	0.10464	0.10464
60	62.5	5	27858	26381	1477	81911	68720.5	0.02149	0.97851	0.10464	0.10464	0.10464
65	72.5	15	4265	4265	0	54053	51920.5	0.00000	1.00000	0.10239	0.10239	0.10239
80	85.0	10	421	421	0	49788	49577.5	0.00000	1.00000	0.10239	0.10239	0.10239
90	95.0	10	301	301	0	49367	49216.5	0.00000	1.00000	0.10239	0.10239	0.10239
100	102.5	5	10514	10514	0	49066	43809.0	0.00000	1.00000	0.10239	0.10239	0.10239
105	125.5	41	809	809	0	38552	38147.5	0.00000	1.00000	0.10239	0.10239	0.10239
146	148.0	4	2432	2432	0	37743	36527.0	0.00000	1.00000	0.10239	0.10239	0.10239
150	175.0	50	10201	10201	0	35311	30210.5	0.00000	1.00000	0.10239	0.10239	0.10239
179	179.5	1	0	0	0	25110	25110.0	0.00000	1.00000	0.10239	0.10239	0.10239
180	180.5	1	0	0	0	25110	25110.0	0.00000	1.00000	0.10239	0.10239	0.10239
181	190.5	19	0	0	0	25110	25110.0	0.00000	1.00000	0.10239	0.10239	0.10239
200	205.0	10	7426	7426	0	25110	21397.0	0.00000	1.00000	0.10239	0.10239	0.10239
210	225.0	30	985	985	0	17684	17191.5	0.00000	1.00000	0.10239	0.10239	0.10239
240	245.0	10	2690	2690	0	16699	15354.0	0.00000	1.00000	0.10239	0.10239	0.10239
250	255.0	10	2284	2284	0	14009	12867.0	0.00000	1.00000	0.10239	0.10239	0.10239
260	265.0	10	2164	2164	0	11725	10643.0	0.00000	1.00000	0.10239	0.10239	0.10239
270	285.0	30	2513	2513	0	9561	8304.5	0.00000	1.00000	0.10239	0.10239	0.10239
300	316.5	33	1420	1420	0	7048	6338.0	0.00000	1.00000	0.10239	0.10239	0.10239
333	349.0	32	162	162	0	5628	5547.0	0.00000	1.00000	0.10239	0.10239	0.10239
364	364.5	1	0	0	0	5466	5466.0	0.00000	1.00000	0.10239	0.10239	0.10239
365	377.5	25	2957	736	2221	5466	5098.0	0.43566	0.56434	0.10239	0.10239	0.10239
366	378.0	24	0	0	0	2509	2509.0	0.00000	1.00000	0.05778	0.05778	0.05778
390	445.0	110	356	356	0	2509	2331.0	0.00000	1.00000	0.05778	0.05778	0.05778
500	523.5	47	1097	1097	0	2153	1604.5	0.00000	1.00000	0.05778	0.05778	0.05778
547	623.5	153	673	673	0	1056	719.5	0.00000	1.00000	0.05778	0.05778	0.05778
700			383	383	0	383	191.5	0.00000	1.00000	0.05778	0.05778	0.05778
			4492248									64.84915

Source: Computed from unit level data of NSS, Round 60, 2004

Notes: Sample weight has been applied

When the duration is truncated at 15 days, 30 days, 180 days and 365 days, the average duration of illness (in days) has been estimated as 7.2, 9.6, 28.5 and 51.3, respectively.

Table 9: Computation of average duration of ailment from diarrhoea/dysentery/increased frequency of stools using the life table method based on NSS data, Round 75, 2017-18

Duration (days)	Midpoint	Width	Total	(Contd.)	(ended)	Number entering interval	Number exposed to risk	Conditional Proportion Ending	Conditional proportion surviving (P)	Cumulative proportion surviving (C)		
				Censored	Complete						1+3	2+4
t	m	w	O	E	F	G	G - E/2 = H	F/H	1- F/H = P			
0	0.5	1	0	0	0	1433299	1433299.0	0.00000	1.00000	1.00000	1.00000	1.00000
1	1.5	1	70936	1361	69575	1433299	1432845.3	0.04856	0.95144	1.00000	1.00000	1.00000
2	2.5	1	287136	2873	284263	1362363	1361405.3	0.20880	0.79120	0.95144	0.95144	0.95144
3	3.5	1	327701	47029	280672	1075227	1059550.7	0.26490	0.73510	0.75278	0.75278	0.75278
4	4.5	1	220405	7559	212846	747526	745006.3	0.28570	0.71430	0.55337	0.55337	0.55337
5	5.5	1	211970	12116	199854	527121	523082.3	0.38207	0.61793	0.39527	0.39527	0.39527
6	6.5	1	37854	3709	34145	315151	313914.7	0.10877	0.89123	0.24425	0.24425	0.24425
7	7.5	1	55349	3845	51504	277297	276015.3	0.18660	0.81340	0.21768	0.21768	0.21768
8	8.5	1	31831	2627	29204	221948	221072.3	0.13210	0.86790	0.17706	0.17706	0.17706
9	9.5	1	11771	1099	10672	190117	189750.7	0.05624	0.94376	0.15367	0.15367	0.15367
10	10.5	1	27189	11082	16107	178346	174652.0	0.09222	0.90778	0.14503	0.14503	0.14503
11	11.5	1	17088	0	17088	151157	151157.0	0.11305	0.88695	0.13166	0.13166	0.13166
12	12.5	1	4936	1727	3209	134069	133493.3	0.02404	0.97596	0.11677	0.11677	0.11677
13	13.5	1	5434	4369	1065	129133	127676.7	0.00834	0.99166	0.11397	0.11397	0.11397
14	14.5	1	320	0	320	123699	123699.0	0.00259	0.99741	0.11301	0.11301	0.11301
15	15.5	1	24791	6848	17943	123379	121096.3	0.14817	0.85183	0.11272	0.11272	0.11272
16	17.0	2	5860	5860	0	98588	96634.7	0.00000	1.00000	0.09602	0.19204	0.19204
18	19.0	2	4931	4931	0	92728	91084.3	0.00000	1.00000	0.09602	0.19204	0.19204
20	22.5	5	3614	3614	0	87797	86592.3	0.00000	1.00000	0.09602	0.48010	0.48010
25	26.0	2	1900	1442	458	84183	83702.3	0.00547	0.99453	0.09602	0.19204	0.19204
27	28.5	3	1146	1146	0	82283	81901.0	0.00000	1.00000	0.09549	0.28648	0.28648
30	32.0	4	6755	6755	0	81137	78885.3	0.00000	1.00000	0.09549	0.38198	0.38198
34	34.5	1	31984	31984	0	74382	63720.7	0.00000	1.00000	0.09549	0.09549	0.09549
35	40.0	10	17504	17504	0	42398	36563.3	0.00000	1.00000	0.09549	0.95495	0.95495
45	47.5	5	75	75	0	24894	24869.0	0.00000	1.00000	0.09549	0.47747	0.47747
50	51.0	2	697	697	0	24819	24586.7	0.00000	1.00000	0.09549	0.19099	0.19099
52	56.0	8	295	295	0	24122	24023.7	0.00000	1.00000	0.09549	0.76396	0.76396
60	67.5	15	708	708	0	23827	23591.0	0.00000	1.00000	0.09549	1.43242	1.43242
75	76.0	2	360	360	0	23119	22999.0	0.00000	1.00000	0.09549	0.19099	0.19099
77	78.5	3	462	462	0	22759	22605.0	0.00000	1.00000	0.09549	0.28648	0.28648
80	85.0	10	156	156	0	22297	22245.0	0.00000	1.00000	0.09549	0.95495	0.95495
90	145.0	110	1274	1274	0	22141	21716.3	0.00000	1.00000	0.09549	10.50444	10.50444
200	222.0	44	6769	6769	0	20867	18610.7	0.00000	1.00000	0.09549	4.20178	4.20178
244	272.0	56	301	301	0	14098	13997.7	0.00000	1.00000	0.09549	5.34771	5.34771
300	333.0	66	717	717	0	13797	13558.0	0.00000	1.00000	0.09549	6.30266	6.30266
366	493.0	254	2820	2820	0	13080	12140.0	0.00000	1.00000	0.09549	24.25570	24.25570
620	675.0	110.0	8014	8014	0	10260	7588.7	0.00000	1.00000	0.09549	10.50444	10.50444
730	1225.0	990.0	174	174	0	2246	2188.0	0.00000	1.00000	0.09549	94.53995	94.53995
1720	1965.0	490.0	142	142	0	2072	2024.7	0.00000	1.00000	0.09549	46.79250	46.79250
2210	2645.0	870.0	301	301	0	1930	1829.7	0.00000	1.00000	0.09549	83.08056	83.08056
3080	3365.0	570.0	897	897	0	1629	1330.0	0.00000	1.00000	0.09549	54.43209	54.43209
3650			732	732	0	732	488.0	0.00000	1.00000	0.09549	0.00000	0.00000
			1433299									353.21295

Source: Computed from the unit level data of NSS, Round 75, 2017-18

Notes: Sample weight has been applied

When the duration is truncated at 15 days, 30 days, 180 days and 365 days, the average duration of illness (in days) has been estimated as 5.6, 7.2, 26.4 and 57.7, respectively.

Estimating the average duration of ailment by the life table method reveals an important shortcoming of the NSS data. It indicates that the life table duration of illness has been considerably amplified by the reporting and recording of a few cases with long-duration.

Checking consistency between estimated life Table duration and implied duration through a mathematical relationship

A mathematical relationship exists among incidence, prevalence and duration of ailment. If the incidence rate of a disease in a population is approximately constant and the duration of the diseases

also remains stable, then the prevalence is the product of incidence and duration. It can be expressed as:

$$P = I \cdot D \quad \text{or, } D = P/I$$

Where P = Prevalence rate, I = Incidence rate and D = Duration of disease/condition

Though there is seasonal variability in the incidence rate for some ailments, we assume that there should not be a large difference between estimated life table duration and implied duration derived by P/I. From Table 10 (based on data of NSS, Round 60), it is observed that compared to the implied duration (P/I), the life table duration for each ailment is markedly high.

Table 10: Difference in the duration of illness computed by two different procedures based on NSS data, Round 60, 2004

Ailment types	Incidence rate per 1000 per year (I)	Prevalence per 1000 (P)	D=P/I	Life Table estimate of duration in days	Life Table estimate of duration in years (LTED)	Difference between LTED &P/I	Proportion who reported status but not duration (%)
Diarrhoea/dysentery	93.1	1.3	0.01370	64.8	0.17767	0.16397	0.5
Gastritis/gastric/peptic ulcer	29.2	2.5	0.08468	612.5	1.67805	1.59337	0.1
Worm Infection	6.9	0.2	0.02369	194.8	0.53366	0.50997	0.0
Amoebiasis	5.2	0.2	0.03836	228.0	0.62475	0.58639	0.8
Hepatitis/jaundice	3.4	0.3	0.08965	587.1	1.60848	1.51883	0.0
Heart disease	4.7	2.4	0.51708	910.6	2.49477	1.97769	0.6
Hypertension	12.6	4.6	0.36799	882.7	2.41827	2.05028	0.0
Respiratory disease including ear/nose/throat ailment	108.3	3.4	0.03173	325.9	0.89295	0.86123	0.1
Tuberculosis	1.5	1.1	0.74180	932.2	2.55398	1.81218	0.5
Bronchial Asthma	15.0	3.0	0.20013	769.6	2.10843	1.90830	0.5
Disorders of joints and bones	22.2	5.7	0.25685	858.3	2.35143	2.09458	0.3
Diseases of kidney/urinary system	4.6	0.8	0.17459	798.1	2.18649	2.01190	0.9
Prostatic disorders	0.7	0.1	0.19800	758.1	2.07701	1.87901	0.0
Gynaecological disorders	15.5	1.7	0.11277	663.8	1.81864	1.70587	0.1
Neurological disorders	8.8	1.7	0.19754	796.1	2.18120	1.98366	0.3
Psychiatric disorders	1.4	0.6	0.44194	903.8	2.47608	2.03414	0.7
Conjunctivitis	4.5	0.3	0.06292	458.2	1.25531	1.19238	0.0
Glaucoma	0.7	0.2	0.35756	743.0	2.03570	1.67814	0.0
Cataract	1.5	1.4	0.94874	916.9	2.51219	1.56345	0.9
Diseases of skin	16.5	1.8	0.11135	716.4	1.96267	1.85132	0.1
Goitre	0.3	0.1	0.28598	713.1	1.95366	1.66768	0.0
Diabetes mellitus	3.8	3.3	0.87735	962.1	2.63595	1.75860	0.3
Under-nutrition	0.4	0.1	0.25603	387.1	1.06058	0.80455	0.0
Anaemia	2.3	0.4	0.15727	656.1	1.79756	1.64029	0.0
Sexually transmitted diseases	0.3	0.0	0.18326	542.6	1.48668	1.30342	0.0
Malaria	29.1	0.6	0.01949	20.5	0.05620	0.03671	0.2
Eruptive	8.4	0.2	0.02595	41.1	0.11262	0.08667	0.0
Mumps	4.4	0.1	0.02882	93.2	0.25523	0.22641	0.0
Diphtheria	2.6	0.0	0.01748	44.0	0.12057	0.10309	0.4
Whooping cough	40.3	1.1	0.02655	301.9	0.82708	0.80053	0.1
Fever of unknown origin	362.1	5.3	0.01477	79.1	0.21660	0.20182	0.4
Tetanus	0.3	0.0	0.06868	149.2	0.40869	0.34002	0.0
Filariasis/Elephantiasis	0.2	0.1	0.62075	818.1	2.24148	1.62073	7.2
Locomotor disability	4.4	1.7	0.38072	885.7	2.42649	2.04577	1.2
Visual disability (excluding cataract)	2.1	1.0	0.47417	937.3	2.56799	2.09382	0.2
Speech disability	0.2	0.3	1.09834	847.5	2.32181	1.22347	5.3
Hearing disability	2.7	0.9	0.31588	814.4	2.23134	1.91545	0.6
Diseases of mouth/teeth/gum	14.8	0.5	0.03667	393.7	1.07875	1.04208	1.6
Accidents/injuries/burns/fractures/poisoning	33.9	1.9	0.05628	569.5	1.56028	1.50401	0.0
Cancer and other tumours	2.0	0.5	0.23948	893.2	2.44723	2.20776	1.0
Other diagnosed ailments	176.9	7.8	0.04434	451.9	1.23812	1.19378	0.2
Other undiagnosed ailments	27.7	1.7	0.06141	583.1	1.59748	1.53607	0.9

Source: Computed from unit level data of NSS, Round 60, 2004

Note: Computation was done using sample weights

Table 11: Difference in the duration of illness computed by two different procedures based on NSS data, Round 75, 2017-18

Ailment type	Incidence rate per 1000 per year (I)	Prevalence per 1000 (P)	D=P/I	Life table estimate of duration in days	Life table estimate of duration in years (LTED)	Difference between LTED and P/I
Fever with consciousness or altered consciousness	45.5	0.5	0.01034	1153.7	3.16085	3.15051
Malaria	11.0	0.2	0.01951	162.8	0.44604	0.42652
Fever due to diphtheria, whooping cough	29.3	0.4	0.01199	355.5	0.97398	0.96199
All other fevers including typhoid, fever with rash/eruptive lesions and fevers of unknown origin	367.3	3.2	0.00883	381.7	1.04581	1.03698
Tuberculosis	1.6	0.3	0.20887	9262.3	25.37618	25.16731
Filariasis	0.2	0.0	0.13118	8341.5	22.85353	22.72235
Tetanus	0.4	0.0	0.00227	183.8	0.50369	0.50143
HIV/AIDS	0.0	0.0	-	4370.0	11.97260	-
Other sexually transmitted diseases	0.3	0.0	0.04565	2896.6	7.93577	7.89012
Jaundice	1.3	0.1	0.08551	3552.9	9.73392	9.64841
Diarrhoeas/dysentery/increased frequency of stools	23.8	0.2	0.00752	385.8	1.05689	1.04937
Worms infestations	1.0	0.1	0.05192	3285.4	9.00119	8.94926
Cancers and occurrence of any growing painless lump in the body	0.1	0.3	4.73733	14695.0	40.26020	35.52286
Anaemia	4.2	0.4	0.09194	11864.7	32.50596	32.41402
Bleeding disorders	0.4	0.1	0.27561	7558.4	20.70781	20.43220
Diabetes	2.1	10.0	4.81027	18862.8	51.67901	46.86874
Under-nutrition	0.8	0.1	0.07306	4240.2	11.61696	11.54390
Goitre and other diseases of thyroid	0.4	1.5	3.77847	14549.1	39.86043	36.08196
Others (including obesity)	0.6	0.2	0.43272	6536.5	17.90809	17.47537
Mental retardation	0.0	0.2	17.94048	14466.6	39.63448	21.69400
Mental disorders	0.0	0.4	22.13036	18060.0	49.47945	27.34909
Headache	12.0	0.6	0.05181	7800.8	21.37199	21.32017
Seizures or unknown epilepsy	0.0	0.2	6.06710	14409.2	39.47716	33.41006
Weakness in limb muscles and difficulty in movements	3.4	0.7	0.21844	8297.1	22.73180	22.51336
Stroke/hemiplegia/sudden onset weakness in half of body or loss of speech	0.5	0.5	0.97269	13505.0	36.99988	36.02720
Others including memory loss, confusion	0.1	0.2	1.55715	15858.6	43.44825	41.89110
Discomfort/pain in the eye with redness or swellings/boils	6.7	0.2	0.03451	2514.1	6.88803	6.85352
Cataract	0.2	0.1	0.72516	8391.4	22.99006	22.26489
Glaucoma	0.0	0.1	-	16399.8	44.93101	-
Decreased vision (chronic, not possible to correct with glasses)	0.1	0.1	0.68939	10956.7	30.01842	29.32903
Eye problem: Others (Strabismus, nystagmus, ptosis and adnexa)	0.4	0.1	0.31381	4863.0	13.32328	13.00947
Earache with discharge/bleeding from ear/infections	3.2	0.1	0.02990	4471.2	12.24978	12.21988
Decreased/loss of hearing	0.0	0.1	2.71302	17963.0	49.21362	46.50060
Hypertension	4.8	10.6	2.23126	19577.8	53.63786	51.40660
Heart disease: Chest pain, breathlessness	4.8	2.4	0.49646	13498.8	36.98291	36.48645
Acute upper respiratory infections	93.9	1.6	0.01692	2126.7	5.82669	5.80976
Cough with sputum with or without fever but not TB	22.1	0.4	0.01971	3080.0	8.43826	8.41855
Bronchial asthma/recurrent episode of wheezing and breathlessness	2.0	2.1	1.07388	21362.1	58.52618	57.45229
Diseases of mouth, teeth, gums	4.8	0.2	0.04169	2542.0	6.96435	6.92266
Pain in abdomen: Gastric and peptic ulcers/ acid reflux	25.4	1.8	0.07157	9731.4	26.66134	26.58977
Lump or fluid in abdomen or scrotum	0.5	0.3	0.57008	10519.6	28.82085	28.25077
Gastrointestinal bleeding	0.2	0.1	0.59958	10411.2	28.52379	27.92421
Skin infection (boil, abscess, itching) and other skin disease	13.2	1.4	0.10877	8403.8	23.02399	22.91522
Joint or bone disease/pain or swelling in any of the joints	15.7	4.6	0.29184	13139.4	35.99827	35.70643
Back or body aches	9.6	1.3	0.13952	18484.1	50.64147	50.50195
Any difficulty or abnormality in urination	1.6	0.4	0.24286	6766.2	18.53748	18.29462
Pain in pelvic region/RTI/Pain in male genital area	0.6	0.2	0.30228	5269.2	14.43612	14.13385
Change/irregularity in menstrual cycle or excessive bleeding/pain during menstruation and any other gynaecological and andrological disorders including male/female infertility	2.0	0.3	0.13091	11386.9	31.19697	31.06606
Pregnancy with complications before or during labour (abortion, ectopic pregnancy, hypertension)	0.6	0.1	0.18642	344.2	0.94294	0.75652
Complications in mother after birth of child	0.1	0.0	0.28070	428.7	1.17448	0.89378
Illness in newborn/sick newborn	0.5	0.0	0.02731	393.2	1.07708	1.04977
Accidental injury, road traffic accidents and falls	9.5	0.5	0.05516	2935.3	8.04205	7.98688
Accidental drowning and submersion	0.4	0.0	0.05902	357.0	0.97801	0.91898
Burns and corrosions	0.7	0.0	0.04542	1810.6	4.96058	4.91517
Poisoning	0.1	0.0	0.03309	2177.3	5.96509	5.93200
Intentional self-harm	0.0	0.0	-	60.0	0.16438	-
Assault	0.0	0.0	0.15800	1460.0	4.00000	3.84200
Contact with venomous/harm-causing animals and plants	0.6	0.0	0.03736	61.8	0.16937	0.13201
Symptom not fitting into any of above categories	5.0	0.8	0.15034	11973.9	32.80518	32.65484
Could not even state the main symptom	0.2	0.0	0.06509	2493.1	6.83052	6.76543

Source: Computed from the unit level data of NSS, Round 75, 2017-18

Note: Computation was done using sample weights

Therefore, the difference in the duration of illness calculated by these two procedures is enormous. The differences are extremely large for long-duration ailments such as heart disease, hypertension, neurological disorders, bronchial asthma, locomotor disability etc. It is also evident from Table 11 (based on data of NSS, Round 75) that for each reported diagnosis/symptom, the difference between life table duration and implied duration is exorbitantly high due to the very high life table duration of ailments.

Discussion

In India, declining fertility rates, reduction in mortality, and increasing survival at older ages are causing population ageing. The mortality rate in India dropped from 14.9 during 1971-1981 (Bhinde and Kanitkar, 2008) to 6.2 in 2018 (Office of the Registrar General and Census Commissioner, India, 2020). The average expectation of life at birth increased from 52.3 years in 1976-1980 (Bhinde and Kanitkar, 2008) to 69.4 years in 2014-2018 (Office of the Registrar General & Census Commissioner, India, 2020). Also, the proportion of the elderly is projected to reach 19 per cent in 2050 (United Nations Population Fund, 2017). Therefore, the prevalence of morbidity will further increase in society. The burden of non-communicable diseases has already crossed the burden of contagious diseases in India (India State-level Disease Burden Initiative Collaborators, 2017). In this situation, mortality indicators are perhaps inadequate to express the health status of the population of India. Therefore, several researchers favour using DALY to measure health in India because DALY combines Years Lost due to Disability (YLD) and Years of Life Lost due to Premature Mortality (YLL).

As YLD can be estimated following the incidence or prevalence approach, we assessed the data quality of the 60th Round and the 75th Round of the National Sample Survey (NSS) to adopt the suitable approach. Data quality analysis is also crucial as it influences the research findings, determining policy decisions. We found that in both Rounds of NSS data, inconsistency exists between the reported “status of ailment” and the “duration of ailment” and between the “life table estimates of the duration of ailment” and the “implied duration derived by mathematical relationship”. The average duration of ailment is an essential input for the calculation of YLD, but we observed that the respondents have not correctly reported the total span of illnesses. It is a fundamental problem with health data in most developing countries.

The NSSO Report "Morbidity, Health Care and the Condition of the Aged", based on the analysis of the 60th Round of NSS data, showed the cases of gynaecological disorders among males and prostatic disorders among females. It indicates the reporting/recording error and shows that cross-checking of data was not properly done during data processing.

The NSSO data revealed that in 2004 in India, among the diagnosed diseases/conditions, the highest prevalence rate per 100,000 populations was recorded for disorders of joints and bones (570.7), followed by hypertension (463.3), respiratory disease including ear/nose/throat ailment (343.5), diabetes mellitus (333.1) and bronchial asthma (300.1). It indicates that India carries the dual burden of both infectious and non-communicable diseases. Therefore, the government must adopt a comprehensive policy framework emphasising both communicable and non-communicable diseases. Analysing the 2017-18 NSS data we found that the point prevalence was exorbitantly high for hypertension (1060.7) and diabetes (1000.6). A recent study, particularly designed to assess diabetes and hypertension prevalence among Indian adults, found that the prevalence of these two diseases “is high in middle and old age across all geographical areas and socio-demographic groups in India, and hypertension prevalence among young adults is higher than previously thought” (Geldsetzer et al., 2018, p. 3 of 20). Therefore, more focussed policies and programmes are needed to prevent and control NCDs among young adults, middle-aged and elderly.

A considerable variation in the prevalence rates of some diseases was observed by gender. For example, we found that disorders of joints and bones, anaemia, goitre etc., had considerably higher prevalence rates among the women, and the prevalence rates of hepatitis/jaundice, tuberculosis, bronchial asthma etc., were much higher among the men. In such cases, policymakers should pay greater attention to the more affected gender during disease-specific policy formulation.

Conclusion

The results of our analysis reveal that the total duration of ailments has not been correctly reported. It is a major problem with health data in most developing countries, where literacy and primary education are considerably low. In most cases, the “status of ailment” did not match with the “duration of ailment”. Our life table estimates of the duration of ailments show considerable variation when compared with the implied duration derived by P/I. It indicates that the reporting of duration was done very casually in 2004 as well as in 2017-18. Also, there is a chance of recall lapse. On the other hand, there is no question of recall lapse in case of prevalence. Therefore, a greater confidence level is attached to the prevalence approach compared to the incidence approach. This leads to the rejection of the incidence approach and accepting the prevalence approach for estimating YLD using NSS data. Based on the evaluation of data quality, it can be said that the average duration of ailments in NSS data have serious shortcomings. In this situation, the prevalence approach appears more suitable in determining YLD than the incidence approach (which needs information on the average duration of ailment) using the NSS data.

Conflict of Interest

No conflict of interest was reported by the authors.

Funding and acknowledgement

No funding was received for the above study. We are incredibly grateful to Prof. P.M. Kulkarni for his assistance and valuable suggestions. Both the authors are grateful to Population Council, India, for selecting our article as the best paper in the 2nd DATA-Q-THON competition (held in 2019) under the theme “Data issues in comparison of administrative and survey data”.

References

- Commission on Social Determinants of Health (CSDH), 2008, Closing the gap in a generation: Health equity through action on the social determinants of health. Final Report of the Commission on the Social Determinants of Health. Geneva, World Health Organization.
- Field, M. J., and Gold, M. R. (Ed.), 1998, Summarizing population health: Directions for the development and application of population metrics. Washington DC, National Academies Press (US).
- Abramson, J. H., 2004, Cross-sectional Studies. In: R. Detels et al. (eds.), Oxford Textbook of Public Health, 4th edition, Oxford University Press, New York.
- Mathers, C. D., Vos, T., Lopez, A., Salomon, J., and Ezzati M., 2001, National Burden of Disease Studies: A Practical Guide. Edition 2.0, World Health Organization, Geneva.
- Murray, C. J. L., and Lopez, A. D., (eds), 1996, The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries, and Risk Factors in 1990 and Projected to 2020. Global Burden of Disease and Injury Series, Vol. 1, Harvard School of Public Health, Boston.
- Lee, E. T., 1993, Functions of Survival Time. In D. J, Bogue et al. (eds.), Readings in Population Research Methodology, Vol. 6, United Nations population Fund, Chicago.
- National Sample Survey Organization, 2006, Morbidity, Health Care and the Condition of the Aged: NSS 60th Round (January – June 2004). Report No. 507(60/25.0/1). National sample Survey Organization, Ministry of Statistics and Programme Implementation, New Delhi, Government of India.
- National Statistical Office (NSO), 2019, Key indicators of social consumption in India: Health, NSS 75th Round, (July 2017- June 2018). Ministry of Statistics and Programme Implementation, New Delhi, Government of India.
- Bhende, A. A., and Kanitkar, T, 2008, Principles of population studies. 19th Edition, Himalaya Publishing House, Mumbai.
- Office of the Registrar General & Census Commissioner, India, 2020, Sample registration system statistical report 2018, Ministry of Home Affairs, Government of India, New Delhi.
- Office of the Registrar General & Census Commissioner, India, 2020, SRS based abridged life Tables 2014-18. Ministry of Home Affairs, Government of India, New Delhi.
- United Nations Population Fund, 2017, Caring for our elders: Early responses- India ageing report - 2017. UNFPA, New Delhi.
- India State-level Disease Burden Initiative Collaborators, 2017. Nation within a nation: Variations in epidemiological transition across the states of India, 1990-2016 in the Global Burden of Disease Study. *Lancet*, 390(10111): 2437-2460. DOI: 10.1016/S0140-6736(17)32804-0
- Geldsetzer, P., Manne-Goehler, J., Theilmann, M., Davies, J. I., Awasthi, A., Vollmer, S. et al., 2018, Diabetes and hypertension in India: A nationally representative study of 1.3 million adults. *JAMA Internal medicine*, 178(3): 363-372. DOI: 10.1001/jamainternmed.2017.8094