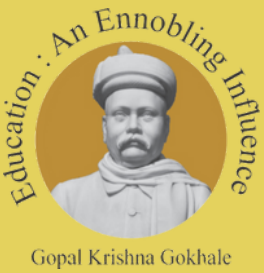

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Content

Burden of non-communicable diseases (NCDs) among pregnant women in India

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Burden of non-communicable diseases (NCDs) among pregnant women in India

Abstract

Background and objective: NCDs such as anaemia, hypertension and diabetes and its treatment may upsurge the risk of childbirth-related complications for both women and their babies. The present study is an attempts to assess the level and determinants of NCDs among pregnant women.

Data and method: Study used National Family Health Survey-4 (2015-16) to fulfil the study objectives. Bivariate and logistic regression techniques have been used for data analysis.

Results: Study findings suggest the prevalence of anaemia among pregnant women found to be 25.9%, whereas the corresponding figure for hypertension and diabetes were 4.4 and 2.4% respectively. Further, substantial socio-economic differentials have been observed in the prevalence of NCDs among pregnant women. Results of regression analysis suggest that anaemia and hypertension is significantly higher among women in their third trimester [(OR=2.10; $p<0.001$) and (OR=1.63; $p<0.001$)] respectively as compare to women in first trimester. Similarly, pregnant women in the age group 35-49 were at the elevated risk of hypertension (OR=2.78; $p<0.001$)) and diabetes (OR=2.50; $p<0.001$)) compared to women in 15-24 age group. Further, the risk of anaemia found significantly lower among pregnant women from richest quintile (OR=0.71; $p<0.001$) and women with higher educational level (OR=0.72; $p<0.001$) when compared to women from poorest wealth quintile and women with no formal education respectively. Similarly, pregnant women from riches quintile (OR=1.68; $p<0.001$) and women from other religion (OR=1.75; $p<0.001$) are significantly more likely to develop diabetes compared to women from poorest quintile and women from Hindu religion respectively.

Conclusion: Early screening for predicting risk of gestational anaemia, gestational diabetes, gestational hypertension is critical in minimizing maternal and reproductive outcome. The existing guidelines for Screening and Management of Gestational Diabetes Gestational Hypertension need to be contextualized and modified according to a local need for effective treatment.

Keywords: NCDs, Pregnant women, NFHS-4

Background

Maternal mortality is excessively high across the world. In 2017, nearly 295 000 women died during and following pregnancy and childbirth globally, with the vast majority of these deaths (94%) occurred in low-resource settings, and most could have been prevented (WHO, 2019). Sub-Saharan Africa and Southern Asia accounted for approximately 86% of the estimated global maternal deaths in 2017, with Sub-Saharan Africa alone accounted for roughly two-thirds of maternal deaths, while Southern Asia accounted for nearly one-fifth. Almost 15% of maternal deaths are due to pre-existing medical conditions (Say, et al., 2014). Though, the maternal mortality ratio dropped by about 38% worldwide between 2000 and 2017. At the same time, between 2000 and 2017, a 60% reduction in maternal mortality ratio (MMR) has been observed in Southern Asia.

Many direct and indirect causes are associated with the high rate of MMR in the world. Moreover, indirect causes of maternal death are becoming prominent and accounting for more than a quarter of maternal deaths worldwide (Say, et al., 2014). Indirect causes include deaths due to communicable, non-communicable diseases (NCDs), and other indirect causes such as accidents (Lumbiganon, et al., 2014; WHO, 2012). More Stress has been placed on communicable diseases during pregnancy because it can be easily detected, for illustration-prevention and control of malaria, syphilis, HIV etc. However, NCDs during pregnancy do not adequately address during pregnancy, especially in resource constraint areas.

Important NCDs during pregnancy comprise a huge number of different health conditions. They are cardiovascular diseases such as hypertension, endocrine, or metabolic diseases such as diabetes, hematological diseases such as anaemia, mental illness such as antepartum and postpartum depression, and neoplasm (Hussein, 2017). Prevalence of non-communicable diseases (NCDs) during pregnancy have a substantial adverse effect on maternal health and pregnancy outcomes. Hypertension, diabetes, anemia, obesity, overweight, and undernourishment during pregnancy are linked to hemorrhage, pre-eclampsia, stillbirth, low birth weight, preterm birth, congenital malformation, and maternal and neonatal mortality (Heslehurst et al., 2008; WHO, 2011; Wendland, 2012; Haider et al., 2013). NCD-related symptoms during pregnancy are generally misinterpreted as normal (by women themselves) and women's reported symptoms during pregnancy, and in general, are often dismissed by health practitioner (March of Dimes, 2014; Amant, et al., 2015). Nevertheless, eighteen million women of reproductive age die each year from NCDs and two in every three deaths among

women are due to the NCDs. Diabetes affects 1 in every 6 pregnancies around the world (Iversen, 2017) and Hypertensive disorders affect up to 10 percent of pregnancies globally (ACOG, 2019). The rising incidence of NCDs in pregnant women directly affects the number of maternal deaths globally.

In India, the recent estimates of Maternal Mortality Ratio (MMR) is 113 maternal deaths per every 100,000 live births (SRS, 2019). Perhaps, India may achieve the Sustainable Development Goals (SDGs) for maternal health. However, India is experiencing high interstate differences in MMR. It is also evident that socio-economically backward sates have higher rates of maternal mortality in India (SRS, 2019). The Non-communicable diseases (NCDs) make up a considerable health burden in India. Pregnancy Induced Hypertension, Gestational Diabetes Mellitus, and gestational hypothyroidism were identified as factors contributing to a high-risk pregnancy (Majella, et al., 2019). Women in rural India and belongs to marginalised sections are particularly vulnerable due to limited knowledge and healthcare access. Further, high-risk conditions detected during pregnancy, such as hypertensive disorders and gestational diabetes mellitus (GDM) increase the risk of cardiometabolic disease in the years following birth.

Though, the burden of NCDs has been grown, India still does not have sufficiently detailed data on NCDs for research and policy purposes, particularly data on pregnant women. Hence, limited evidence is available on the magnitude of common NCDs in pregnant women in India; and available evidence are based on either empirical data or from facility-level data. As India is in the third stage of Obstetric transition phenomena, the development of evidence-based guidelines for improving knowledge and practice is vital to minimize adverse maternal and pregnancy outcomes.

The determinants of maternal mortality and morbidity have been described since back in term of distal and intermediate determinants. The distal determinants include factors like women's socio-economic characteristics as well as broader cultural factors. Intermediate determinants encompass biomedical factors, including women's general and reproductive health, and health care system factors, like access to care and use of services. The commonest causes of maternal death are the so-called direct causes, due to obstetric complications like haemorrhage during childbirth, eclampsia, abortion, obstructed labour and sepsis. For these causes, efforts to reduce global maternal mortality have focused on obstetric interventions and motherhood services. Less attention has been paid to the general health of women and medical conditions during

pregnancy that result in maternal mortality and morbidity. In the backdrop of the Sustainable Development Goals (SDG), countries have united behind a new target to accelerate the decline of maternal mortality by 2030. SDG-3 focuses to reduce the global maternal mortality ratio (MMR) to less than 70 per 100 000 births, with no country having a maternal mortality rate of more than twice the global average. To achieve the SDG-3 and national goal (of reduction in maternal and new-born mortality) proper identification and magnitude of NCDs among women during pregnancy need to be addressed. Therefore, this study focuses attention on the relatively neglected problem of non-communicable diseases (NCDs) during pregnancy at national and state level, and investigates the public health implications of changing patterns of health in pregnancy. The present study has its objectives in three folds. First, it assesses the level and trends of different types of NCDs (Anemia, Hypertension and Diabetes) among pregnant women. Secondly, study tries to find out the determinants of NCDs (Anemia, Hypertension and Diabetes) among pregnant women and finally, it assesses the cause of maternal death; particularly maternal death caused by NCDs India.

Data source and method

Data

Data for the present study have been extracted from Health Management Information System (HMIS) during 2016-2020. The study has assessed the situation of NCDs among women during their pregnancy at national as well as state level.

To study the prevalence of NCDs among pregnant women across socio-economic and demographic characteristics fourth round of National Family Health Survey (NFHS-4) data, conducted during 2015-16 has been used. The fourth round collected information from 601509 households on important population, nutrition, socioeconomic, and maternal-child health indicators. It was the first round to cover all 36 states and union territories in India and included biomarker sampling for height, weight, blood pressure, and blood glucose. The target population of this survey was women 15 to 49 years of age. At the time of the survey, trained health investigators conducted biomarker sampling and measurements of weight, height, blood pressure, and random blood glucose level for respondents. The response rate for NFHS-4 was approximately 98% for households and 97% for eligible women.

Outcome variables

The anaemia, Hypertension and Diabetes in the pregnant women were the primary outcome variables of the study. The operation definition of the mentioned indicators is defined as;

Anaemia: A pregnant woman is classified as anaemic if she has a Hb level <10.0 g/dl.
Hypertension: A pregnant woman is classified as having hypertension if she has SBP≥140 mmHg or DBP≥ 90 mmHg at the time of survey, or she is currently taking medicine to lower her blood pressure
Diabetes: A pregnant woman is classified as having Diabetes if she has a random blood glucose level of 141 mg/dl or higher.

All of the outcome variables of the present study were coded in dichotomises form; i.e. present of anaemia, present of hypertension and present of diabetes were assigned code '1', otherwise '0'.

Explanatory variables

Based on the extensive literature, we considered explanatory variables such as trimester of pregnancy (first, second and third); age (15-24, 25-34 and 35-49 years); Children ever born (no child, one child and two or more than two child); place of residence (urban vs. rural); wealth quintile (poorest, poor, middle, rich and richest); caste (scheduled caste, scheduled tribe, other backward caste - OBC and general); religion (Hindu, Muslim and others); education level (no education, primary, secondary and higher); women's height (<145 cm vs. 145 cm or more); tobacco use (yes vs. no); nutritional/health services matters talked about in the last 3 months (no vs. yes); mass media exposure (no vs. any exposure); geographical region of residence (north, central, east, northeast, west and south).

Statistical analysis

Bivariate analyses were carried out to assess the level of anaemia, hypertension and diabetes among pregnant women by their demographic and socioeconomic characteristics by applying appropriate sampling weights. In multivariate analysis, binary logistic regression models were used to assess the net effects of several confounding factors associated with the occurrence of anemia among pregnant women. The regression result has been presented in terms of adjusted odds ratio with 95% confidence interval across the categories of the predictor variables. All analyses of this study were carried out using STATA 14 software.
The time series trend analysis has been done for HMIS data set.

Results

Level and trend of NCDs (Anemia, Hypertension and Diabetes) among pregnant women at national as well as state level 2017-18 to 2019-20

Table 1 shows the percentage of pregnant women having severe anaemia during pregnancy and the percentage of severe anaemic women treated at the institution during 2017-18-1920. Overall, about 3.6 to 3.7 percentage of total pregnant women who were registered for ANC had severe anaemia (Hb<7) during 2017-18 to 2019-20. During the same period, 45.3%, 53.9% and 60.3 % of pregnant women having severe anaemia were treated at the institution during 2017-18, 2018-19 and 2019-20 respectively.

The percentage of pregnant women with severe anaemia was higher in Jammu and Kashmir (6 to 14.8%) followed by Haryana (5.8 to 6.9%), Tamil Nadu (6.9 to 9.9%), Gujarat (4.8 to 5.7%), Karnataka4.5 to 6.7%), Meghalaya (3.0 to 4.3%) and Uttar Pradesh (3.6 to 4.1%). Less than one per cent of pregnant women of total ANC registration were severe anaemic in each state Himachal Pradesh (0.8 to 0.9%, Kerala (0.6 to 1.2%), Manipur (0.2 to 0.3%), Nagaland (0.5 to 0.8%) and West Bengal (07 to 0.8%) during 2017-18-to 2019-20. Of total severe anaemic pregnant women less than half of the women (29.9% in 2017-18, 35.4% in 2018-19 and 44.9% in 2019-20) were treated at institution in Uttar Pradesh. Similar kind of results has been observed in Tamil Nadu, though both of the states are totally different in terms of demographic and public health system approach. Nonetheless Gujarat and Haryana had higher percentage of severe anaemic pregnant women, but more than seventy percentages of the cases were treated at the institution during the same time period.

Table 2 depicts the percentage of new cases of pregnant women detected at institution for hypertension to the total ANC registration during 2016-17- 2019-20. At national level the new cases have been decline from 3.5% in 2016-17 to 2.1% 2019-20 of total ANC registration. The smaller territories, particularly, Andaman and Nicobar Islands (3.7% to 6.5%), Dadra and Nagar Haveli (5.3% to 6.7%), Chandigarh (2.4% to 5.1%), Lakshadweep (4.5% to 7.5%) Goa (4.2% to 6.1%) have shown the high rate of hypertension among pregnant women during the study periods. Though, all these territories have shown the decline trend in the rate of hypertension among pregnant women during 2916-17- to 2019-20. Interestingly, the bigger southern states have shown the high rate of hypertension among pregnant women then lagging behind states. For example, the new case of PW detected at institution for hypertension was

higher in Karnataka (3.8% to 4.1%), Tamil Nadu (4.0 to 5.3%) and Kerala (3.1% to 3.3%) during 2016-17 to 2019-20.

The percentage of new cases of pregnant women detected at institution for hypertension to total ANC registration was least in the states like- Bihar (1.9 in 2016-17 to 0.9% in 2019-20), Manipur (0.5% in 2016-17 to 0.6% in 2019-20), Jharkhand (4.1% in 2016-17 to 1.2% in 2019-20), Gujarat (2.0% in 2016-17 to 1.6% in 2019-20), Uttarakhand (3.2% in 2016-17 to 1.4% in 2019-20), Uttar Pradesh (7.3% in 2016-17 to 1.6% in 2019-20) and Andhra Pradesh (2.5% in 2016-17 to 1.8% in 2019-20). The good thing is that all are showing he declined trend in the rate of hypertension among pregnant women over the period of time.

Table 3 presents percentage of pregnant women tested positive for Gestational diabetes mellitus (GDM) to total ANC registration during 2017-18 to 2019-20. At the national level, 5 pregnant women per thousand ANC registration were tested positive for GDM. The prevalence of GDM was higher in Lakshadweep (from 60 in 2017-18 to 75 in 2019-20), Kerala (15 in 2017-18 to 26 in 2019-20), Goa (37 in 2017-18 to 50 in 2018-19), Andaman and Nicobar Island (18 in 2017-18 to 2.7 in 2018-19) and Tamil Nadu (25 in 2017-18 and 2019-20 to 29 in 2018-19). Interestingly, backword state like Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh has shown low prevalence of GDM than the national average over the period of time.

Determinant of NCDs (Anemia, Hypertension and Diabetes) among pregnant women

To see the socio-economic differentials in prevalence of NCDs among pregnant women fourth round of National Family Health Survey data has been utilised which is presented in the table 4, 5 and 6 at national level.

Table 4 presents socio-economic differentials in the prevalence of anaemia among pregnant women. In total, a little more than one fourth (25.9%) of the pregnant women found to be anemic at the time of survey. The prevalence of anaemia was higher among the pregnant women who were in her third trimester (30.9%), women belong to age group 35-49 years of age (33.3%), who had already two or more children (31.9%), resides in rural areas (27.3%), belonged to poorest household (31.4%), from the Scheduled tribes (33.9%), women from Hindu religion (26.2%), women with no education (32.9%), women with less than 145 cm of height (30.3%), consume tobacco (36%), not advised or talk about nutritional/Health related matters in the last 3 months by any health worker (25.9%) and women from eastern region (28.3%). The regression results also confirm the same. For example, the odds for having anaemia during pregnancy was higher among women who were in their third trimester (OR:

2.1; p<0.001) and having two or more children (OR:1.4; p<0.001) compared to women in the first trimester and women with no child respectively. Similarly, odds for having anaemia was significantly lower among women belongs to 24-34 age group (OR:89; p<0.05), belongs to richest household (OR: 0,71; p<0.001), from other caste group (OR: 0.62; p<0.001), following other religion (OR:0.81; p<0.05), women with the height of 145 cm or above (OR:0.86; p<0.01), currently consume tobacco (OR: 0.75; p<0.01) and belong to northeast region (OR: 0.61; p>0.001) and south region (OR: 0.75; p<0.001) compared to women in the age group 15-24, belong to poorest household, women from scheduled tribe community, women from Hindu religion, women's height less than 145 cm, do not consume tobacco and women from north region respectively.

A similar exercise has been conducted in order to identify prevalence and odds of hypertension and presented in Table 5. Results suggest that on an average 4.4% of pregnant women were suffering from hypertension at the time of survey. This prevalence considerably varies by socio-economic condition of the respondents. The prevalence of hypertension was higher among the pregnant women who were in their third trimester (6.0%), women belonged to age group 35-49 years (9.7%), who had already two or more children (4.9%) resides in urban areas (4.7%), belonged to richest household (4.9%), from the Scheduled tribes (5.2%), women from other religion (6.5%), pregnant women with higher level of education (4.9%), consume tobacco (4.8%), not advised or talk about nutritional/Health related matters in last 3 months with any health worker (4.4%) and women from Northeast region (7.6%). The results of regression results also affirm these findigs. For illustration, the odds for having hypertension during pregnancy was significantly higher among women who were in their third trimester (OR: 1.6; p<0.001) and those who were in their 35-49 age group (OR: 2.7; p<0.001) compared to women in the first trimester and women in the age group of 15-24 respectively. Similarly, odds for having hypertension was significantly lower among women belongs to central India (OR: 75; p<0.01) with respect to women from Northern region.

In addition to hypertension, the prevalence and odds of diabetes has been identified and presented in Table 6. At national level the prevalence of Diabetes among pregnant women was 2.4%. The prevalence of diabetes is varied by socio-economic differentials and evident from the Table 6.

The prevalence of Diabetes was higher among the pregnant women who were in their first trimester of pregnancy (2.8%), women belonged to age group 35-49 years (4.3%), among urban

resident (3.0%), belonged to richest household (3.7%), women from other backward caste (2.6%), followers of other religion (4.1%), pregnant women with higher level of education (4.3%), women with less than 145 cm of height (2.5%), consume tobacco (2.8%), who had advised or discuss about nutritional/Health related matters in last 3 months with any health worker (2.6%), pregnant women who exposed to media (2.6%) and pregnant women from south region (3.5%). While identifying odds of diabetes among pregnant women, results suggest that the odds for having diabetes during pregnancy was significantly higher among women who were in their 35-49 age group (OR: 2.5; $p<0.001$), women from the richest household (OR: 1.6; $p<0.05$), either belong to Muslim (OR:1.374; $p<0.05$) or other religion (1.753; $p<0.05$) and residents of southen region (OR:1.5; $p<0.05$) as compare to women in the age group 15-24, women from poorest household, women from Hindu religion and women from northern region respectively.

Summary and Discussion

The present study found a high rate of NCDs; namely Anaemia, hypertension and Diabetes among pregnant women. The evidence of the HMIS data shows that the prevalence of severe anaemia (Hb<7 g/dl) is increases over the period of time in most of the states. The situation became worse in the states like Gujarat, Haryana and Jammu and Kashmir, Maharashtra and Uttar Pradesh where the percentage of pregnant women with severe anaemia has been increased. At national level, from only 60.3 percentage of the severe anaemic women were treated at institution in 2019-20 that is not accepted in the given current scenario of high level of maternal and inborn mortality. Even in the backward states such as Assam and Bihar the rate of severe anaemic women has been increased over the period and out of total less than half of the women were treated at institution. To see whether socio-economic factors affect the NCDs (anaemia, hypertension and diabetes) among pregnant women, fourth round of National Family Health Survey (NFHS-4) data has been used. The study observed a vast socio-economic differential in the prevalence of NCDs among pregnant women. The details about each indicator are given in below sections.

Anemia

Anemia during pregnancy is associated with an augmented risk of maternal and child mortality and morbidity in low-income countries (Kalaivani, 2009; WHO, 2014). Similar to earlier studies of other countries (McLean et al., 2009; Picciano, 2003), the present study supports that the later stage of pregnancy and higher parity are associated with higher risk of anemia among pregnant women. In the analysis, women's age emerged as a critical factor that elevates the

risk of NCDs during pregnancy. Older women were at a significantly higher risk of having anaemia, hypertension and diabetes during pregnancy. The etiology of anaemia is complex and ranges from bone marrow failure syndromes to chronic kidney disease and from nutritional deficiencies to inflammatory processes, including inflammation in immunosenescence (Stauder, et al., 2018).

The result further suggests that the prevalence of anaemia among pregnant women is greatly skewed toward the disadvantaged group of women. For illustration, pregnant women living in rural areas, belongs to the poorest and poor households, women from schedule tribes and schedule caste, women with no education and having no media exposure are at greater risk of having anemia during their pregnancy. These women suffer more because of demand-side factors. They have less purchasing power to acquire essential levels of supplements, protein, and vitamins during the pregnancy (Goli, et al., 2015). The risk of having anaemia among pregnant women decreases with the increase of the economic status of the household. This is probably because anaemia is associated with diet patterns and nutritional deficiencies, and lower knowledge and least access to health facilities among the poor than richer.

Additionally, increasing the height of women is negatively associated with the risk of anemia among pregnant women. The prevalence of anemia was higher among smokers compared with no-smokers, though the association was not statistically significant. Biochemically, tobacco use may affect iron metabolism (Kocyigit et al., 2001), iron stores (Northrop et al., 2007), inflammation (Chelchowska et al., 2016), and haemoglobin levels (WHO, 2013). Behaviorally, tobacco use may act as an appetite suppressant (Blaha et al., 1998; Koopmann et al., 2015; Miyata et al., 1999), and has been linked with lower food intake. In contrast, even though many women in India use tobacco during pregnancy, but there is no national policy to address antenatal tobacco use, despite international recommendations (WHO, 2013).

Hypertension

Unlike anemia, the socio-economically developed states such as Tamil Nadu, Kerala, Karnataka and UTs namely; Goa, Chandigarh, Lakshadweep and Dadra and Nagar Haveli are showing the relatively higher percentage of women had Hypertension. On the other hand, socio-economically backword states (Bihar, Uttar Pradesh, Jharkhand etc.) had relatively low percentage of pregnant women with Hypertension. Moreover, as far as socio-economic demographic factors are concerned, the prevalence of Hypertension among pregnant women was significantly higher among the women in their third trimester of pregnancy, which belongs

to the 35-49 years' age group. Further, pregnant women belong to wealthier families, followers of Muslim or other religions and women from the northeast region.

The higher prevalence of Hypertension among women belongs to richer households might be because of their risky health behaviours such as stress, unbalanced diet, and physical inactivity.

Interestingly, higher education pregnant women reported a relatively higher prevalence of Hypertension. This can be because education makes the people aware of the disease and the precautions to be undertaken by a healthy individual. Additionally, the prevalence of Hypertension was higher among those who consume tobacco than non-user, though the regression result shows the peculiar result that indicates that merely tobacco consumption is not enough for higher risk. We have also found that discussion with the frontline health worker in the last three months was associated with reduced risk of hypertension, indicating the importance of counselling and awareness during pregnancy.

A wide regional variability existed in the prevalence of Hypertension among pregnant women. For illustration, the Northeast region had significantly had high prevalence of Hypertension. One of the plausible reasons for high prevalence in this region could be unhealthy lifestyles and dietary patterns and inadequate knowledge about the risk factors of NCDs (Imamura et al., 2015; Vaidya, 2013; Choudhary, 2016). Other reason could be unaffordable anti-hypertensive medication or lack of treatment services, and distant heath care centres (Chow et al., 2013).

Diabetes

As far as the prevalence of diabetes among pregnant women is concerned, the existing evidence demonstrated the inconsistency regarding the prevalence of diabetes among women during pregnancy in India, which varies between 4% to 14%. (Raja, et al., 2014; Seshiah et al., 2004; Mishra et al., 2018; Mithal et al., 2015; Rajput et al., 2013). The difference in the estimates might be due to differences in the variations in sample sizes, sample size and different cutoffs used. Moreover, HMIS data shows that less than one per cent of women had gestational diabetes mellitus over the period of time, even the trend is almost stagnated. Some of the states, namely; Kerala, Karnataka and Tamil Nadu and UTs, namely; Andaman and Nicobar Islands, Chandigarh, Goa Lakshadweep, have historically reported a higher percentage of pregnant women with gestational diabetes mellitus, which is a cause of concern of policymakers and planners.

Our study shows that the rates of diabetes substantially vary across the demographic and socioeconomic characteristics of the respondents. The rate of diabetes was significantly higher among elderly women, who belong to rich households, followers of Muslim or other religions and women residing in the south region.

Interestingly, those women who were in their second trimester of pregnancy had a significantly lower risk of becoming diabetic than women who were in their first trimester of pregnancy. In the first three months of pregnancy, a drastic change in the female body creates a hormonal imbalance that elevates the glucose level. Besides, in the early stage of pregnancy, women are less familiar with pregnancy management, associated with a low level of awareness regarding diet and nutritional supplements that leads to an elevated risk of Gestational Diabetes among pregnant women.

Women's increased age is an important risk factor for the development of diabetes during pregnancy (Swaminathan, et al., 2020). In the present study, the prevalence of diabetes gradually increased with advancing age. We also observed an effect of parity on the prevalence of GDM. Women who had never been born any child before are more likely at risk of diabetes during pregnancy. This might be because of a sudden change in the hormones as they become pregnant first time.

Women residing in urban areas are more likely to be associated with an elevated risk of diabetes than rural inhabitants. This may be due to a generally lower level of physical activity, unhealthier diet, as well as other factors such as increased pollution in urban compared to rural habitats (Ramachandran, et al. 1999; Zargar et al., 2004; Ramachandran, 1997). Besides, the higher level of awareness and access to health care facilities might be one of the reasons for the elevated risk of diabetes among urban habitant women.

The study has found that the risk of diabetes among pregnant women increases with the increase in the household wealth and education level. Though the education level is not showing a significant association. The higher prevalence of diabetes among richer shows their better access to health care and awareness of the disease and the precautions to be undertaken by a healthy individual.

Furthermore, women’s height greater than 145 cm is less likely to be associated with diabetes during pregnancy. The height of the women is associated with the disadvantaged groups and may to some extent express growth ‘stunting’. The women’s height may be a marker of early pre-and post-natal nourishment and development, and may to some extent support the role of

the early environment and developmental programming on the risk of developing Gestational Diabetes.

Conclusion and Policy recommendations

Based on the finding of the study the following recommendations have been made to address the high prevalence of anemia, hypertension and diabetes among pregnant women, eventually to avoid the preventable maternal deaths.

- Study shows the high prevalence of Anemia among pregnant women, strengthening and monitoring the existing programs; i.e. ICDS, RKSK, JSSK, RMNCH+A, National Food Security Act, removing bottlenecks in accessing to programs by promoting awareness and health knowledge among women regarding nutrition and health care is critical for improving anemia among women in India.
- Developed states such as Karnataka, Maharashtra, Goa, Tamil Nadu, Kerala has been reported a relatively higher rate of NCDs (Anemia, hypertension and diabetes) among pregnant women than in backward states. Such geographical variation across the states might be attributable to the difference in food preferences and cultural beliefs about dietary consumption during pregnancy, the occurrence of communicable diseases, and the difference in the availability of healthcare facilities. Hence, the government should form the action plan for each state separately, blanket policy cannot be effective to avoid NCDs among pregnant women. Within the states, the government need to identify hotspots and need to prepare a strategy at the district level, special focus should be given to districts with a high prevalence rate of NCDs to tackle the pandemic of NCDs.
- It is recommended that addressing the specific needs of pregnant women through effective health care delivery system would help in reducing the prevalence of anemia among pregnant women.
- Increased outreach of health services, training, and motivating frontline health workers not only for pregnancy registration but also for promoting knowledge about balanced nutrition, dietary diversity and provision of supplementary nutrition is crucial to prevent anemia among pregnant women.
- There is a guideline for screening and management of gestational diabetes (GOI, 2014), but this guideline need to be contextualised and modified according to local need for effective treatment and adoption.
- India does not have clear-cut guidelines for Pregnancy Induce Hypertension (PIH). Hence there is an urgent need to developed a proper guideline for PIH based on the local needs.

- The findings of this study endorse that early screening for predicting the risk is an effective deterrent strategy for the prevention, treatment, and management of high-risk pregnancies, thereby curtailing the related morbidities and mortality.
- Empirical studies on community-based screening and management of NCDs during pregnancy is scanty in India which attenuates the likelihood for developing tailored community-based management guidelines for these high-risk conditions. Hence, the study recommends high-quality evidence through primary research at a community level.

Limitations of the study

This study has a few limitations that need to be mentioned and keep into while interpreting the results. Firstly, we have triangulated HMIS and NFHS data that are not comparable given the nature of data collection and sample selection. The data quality of HMIS is a big issue, we have not done the quality check before analysing it, hence there might be a chance of error in the reported prevalence rate. However, this study emphasizes the increasing burden of NCDs among pregnant women. NFHS is a cross- sectional study therefore a causal relationship cannot be necessarily established between the predictors and outcomes variables. Furthermore, there could be a possibilities of misreporting because of single-day measurements. The present study is limited to women who were pregnant at the time of the survey and assumed that elevated Hypertension, Anemia and random blood glucose level as cut-offs decided in the report.

Ethical approval

This analysis was based on the Demographic and Health Survey data from India available in the public domain. The study conducted a secondary analysis with no identifiable information on survey respondents.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Amant, F., Han, S. N., Gziri, M. M., Vandenbroucke, T., Verheecke, M., & Van Calsteren, K. (2015). Management of cancer in pregnancy. Best Practice & Research. Clinical Obstetrics & Gynaecology, 29(5), 741–753. https://doi.org/10.1016/j. bpobgyn.2015.02.006.

American College of Obstetricians and Gynecologists. (2019). ACOG Practice Bulletin No. 202: Gestational hypertension and preeclampsia. Obstetrics & Gynecology, 133(1), e1. https://doi.org/10.1097/AOG.0000000000003018

Bláha, V., Yang, Z. J., Meguid, M., Chai, J. K., & Zadák, Z. (1998). Systemic nicotine administration suppresses food intake via reduced meal sizes in both male and female rats. *ACTA MEDICA-HRADEC KRALOVE-*, *41*, 167-174.

Chełchowska, M., Ambroszkiewicz, J., Gajewska, J., Jabłońska-Głąb, E., Maciejewski, T. M., & Ołtarzewski, M. (2016). Hepcidin and iron metabolism in pregnancy: correlation with smoking and birth weight and length. *Biological trace element research*, *173*(1), 14-20.

Choudhary, R., Sharma, S. M., Kumari, V., & Gautam, D. (2016). Awareness, treatment adherence and risk predictors of uncontrolled hypertension at a tertiary care teaching hospital in Western India. *Indian heart journal*, *68*(Suppl 2), S251.

Chow, C. K., Teo, K. K., Rangarajan, S., Islam, S., Gupta, R., Avezum, A., ... & Yusuf, S. (2013). Prevalence, awareness, treatment, and control of hypertension in rural and urban communities in high-, middle-, and low-income countries. *Jama*, *310*(9), 959-968.

Goli, S., Rammohan, A., & Singh, D. (2015). The effect of early marriages and early childbearing on women's nutritional status in India. *Maternal and Child Health Journal*.

Government of India. (2014). National Guidelines for Diagnosis & Management of Gestational Diabetes Mellitus. Maternal Health Division, Ministry of Health and Family Welfare, GOI. [cited 10 Aug. 21]. Available from: https://nhm.gov.in/images/pdf/programmes/maternal-health/guidelines/National_Guidelines_for_Diagnosis_&_Management_of_Gestational_Diabetes_Mellitus.pdf

Haider, B. A., Olofin, I., Wang, M., Spiegelman, D., Ezzati, M., & Fawzi, W. W. (2013). Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes: systematic review and meta-analysis. *Bmj*, *346*.

Heslehurst, N., Simpson, H., Ells, L. J., Rankin, J., Wilkinson, J., Lang, R., ... & Summerbell, C. D. (2008). The impact of maternal BMI status on pregnancy outcomes with immediate short-term obstetric resource implications: a meta-analysis. *Obesity reviews*, *9*(6), 635-683.

Hussein, J. (2017). Non-communicable diseases during pregnancy in low and middle income countries. *Obstetric medicine*, *10*(1), 26-29.

Imamura, F., Micha, R., Khatibzadeh, S., Fahimi, S., Shi, P., Powles, J., ... & Global Burden of Diseases Nutrition and Chronic Diseases Expert Group (NutriCoDE. (2015). Dietary

quality among men and women in 187 countries in 1990 and 2010: a systematic assessment. *The lancet global health*, *3*(3), e132-e142.

Iversen, K. (2017). Diabetes in pregnancy: A neglected cause of maternal mortality. Maternal Health Task Force. https://www.mhtf.org/2017/05/10/diabetes-inpregnancy-a-neglected-cause-of-maternal-mortality/

Kalaivani, K. (2009). Prevalence & consequences of anaemia in pregnancy. *Indian J Med Res*, *130*(5), 627-33.

Kocyigit, A., Erel, O., & Gur, S. (2001). Effects of tobacco smoking on plasma selenium, zinc, copper and iron concentrations and related antioxidative enzyme activities. *Clinical biochemistry*, *34*(8), 629-633.Koopmann, A., Bez, J., Lemenager, T., Hermann, D., Dinter, C., Reinhard, I., ... & Kiefer, F. (2015). Effects of cigarette smoking on plasma concentration of the appetite-regulating peptide ghrelin. *Annals of Nutrition and Metabolism*, *66*(2-3), 155-161.

Lumbiganon, P., Laopaiboon, M., Intarut, N. A., Vogel, J. P., Souza, J. P., Gülmezoglu, A. M., ... & WHO Multicountry Survey on Maternal and Newborn Health Research Network. (2014). Indirect causes of severe adverse maternal outcomes: a secondary analysis of the WHO Multicountry Survey on Maternal and Newborn Health. *BJOG: An International Journal of Obstetrics & Gynaecology*, *121*, 32-39. https://doi.org/10.1111/1471-0528.12647.

Majella, M. G., Sarveswaran, G., Krishnamoorthy, Y., Sivaranjini, K., Arikrishnan, K., & Kumar, S. G. (2019). A longitudinal study on high risk pregnancy and its outcome among antenatal women attending rural primary health centre in Puducherry, South India. *Journal of education and health promotion*, *8*.

March of Dimes. (2014). Multiple sclerosis and pregnancy. https://www. marchofdimes.org/complications/multiple-sclerosis-and-pregnancy.aspx 8.

McLean, E., Cogswell, M., Egli, I., Wojdyla, D., & De Benoist, B. (2009). Worldwide prevalence of anaemia, WHO vitamin and mineral nutrition information system, 1993–2005. *Public health nutrition*, *12*(4), 444-454.

Mithal, A., Bansal, B., & Kalra, S. (2015). Gestational diabetes in India: Science and society. *Indian journal of endocrinology and metabolism*, *19*(6), 701.

Miyata, G., Meguid, M. M., Fetissov, S. O., Torelli, G. F., & Kim, H. J. (1999). Nicotine's effect on hypothalamic neurotransmitters and appetite regulation. *Surgery*, *126*(2), 255-263.Nordenberg, D., Yip, R., & Binkin, N. J. (1990). The effect of cigarette smoking on hemoglobin levels and anemia screening. *Jama*, *264*(12), 1556-1559.

Northrop-Clewes, C. A., & Thurnham, D. I. (2007). Monitoring micronutrients in cigarette smokers. *Clinica Chimica Acta*, *377*(1-2), 14-38.

Office Registrar General of India (2018). Special bulletin on maternal mortality in India 2014–16. New Delhi: Office of the Registrar General and Census Commissioner of India.

Raja, M. W., Baba, T. A., Hanga, A. J., Bilquees, S., Rasheed, S., Haq, I. U., ... & Bashir, A. (2014). A study to estimate the prevalence of gestational diabetes mellites in an urban block of Kashmir valley (North India). *Int J Med Sci Public Health*, *3*(2), 191-5.

Rajput, R., Yadav, Y., Nanda, S., & Rajput, M. (2013). Prevalence of gestational diabetes mellitus & associated risk factors at a tertiary care hospital in Haryana. *The Indian journal of medical research*, *137*(4), 728.

Ramachandran, A., Snehalatha, C., Latha, E., Manoharan, M., & Vijay, V. (1999). Impacts of urbanisation on the lifestyle and on the prevalence of diabetes in native Asian Indian population. *Diabetes research and clinical practice*, *44*(3), 207-213.

Ramachandran, A., Snehalatha, C., Latha, E., Vijay, V., & Viswanathan, M. (1997). Rising prevalence of NIDDM in an urban population in India. *Diabetologia*, *40*(2), 232-237.

Say, L., Chou, D., Gemmill, A., Tunçalp, Ö., Moller, A. B., Daniels, J., ... & Alkema, L. (2014). Global causes of maternal death: a WHO systematic analysis. *The Lancet global health*, *2*(6), e323-e333. https://doi.org/10.1016/S2214-109X(14)70227-X.

Seshiah, V., Balaji, V., Balaji, M. S., Sanjeevi, C. B., & Green, A. (2004). Gestational diabetes mellitus in India. *Japi*, *52*(9), 707-711.

Stauder, R., Valent, P., & Theurl, I. (2018). Anemia at older age: etiologies, clinical implications, and management. *Blood, The Journal of the American Society of Hematology*, *131*(5), 505-514.

Swaminathan, G., Swaminathan, A., & Corsi, D. J. (2020). Prevalence of gestational diabetes in India by individual socioeconomic, demographic, and clinical factors. *JAMA network open*, *3*(11), e2025074-e2025074.

Vaidya, A., Aryal, U. R., & Krettek, A. (2013). Cardiovascular health knowledge, attitude and practice/behaviour in an urbanising community of Nepal: a population-based cross-sectional study from Jhaukhel-Duwakot Health Demographic Surveillance Site. *BMJ open*, *3*(10), e002976.

Wendland, E. M., Torloni, M. R., Falavigna, M., Trujillo, J., Dode, M. A., Campos, M. A., ... & Schmidt, M. I. (2012). Gestational diabetes and pregnancy outcomes-a systematic review of the World Health Organization (WHO) and the International Association of Diabetes in Pregnancy Study Groups (IADPSG) diagnostic criteria. *BMC pregnancy and childbirth*, *12*(1), 1-13.

World Health Organization. (2012). *The WHO application of ICD-10 to deaths during pregnancy, childbirth and puerperium: ICD-MM*. World Health Organization.

World Health Organization. (2014). *Serum transferrin receptor levels for the assessment of iron status and iron deficiency in populations* (No. WHO/NMH/NHD/EPG/14.6). World Health Organization.

World Health Organization. (2019). Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division.

World Health Organization (1996). Hypertension Control. Technical Report Series. World Health Organization.

World Health Organization (2013). WHO recommendations for the prevention and management of tobacco use and second-hand smoke exposure in pregnancy. Geneva: World Health Organization; p. 103.

Zargar, A. H., Sheikh, M. I., Bashir, M. I., Masoodi, S. R., Laway, B. A., Wani, A. I., Bhat M.H. & Dar, F. A. (2004). Prevalence of gestational diabetes mellitus in Kashmiri women from the Indian subcontinent. *Diabetes research and clinical practice, 66*(2), 139-145.

Tables

Table 1: percentage of pregnant women having severe anaemia during pregnancy and percentage of severe anaemic women treated at the institution during 2016-17 to 2019-20

	% PW having severe anaemia (Hb<7) to total ANC registration			% PW having Hb<7 treated at institution to women having Hb level<7		
	2019-20	2018-19	2017-18	2019-20	2018-19	2017-18
All India	3.7	3.7	3.6	60.3	53.9	45.3
A & N Islands	3.3	9.0	6.6	96.2	37.8	24.3
Andhra Pradesh	1.4	1.7	3.0	90.5	59.7	55.4
Arunachal Pradesh	1.1	2.8	2.5	63.4	34.8	18.6
Assam	3.1	3.0	2.4	48.6	35.9	30.4
Bihar	1.9	1.7	1.5	40.0	36.5	26.3
Chandigarh	1.8	1.5	1.6	92.7	93.3	93.8
Chhattisgarh	2.6	2.8	3.8	89.3	78.7	58.9
Dadra & Nagar Haveli	3.2	3.3	4.1	85.9	86.2	82.0
Daman & Diu	2.8	1.3	3.5	85.8	60.2	22.2
Delhi	2.7	2.0	2.0	75.9	63.3	63.9
Goa	0.9	1.0	1.3	90.7	75.6	79.2
Gujarat	5.7	5.4	4.8	93.6	88.3	48.1
Haryana	6.9	6.8	5.8	70.3	72.2	76.3
Himachal Pradesh	0.9	0.8	0.8	63.4	60.9	60.4
Jammu & Kashmir	14.8	11.5	6.0	64.0	64.8	62.7
Jharkhand	1.8	1.6	1.7	65.6	44.7	29.1
Karnataka	4.5	5.1	6.7	61.5	52.1	45.5
Kerala	0.8	1.2	0.6	51.6	52.7	61.3
Lakshadweep	2.2	3.6	6.4	214.3	84.8	67.1
Madhya Pradesh	5.5	4.7	5.2	57.7	51.3	43.7
Maharashtra	4.2	3.9	3.5	91.6	85.0	64.6
Manipur	0.3	0.3	0.2	50.0	47.3	49.3
Meghalaya	4.3	3.0	3.2	54.1	53.9	56.9
Mizoram	0.9	2.5	2.4	45.2	23.6	11.8
Nagaland	0.5	0.6	0.8	76.6	46.8	54.4
Odisha	1.9	1.9	2.1	91.2	84.9	47.6
Puducherry	2.3	2.0	2.5	75.0	94.6	79.4
Punjab	3.1	3.7	3.3	64.4	69.6	63.3
Rajasthan	3.5	3.2	3.1	78.6	74.1	55.8
Sikkim	1.1	0.9	0.9	54.9	73.2	74.4
Tamil Nadu	6.9	7.9	9.9	34.4	33.3	36.1
Telangana	7.0	9.2	7.1	40.5	36.9	48.2
Tripura	1.5	2.0	1.7	81.8	65.4	57.2
Uttar Pradesh	4.1	4.0	3.6	44.9	35.4	29.9
Uttarakhand	2.0	2.4	3.4	69.1	55.7	55.9
West Bengal	0.8	0.7	0.8	76.8	78.4	64.6

Table 2: Percentage of new cases of Pregnant Women detected at institution for hypertension to Total ANC Registrations during 2016-17 to 2019-20.

	% New cases of Pregnant Women detected at institution for hypertension to Total ANC Registrations			
	2019-20	**2018-19**	**2017-18**	**2016-17**
All India	2.1	2.0	2.1	3.5
A & N Islands	6.5	5.3	3.7	6.5
Andhra Pradesh	1.8	1.9	2.4	2.5
Arunachal Pradesh	1.9	2.5	3.1	3.4
Assam	3.1	2.6	2.7	2.4
Bihar	0.9	0.5	0.8	1.9
Chandigarh	5.1	4.2	4.2	2.4
Chhattisgarh	2.1	2.3	2.9	3.9
Dadra & Nagar Haveli	6.7	6.8	6.1	5.3
Daman & Diu	1.2	8.9	1.2	1.6
Delhi	2.9	2.5	2.4	2.2
Goa	4.2	3.8	5.0	6.1
Gujarat	1.6	1.2	1.5	2.0
Haryana	1.8	1.7	2.3	3.1
Himachal Pradesh	2.0	1.8	1.7	2.0
Jammu & Kashmir	2.8	3.2	2.8	2.0
Jharkhand	1.2	1.1	1.3	4.1
Karnataka	4.1	4.3	4.3	3.8
Kerala	3.3	3.8	3.2	3.1
Lakshadweep	4.5	7.5	6.1	5.3
Madhya Pradesh	2.3	1.9	2.1	5.4
Maharashtra	2.0	2.0	1.6	1.1
Manipur	0.6	0.7	0.8	0.5
Meghalaya	2.9	2.4	3.0	2.5
Mizoram	2.6	5.4	2.1	1.1
Nagaland	1.5	1.4	1.6	1.2
Odisha	1.5	1.7	1.7	1.8
Puducherry	2.7	2.5	2.7	2.7
Punjab	2.0	1.8	2.0	2.0
Rajasthan	1.6	1.6	1.7	1.9
Sikkim	3.0	1.7	1.8	2.9
Tamil Nadu	4.0	5.0	5.5	5.3
Telangana	2.7	2.6	2.6	1.9
Tripura	1.7	1.8	2.6	3.8
Uttar Pradesh	1.6	1.4	1.9	7.3
Uttarakhand	1.4	1.8	2.3	3.2
West Bengal	3.8	3.2	2.8	2.1

Table 3: Percentage of pregnant women tested positive for Gestational diabetes mellitus (GDM) to total ANC Registration

	% Pregnant women tested positive for Gestational diabetes mellitus (GDM) to total ANC Registration		
	2019-20	**2018-19**	**2017-18**
All India	0.5	0.5	0.4
A & N Islands	2.5	2.7	1.8
Andhra Pradesh	0.1	0.2	0.2
Arunachal Pradesh	0.1	0.5	0.5
Assam	1.1	0.1	0.1
Bihar	0.1	0.2	0.1
Chandigarh	2.1	1.3	1.0
Chhattisgarh	0.3	0.3	0.2
Dadra & Nagar Haveli	0.3	0.5	0.0
Daman & Diu	0.0	0.0	0.1
Delhi	1.7	0.9	0.6
Goa	3.7	5.0	3.9
Gujarat	0.2	0.2	0.2
Haryana	0.6	0.3	0.1
Himachal Pradesh	1.3	1.0	0.5
Jammu & Kashmir	0.6	0.3	0.2
Jharkhand	0.1	0.1	0.1
Karnataka	1.1	1.1	1.1
Kerala	2.6	2.5	1.5
Lakshadweep	7.5	6.0	6.0
Madhya Pradesh	0.5	0.1	0.5
Maharashtra	0.3	0.4	0.2
Manipur	0.1	0.2	0.1
Meghalaya	0.4	0.2	0.4
Mizoram	0.2	0.4	0.3
Nagaland	0.0	0.0	0.0
Odisha	0.4	0.2	0.1
Puducherry	1.9	2.1	2.2
Punjab	0.1	0.0	0.0
Rajasthan	0.1	0.1	0.0
Sikkim	0.0	0.0	0.0
Tamil Nadu	2.5	2.9	2.5
Telangana	0.0	0.6	0.5
Tripura	0.0	0.0	0.1
Uttar Pradesh	0.3	0.5	0.3
Uttarakhand	0.0	0.0	0.0
West Bengal	0.3	0.2	0.3

Table 4: Prevalence of Anaemia (<10.0 g/dl) among pregnant women by their background characteristics in India, 2015-16.

Background characteristics	Anaemia[$]	Total	Odds ratio	95% confidence intervals
Trimester of pregnancy				
First®	17.8	8,990		
Second	28.1	12,107	1.841***	[1.677,2.021]
Third	30.9	9,216	2.103***	[1.909,2.318]
Age				
15-24®	25.6	17,260		
24-34	25.6	11,971	0.893**	[0.820,0.973]
35-49	33.3	1,095	1.031	[0.861,1.234]
Children ever born				
No child®	21.8	12,290		
One child	26.0	9,644	1.247***	[1.136,1.368]
Two or more than two	31.9	8,392	1.441***	[1.295,1.603]
Place of residence				
Urban®	22.3	8,431		
Rural	27.3	21,895	1.003	[0.899,1.119]
Wealth quintile				
Poorest®	31.4	7,113		
Poor	28.8	6,634	1.059	[0.955,1.174]
Middle	26.1	6,207	0.998	[0.880,1.130]
Rich	23.4	5,491	0.955	[0.825,1.105]
Richest	16.6	4,881	0.715***	[0.596,0.857]
Caste				
Schedule Tribe®	33.9	2,927		
Schedule caste	27.9	6,601	0.802***	[0.710,0.907]
OBC	25.7	13,730	0.739***	[0.658,0.829]
Others	21.1	5,823	0.629***	[0.545,0.725]
Religion				
Hindu®	26.2	23,544		
Muslim	26.1	5,230	1.077	[0.961,1.208]
Others	20.9	1,552	0.811*	[0.679,0.968]
Education level				
No education®	32.9	7,512		
Primary	29.8	3,845	0.925	[0.822,1.040]
Secondary	23.8	14,962	0.830***	[0.751,0.918]
Higher	16.8	4,007	0.719***	[0.610,0.847]
Women's height				
<145 cm®	30.3	3,407		
145 cm or above	25.3	26,902	0.862**	[0.773,0.962]
Tobacco use				
Yes®	36.0	1,416		
No	25.4	28,910	0.756**	[0.638,0.896]
Nutritional/Health services/matters talked about in last 3 months				
No®	25.9	29,716		
Yes	24.4	610	0.93	[0.657,1.317]
Media exposure				
No®	31.1	7,625		
Any exposure	24.1	22,701	0.988	[0.901,1.084]
Regions				
North®	25.9	4,232		

Central	27.6	8,710	0.905	[0.815,1.006]
East	28.3	7,721	0.901	[0.798,1.017]
Northeast	21.2	992	0.619***	[0.520,0.738]
West	25.4	3,558	0.912	[0.771,1.078]
South	20.7	5,113	0.756***	[0.655,0.873]
Total	25.9	30,326		

*Note: level of significance: * p<0.05, ** p<0.01, *** p<0.001. ®: reference category.*
A pregnant woman is classified as anaemic if she has a Hb level <10.0 g/dl; $:Prevalence of anaemia.

Table 5: Prevalence of hypertension among pregnant women by their background characteristics, 2015-16

Background characteristics	Hypertension[$]	Total	Odds ratio	95% confidence intervals
Trimester of pregnancy				
First®	3.6	9,043		
Second	3.7	12,179	0.985	[0.814,1.192]
Third	6.0	9,281	1.634***	[1.361,1.963]
Age				
15-24®	3.5	17,351		
22-34	5.2	12,062	1.488***	[1.254,1.766]
35-49	9.7	1,102	2.780***	[2.082,3.712]
Children ever born				
No child®	4.1	12,379		
One child	4.3	9,711	0.951	[0.787,1.149]
Two or more than two	4.9	8,426	0.908	[0.728,1.132]
Place of residence				
Urban®	4.7	8,542		
Rural	4.3	21,974	0.958	[0.781,1.176]
Wealth quintile				
Poorest®	4.1	7,149		
Poor	4.2	6,641	1.032	[0.822,1.297]
Middle	4.0	6,247	0.988	[0.763,1.280]
Rich	5.0	5,524	1.139	[0.842,1.541]
Richest	4.9	4,955	1.035	[0.737,1.453]
Caste				
Schedule Tribe®	5.2	2,935		
Schedule caste	4.1	6,630	0.826	[0.640,1.066]
OBC	4.0	13,788	0.799	[0.631,1.013]
Others	5.0	5,907	0.927	[0.699,1.230]
Religion				
Hindu®	4.2	23,675		
Muslim	4.8	5,283	1.088	[0.876,1.351]
Others	6.5	1,558	1.309	[0.996,1.719]
Education level				
No education®	4.5	7,545		
Primary	4.4	3,857	0.999	[0.781,1.280]
Secondary	4.2	15,047	0.992	[0.799,1.232]
Higher	4.9	4,067	0.998	[0.719,1.387]
Women's height				
<145 cm®	4.5	3,411		
145 cm or above	4.4	27,087	0.895	[0.700,1.144]
Tobacco use				
Yes®	4.8	1,424		

No	4.4	29,092	1.153	[0.851,1.563]
Nutritional/Health services/matters talked about in last 3 months				
No®	4.4	29,903		
Yes	3.6	612	0.815	[0.414,1.601]
Media exposure				
No®	4.4	7,660		
Any exposure	4.4	22,856	0.92	[0.757,1.124]
Regions				
North®	5.4	4,246		
Central	3.9	8,736	0.753**	[0.624,0.910]
East	3.8	7,749	0.714**	[0.568,0.896]
Northeast	7.6	998	1.24	[0.949,1.631]
West	4.5	3,618	0.77	[0.572,1.040]
South	4.5	5,169	0.85	[0.648,1.112]
Total	4.4	30,516	30656	

***Note**: level of significance: * p<0.05, ** p<0.01, *** p<0.001. ®: reference category.*
A pregnant woman is classified as having hypertension if she has SBP≥140 mmHg or DBP≥ 90 mmHg at the time of survey, or she is currently taking medicine to lower her blood pressure; $: prevalence of hypertension.

Table 6: Prevalence of Diabetes among pregnant women by their background characteristics in India, 2015-16

Background characteristics	Diabetes[$]	Total	Odds ratio	95% confidence intervals
Trimester of pregnancy				
First	2.8	8,984		
Second	2.3	12,102	0.761*	[0.592,0.978]
Third	2.3	9,216	0.816	[0.622,1.071]
Age				
15-24	1.9	17,251		
24-34	3.1	11,970	1.537***	[1.210,1.952]
35-49	4.3	1,094	2.506***	[1.628,3.858]
Children ever born				
No child	2.5	12,291		
One child	2.4	9,636	0.819	[0.618,1.083]
Two or more than two	2.4	8,389	0.891	[0.648,1.224]
Place of residence				
Urban	3.0	8,428		
Rural	2.2	21,887	0.903	[0.748,1.089]
Wealth quintile				
Poorest	1.9	7,109		
Poor	2.0	6,629	1.06	[0.723,1.556]
Middle	2.2	6,207	1.169	[0.752,1.819]
Rich	2.7	5,491	1.473	[0.918,2.366]
Richest	3.7	4,879	1.683*	[1.018,2.782]
Caste				
Schedule Tribe	2.2	2,926		
Schedule caste	1.8	6,595	0.729	[0.476,1.117]
OBC	2.6	13,729	0.952	[0.664,1.364]
others	2.5	5,822	0.834	[0.543,1.281]
Religion				
Hindu	2.2	23,539		
Muslim	3.1	5,229	1.374*	[1.007,1.875]
Others	4.1	1,547	1.753*	[1.041,2.952]
Education level				

No education	2.1	7,508		
Primary	2.0	3,840	0.923	[0.674,1.263]
Secondary	2.2	14,963	0.94	[0.703,1.256]
Higher	4.3	4,004	1.427	[0.973,2.093]
Women's height				
<145 cm	2.5	3,406		
145 cm or above	2.4	26,892	0.873	[0.605,1.261]
Tobacco use				
Yes	2.8	1,417		
No	2.4	28,898	0.706	[0.455,1.096]
Nutritional/Health services/matters talked about in last 3 months				
No	2.4	29,705		
Yes	2.6	610	1.096	[0.588,2.044]
Media exposure				
No	1.9	7,621		
Any exposure	2.6	22,694	1.131	[0.835,1.533]
Regions				
North	2.3	4,231		
Central	2.2	8,709	1.148	[0.833,1.582]
East	2.5	7,719	1.33	[0.933,1.894]
Northeast	2.3	991	1.003	[0.621,1.621]
West	1.5	3,557	0.723	[0.402,1.300]
South	3.5	5,108	1.532*	[1.054,2.227]
Total	2.4	30,315	30522	

*Note: level of significance: * p<0.05, ** p<0.01, *** p<0.001. ®: reference category.*

A pregnant woman is classified as having Diabetes if she has a random blood glucose level of 141 mg/dl or higher; $: Prevalence of Diabetes.

Cause of adolescent and Adult death in India: Evidence from HMIS

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Cause of adolescent and Adult death in India: Evidence from HMIS

Abstract

Background as per Census 2011 the youth population of India aged 15-24 years represent 21% of India's total population. While mortality among adolescents and young adults remains relatively low in India, causes of death at these ages are not well documented. We aimed to explore trends in adult death; its convergence across time period 2017 to 2020 by causes of death in India.

Methods We examined data on adult deaths in children from Health Monitoring System (HMIS) that obtained data on the number of adult death by causes. To explore similarity by cause of adult deaths across time, and region Kullback–Leibler (KL) divergence was applied on the weighted proportion of adult deaths across time and regions.

Findings Overall the highest divergence in terms of adolescent deaths was observed in the state of Madhya Pradesh, Rajasthan, Karnataka, Delhi and in the union territory of Chandigarh and Lakshadweep. Comparatively Eastern zone shows the least divergence in terms of causes of adolescent deaths across the years. Deaths due to causes not known, accounted for the greatest proportions across the region and time, except in the state of Delhi, Mizoram, Sikkim and Nagaland where more or less equivalent number of cause of death was due to known chronic illness closely followed by heart disease/hypertension, cancer and respiratory infections. Hypertension/heart disease was the prominent cause of adolescent deaths in the union territories of Chandigarh, Lakshadweep and Puducherry.

Interpretation Most of the adult deaths that occurred between 2017 and 2020 are due to causes not known. However, exposure in terms of access to information related to health, diagnosis is expected to be comparatively better than other age groups. Hence, death due to causes not known need to be investigated. It is a matter of concern the second most leading cause of death is due to hypertension/heart disease and that too among adults. Hence, not only database on cause of reporting deaths need to be strengthened, but also further research on reasons for causes of adult death needs to be investigated.

1. Background

As per Census 2011 the youth population of India aged 15-24 years represent 21% of India's total population. Further, as compared to 15-19 years of age the mortality rate is relatively high in the age group 20-24 years old with 1.9 and 2.5 respectively (5). While mortality among adolescents and young adults remains relatively low in India, there is a wide range of health issues specific to this age group that requires targeted prevention efforts.

Adolescence, perceived as a healthy age, has largely been neglected by the global health community when compared with younger children Adolescents undergo rapid developments in this period of life which have major health consequences over the lifetime: health- and behaviour-related conditions that originate in adolescence have an impact on adult health with important socioeconomic consequences (1). For instance, tobacco use, consumption of unhealthy diets and harmful use of alcohol are initiated in adolescence and may lead to the premature onset of several non-communicable diseases (NCDs) such as heart disease and chronic lung disease(RGI). In the Indian context, as NCDs and injuries form the major burden of disease and disability, it is important to understand the disease burden in adolescent (14).

Mortality statistics are helpful for formulating economic policy decisions over a large field to cover overall performances as well as distributional concerns regarding class, gender and race. There is so much discussion has been placed. However, little attention has been paid to the mortality among adolescent and adults in India. Any impairment to this productive section of the population through disease or untimely death will inevitably lead to a decline in national efficiency and a slowdown in overall national development.

In India, the most recent cause of death statistics publicly available are from 2013, although they only provide data on the 20% of the population who have a medically certified cause of death (9). Approximately two-thirds of India's 10 million deaths per year occurred before age 70 years in 2014. About 1·4 million of these deaths were in children younger than 5 years of age, 0·6 million deaths were in young people aged 15–29 years, and 4·4 million were in adults aged 30–69 years (10). It is estimated that more than 9 million people in India could die prematurely before the age of 70 years annually by 2030 (7As with universal progress in the drop of child mortality, any future worldwide progress in the reduction of adult mortality will depend generally on progress in India as India is the home of world's highest adolescent and adult population.

2. Rationale of the study

India is undergoing a rapid epidemiological transition and deaths due to non-communicable diseases (NCDs) have exceeded deaths from communicable, maternal, neonatal and nutritional diseases. The demographic and epidemiological transition is not uniform across the states; hence disease burden is also not uniform across all the states. Therefore, tackling a specific disease burden requires robust evidence on the causes of death in order to facilitate a context-specific disease prevention strategy that varies between states. However, recording deaths and assigning cause to them has been always a challenge in low resource setting, where half of the deaths go unrecorded and India is no exception of that. A majority of India's population live in rural areas where access to healthcare and health care facility is not less than a wild goose chase. Though government is spending a large amount to strengthen the health system and improve the health of the population. Still, a significant proportion of deaths occurs outside formal health facilities, and information on cause of death at a population level is rare, hindering population-specific health strategies to address local disease burden. Further, the variation in the extent of epidemiological transition in India, epidemiological and demographic studies addressing the pattern and cause of mortality are rare in India due to paucity of data. The absence of reliable evidence of the levels, variation, and trends in adult mortality in India's districts

restricts the adoption of evidence-based policies and does not allow measurement of the effect of introducing universal health coverage or of specific disease-control programmes. Therefore, this study aims to provide a comprehensive and contemporary picture of the causes of death for adolescent and adults in India, focusing particularly on the levels and changes.

This paper aims to provide a comprehensive and contemporary picture of the causes of death and disability for younger and older adolescents in India, focusing particularly on the levels and changes with respect to the burden of NCDs and injuries. An ethics committee approval was not required for this paper as it involved secondary analysis of publicly available data.

3. Objectives

1. To study the level and trends of cause of deaths among adolescent/adults in India.
2. To identify the hotspot of the adolescent/adults deaths in India.
3. To examine the regional variation in the major cause of adolescent/adults deaths in India.

4. Data source and method

4.1 Data

Data for the present study was extracted from the Health Management Information System (HMIS) portal. Data on adolescent death was extracted from Standard report from HMIS portal. A part of data from Section M16 give data on the most probable cause of adolescent death in India across states, districts and subdistricts by rural and urban areas including death from public and private health facilities. Data for this study of adolescent death was extracted across the region and time from the year 2017 to 2020.

4.2 Methods of data analysis

To understand and study the trends across regions first data from different states were categorized into six different zones North, Central, West, East, North East and south Zones. We first examined data on the causes of adolescent death from the year 2017 to 2020, and compared these data among states from the same zone and then between different zones.

The main causes of death were first identified, then, they were grouped in terms of the top three leading causes of death as compared to the total no. of deaths. The leading causes were further explored to examine if there is any high focus point across the district and sub district. However, if the no. of deaths was uniformly distributed across state the next step to identify high foul point of death was skipped. Further, to understand the convergence and divergence of the data across time and region, we utilize Kullback-Leibler divergence given as. $KL(p, t) = \sum i,j\ pij\ log(pij/rij)$ where pij are proportion across region at time j.

5. Results

5.1 Convergence and Divergence across region and time by cause of death

Overall Figure 1 reflects the highest divergence in terms of causes of adolescent deaths and was observed in the state of Madhya Pradesh as indicated by the KL value of 1.3 between the years 2018-19 and 2019-20 and 0.97 between the years 2017-18 and 2018-19. It was followed in the state of Delhi with a divergence value of 0.54 between the years 2018-19 and 2019-20. The divergence was also observed in the state of Karnataka and in the union territory of Chandigarh and Lakshadweep.

Zone wise figure 2 shows KL divergence in terms of causes of adolescent death in North zone. Least divergence was observed between the years 2017-18 and 2018-19 in the union territory of Chandigarh and in the state of Delhi for the years 2018-19 and 2019-20 and 2017-18 and 2018-19. The Divergence was also observed in the state of Rajasthan, but was comparatively less as compared to the union territory of Chandigarh and Delhi.

As ascertained from the total KL divergence the divergence was highest in the central zone in the state of Madhya Pradesh between the years 2017-18 to 2018-19 and 2018-19 to 2019-20. In the rest of the states in the central zone, the divergence was the least as observed in figure 3. South zones also show a similar trend as depicted in figure 4 with the least divergence between the years in terms of causes of adolescent deaths. The highest divergence was observed in the state of Karnataka with a KL value of 0.45 and 0.39 between the years 2017-18 and 2018-19 and 2017-18 and 2019-2020.

Similarly, the divergence was observed in the western zone among smaller states of Goa the union territory of Dadra and Nagar Haveli and Daman and Diu and was the least in the bigger states of Maharashtra and Gujarat as reflected by their respective KL values in figure 5. However, the divergence shows a maximum value of 0.16 in the state of Goa among all the states and the union territories of the western zone which indicates the divergence was not that high in terms of causes of adolescent deaths across states and union territories.

As observed in Figure 6 except for Arunachal Pradesh all the other states in the north-eastern zone show a least divergence and the highest divergence value in the northeast zone was observed in the state of Arunachal Pradesh with a KL vale of 0.2 between the years 2017-18 and 2019-20. Comparatively eastern zone shows the least divergence among all the regional zones in terms of causes of adolescent deaths across the years 2017 to 2020. Figure 7 shows the highest KL value was observed in the state of Bihar with a value of 0.03 between the years 2017-19 and 2019-20.

5.2 Trends by causes of Deaths

Trends across the years 2017-18 to 2019-20 was examined by regional zones to understand differential in causes of deaths by regions and further to explore if there are any hotspots by any high cause of death in any region.

Figure 8 to 12 represents the percent death due to causes not known out of the total causes of deaths in the north east zone during 2017 to 2020. The major cause of deaths due to causes not known was observed in the northeast states of Arunachal Pradesh, Assam, Manipur, Meghalaya and Tripura. Further the same states show the second most percent cause of death was due to heart disease/hypertension and cancer except in the state of Meghalaya where the second most cause of percent deaths to total deaths was due to cancer followed by other fever related issues.

Except for Delhi all the other states in north zone show cause not known as the prominent cause among all the causes of adolescent deaths over the period 2017 to 2020 as evident from figure 13 to 18. In the state of Delhi more or less equivalent number of death is due to known chronic illness closely followed by heart disease/hypertension and respiratory infections. While in all the other states the difference was in the range of two to four times between causes not known and hypertension.

As observed from Figure 19 to 23 in the central zone the prominent cause of adolescent death in all the states was due to other causes with a clear convergence in all the three years from 2017 to 2020. However, in the year 2018-19 the prominent cause of death in the state of Madhya Pradesh was due to known acute causes closely followed by animal bites and strings.

In the southern zone as shown from figure 24 to 28 the difference in the percent by cause not known to other causes is highest in Andhra Pradesh and Telengana with a difference of near about 60 to 65 percent; followed by the state of Karnataka with a difference of 40 percent. The least difference was observed in the states of Kerala and Tamil nadu with a difference of 6 to 7 percent. In both these states the second leading cause of adolescent death was due to hypertension.

Except for Goa, all the other states in the western zone as shown in figure 29 to 33 show causes not known as the major causes among all the causes of the adolescent death. Even tough in the state of Goa heart disease/hypertension is the major cause of the death the difference due to the cause of death not known and hypertension is marginal with a difference value of one percent. However, in the year 2017-18 in the state of Goa the major cause of death was chronic illness and the percent deaths due to chronic illness was 20 percent. In the rest of the states the difference in the cause of deaths due to cause not known and other causes is high, indicating a skewed pattern in the concentration of cases of deaths due to other causes.

Figure 37 to 40 shows the percent death due to causes not known out of the total causes as observed in the states of Bihar, Jharkhand, Odisha, and West Bengal. The second most proportional causes of death in the states of Bihar and Jharkhand were due to accidents/burnt cases. Whereas the second most cause of proportional deaths were due to heart disease and hypertension in Odisha and West Bengal.

5.3 Death due to Chronic causes

Overall death due to chronic diseases was observed only in a few north east states during 2017 to 2020. Figure 34 to 36 shows in the north east zone the states of Mizoram, Sikkim and Nagaland the highest percent of deaths to the total cause of death were due to chronic illness followed by hypertension/heart disease and respiratory infections.

5.4 Death due to Hypertension

Figure 41 to 43 shows Hypertension/heart disease was the prominent cause of adolescent deaths and was a major cause in the union territories of Chandigarh, Lakshadweep and Puducherry. While hypertension is the leading cause of adolescent deaths it was followed by causes not known among adolescent deaths in the union territories of Puducherry and Lakshadweep and known chronic diseases in case of the union territory of Chandigarh. However, in the union territory of Puducherry neurological disorder including strokes was the next prominent causes in the union territory of Lakshadweep.

6. Summary and Discussion

This study, based on HMIS data, provides trends by causes of adolescent death across region and time. This paper shows the highest divergence in terms of adolescent deaths across time was observed in the state of Madhya Pradesh, Delhi, Rajasthan, Karnataka and in the union territory of Chandigarh and Lakshadweep.Comparatively Eastern zone shows the least divergence in terms of causes of adolescent deaths across years.

It is a matter of concern deaths due to causes not known was the prominent causes out of the total causes which was reflected nearly in the all the states. The second most causes of death were due to heart disease/hypertension followed by cancer.

Hypertension/heart disease was the prominent cause of adolescent deaths in the union territories of Chandigarh, Lakshadweep and Puducherry. While hypertension is the leading cause of adolescent deaths it was followed causes not known among adolescent deaths in the union territories of Puducherry and Lakshadweep and known chronic diseases in case of the union territory of Chandigarh. However, in the union territory of Puducherry neurological disorder including strokes was the next prominent causes in the union territory of Lakshadweep.

7. Conclusion and Policy recommendations

Changes in major causes of deaths across the region and time is important to understand the region and time specific unmet needs and future challenges. Hence, a comprehensive data on causes of

adolescent deaths provides information that is essential to health policy decision making and future planning. Overall the trends did not show major uneven causes across region and time it did show skewedness towards deaths due to causes not known. Hence substantial investment in better data collection across background characteristics, continuous monitoring trends in population to meet the ongoing and changing needs of adolescents is a prime requirement to curb the number of deaths so that all can grow up to lead a healthy life. Accordingly, adolescent health programme by the Government of India, should aim to address the health problems faced by adolescents by strengthening preventive, diagnostic and curative health services.

8. Limitations of the study

The limitations of this paper are that the findings are based on secondary data HMIS, and based on probable cause of adolescent deaths. The high number of adolescent deaths due to causes not known needs further investigation in terms of quality of the data as well as data reporting. It would have been interesting to analyse adolescent death further by age group; social group; education status and other background characteristics.

9. References

1. Chandramouli, C., & General, R. (2011). Census of India. *Provisional Population Totals. New Delhi: Government of India*.

2. Hill K, Zimmerman L, Jamison DT. Mortality risks in children aged 5–14 years in low-income and middle-income countries: a systematic empirical analysis. Lancet Glob Health 2015; 3: e609–16.

3. Internaitonal Institute for Population Sciences (IIPS) and Population Council. Youth in India: Situation and Needs 2006-2007, Executive Summary. Mumbai: IIPS; 2010.

4. IIPS, I. (2017). International. National Family Health Survey (NFHS-4) 2015-16: India.

5. Masquelier B, Hug L, Sharrow D, et al. Global, regional, and national mortality trends in older children and young adolescents (5–14 years) from 1990 to 2016: an analysis of empirical data. Lancet Glob Health 2018; 6: e1087–99.

6. Morris SK, Bassani DG, Awasthi S, et al. Diarrhea, pneumonia, and infectious disease mortality in children aged 5 to 14 years in India. PLoS One 2011; 6: e20119.

7. Norheim, O. F., Jha, P., Admasu, K., Godal, T., Hum, R. J., Kruk, M. E., ... & Peto, R. (2015). Avoiding 40% of the premature deaths in each country, 2010–30: review of national mortality trends to help quantify the UN Sustainable Development Goal for health. The Lancet, 385(9964), 239-252.

8. Pardo, L. Statistical Inference Based on Divergence Measures; Chapman & Hall: New York, NY, USA, 2006.

9.RGI. (2014). Report on medical certification of cause of death, 2015.

10. Unies, N. (2015). World Population Prospects. The 2015 Revision, New York, United Nations. Population Division.

11. UNDESA, P. (2017). World Population Prospects: The 2017 revision. Retrieved August, 26, 2018.

12. World Health Organization. (2003). Towards adulthood: exploring the sexual and reproductive health of adolescents in South Asia. World Health Organization.

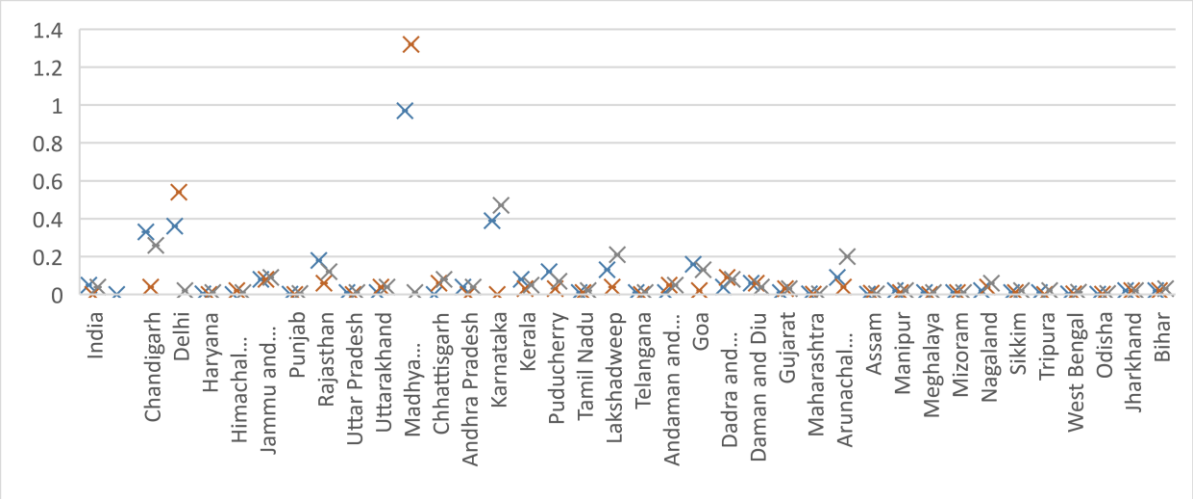
13. World Health Organization. Country Health System Profile: India. 2010 [cited 2010 September 8, 2010]; Available from: http://www.searo.who.int/en/Section313/Section1519_10850.htm

14. World Health Organization. (2014). Health for the world's adolescents: a second chance in the second decade: summary (No. WHO/FWC/MCA/14.05). World Health Organization.

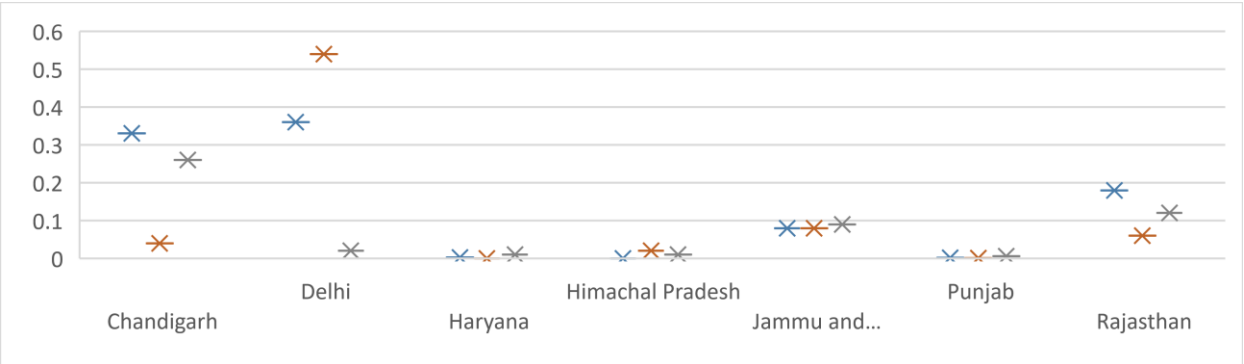
15. World Health Organization. (2018). Standards for improving the quality of care for children and young adolescents in health facilities.

10.Figures

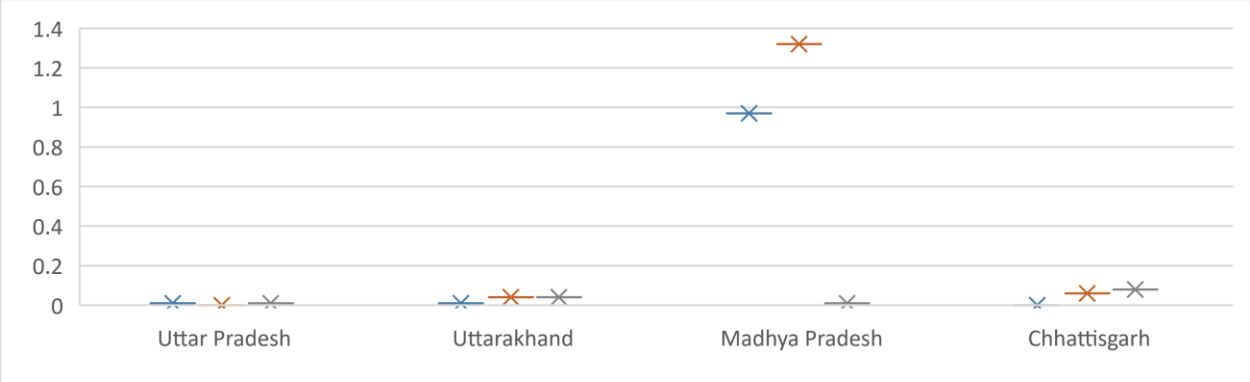
Figures 1. KL Divergence Measures by adolescent death during 2017 to 2020 for India and Selected States



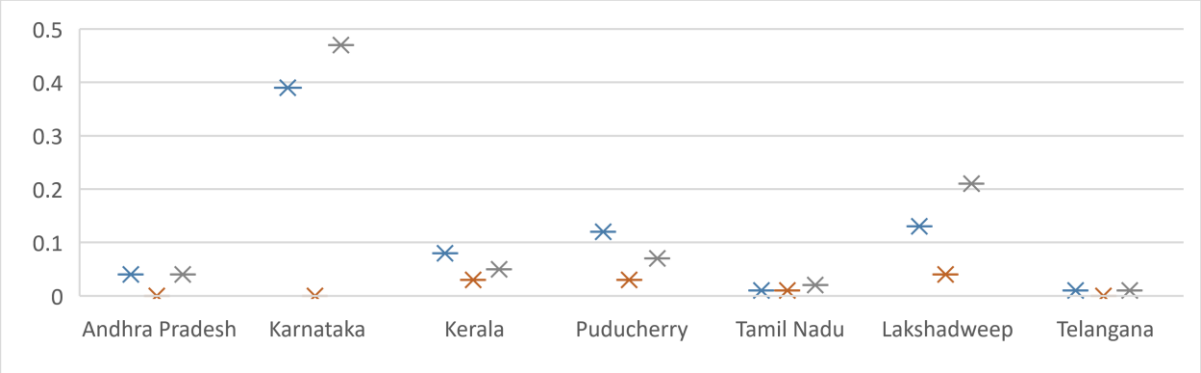
Figures 2. KL Divergence Measures by adolescent death during 2017 to 2020 for North Zone, India



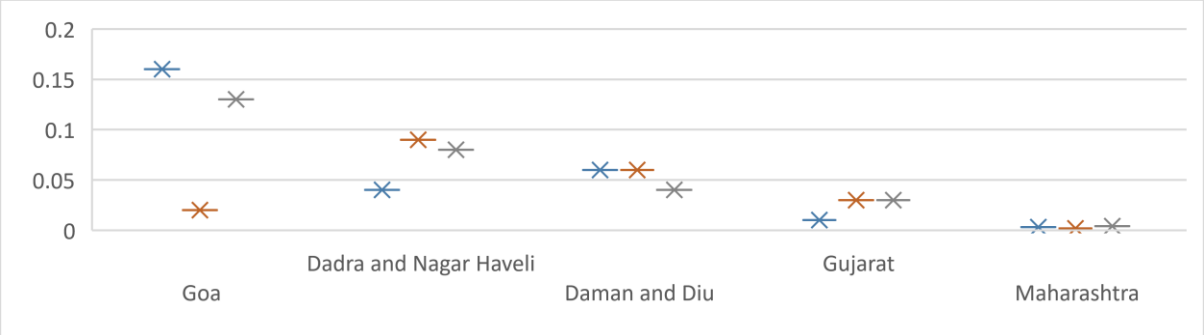
Figures 3. KL Divergence Measures by adolescent death during 2017 to 2020 for Central Zone, India



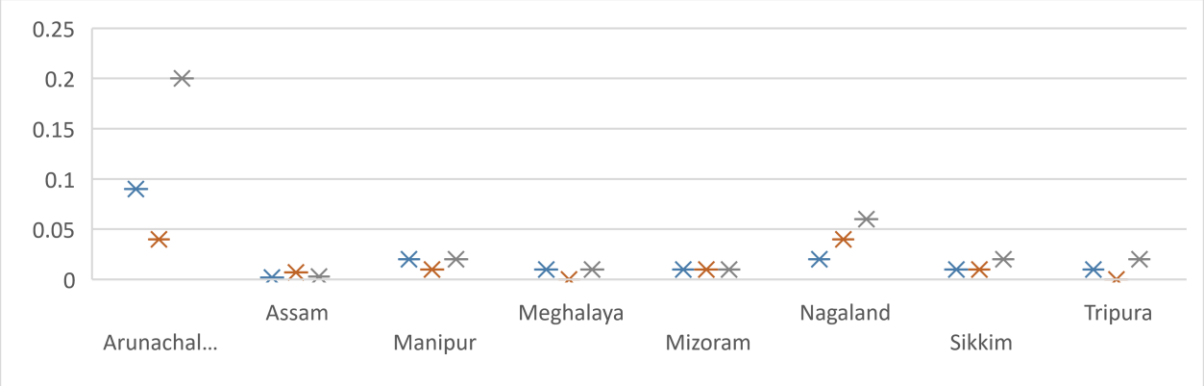
Figures 4. KL Divergence Measures by adolescent death during 2017 to 2020 for South Zone, India



Figures 5. KL Divergence Measures by adolescent death during 2017 to 2020 for West Zone, India



Figures 6. KL Divergence Measures by adolescent death 2017 to 2020 for North East Zone, India



Figures 7. KL Divergence Measures by adolescent death during 2017 to 2020 for East Zone, India

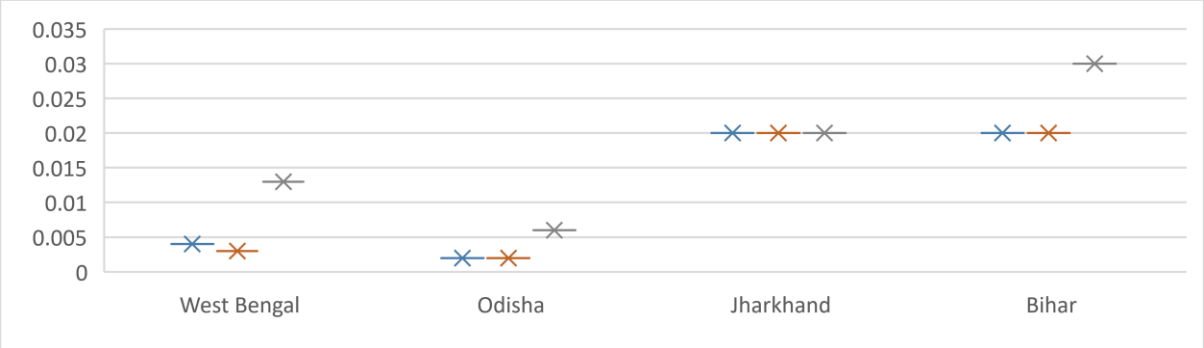
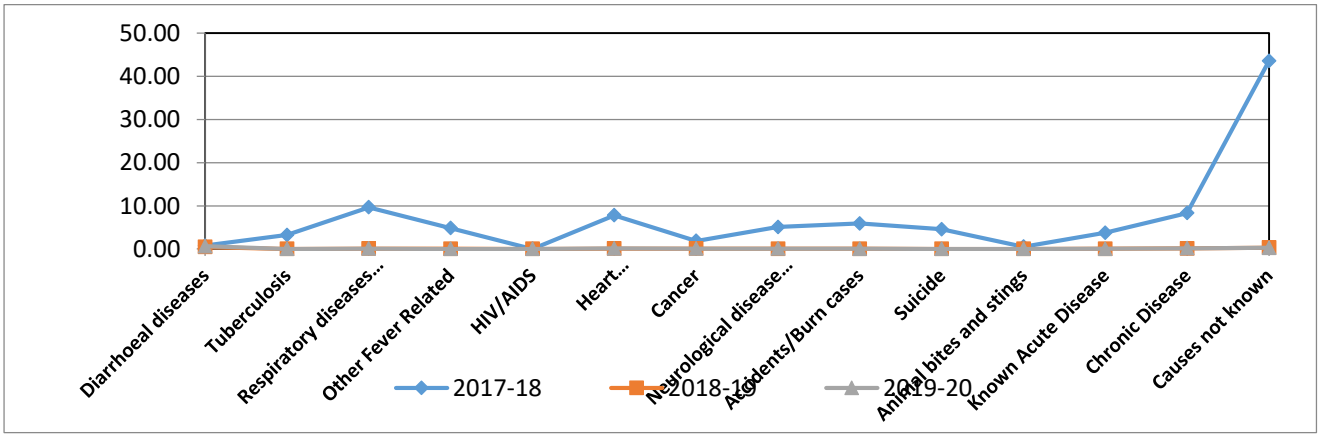
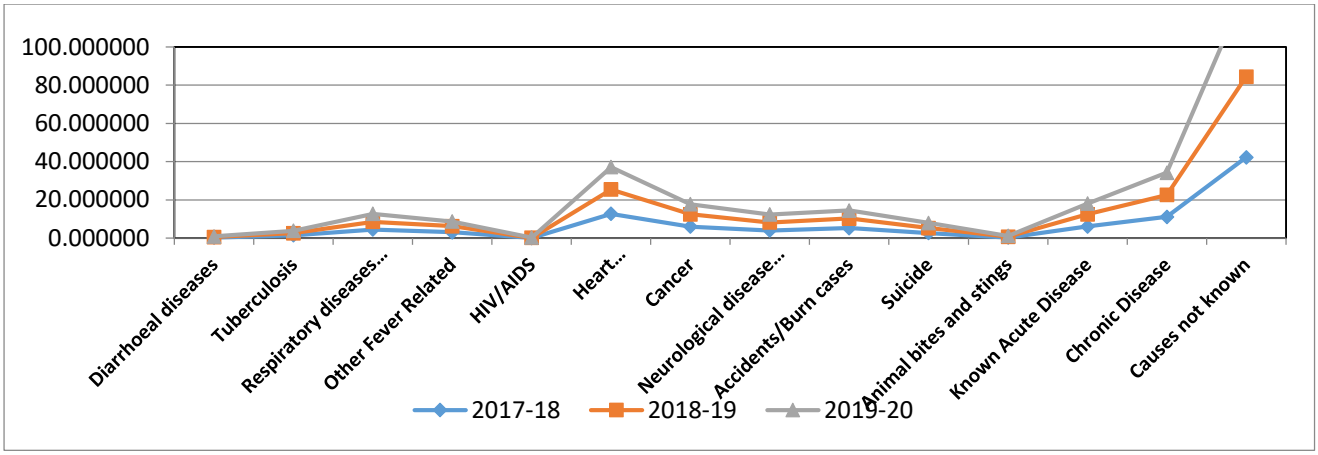


Figure 8: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Arunachal Pradesh



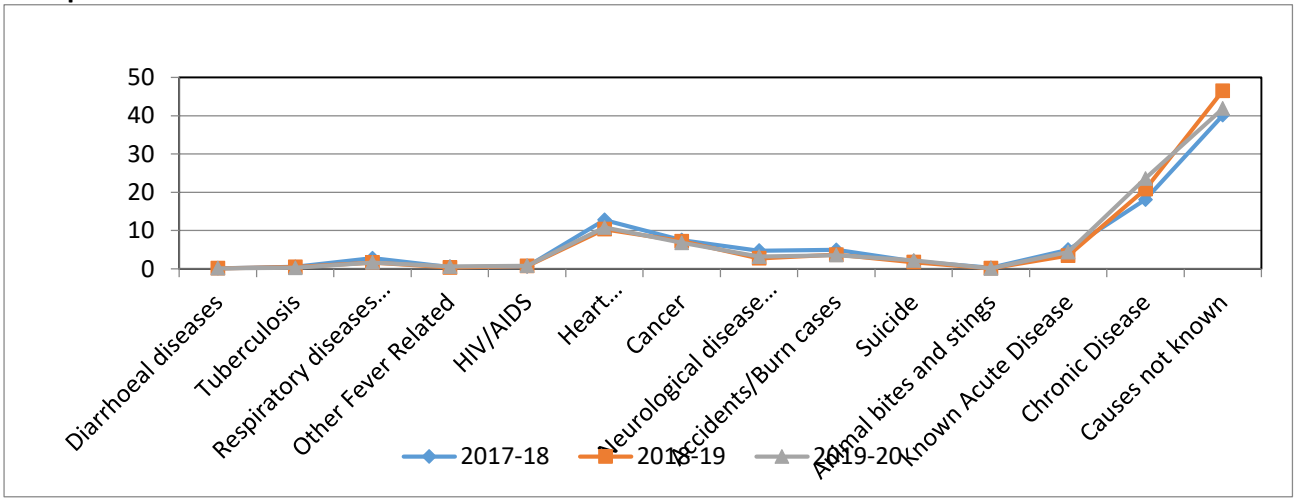
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 9: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Assam



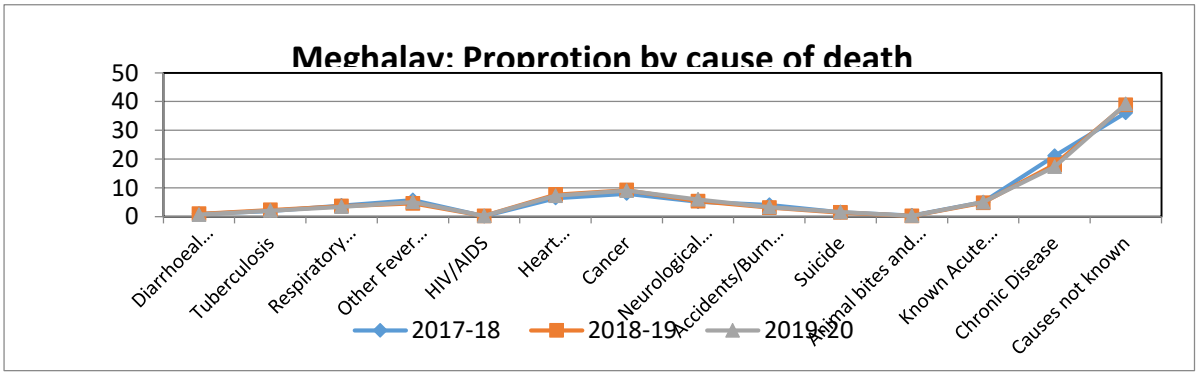
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 10: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Manipur



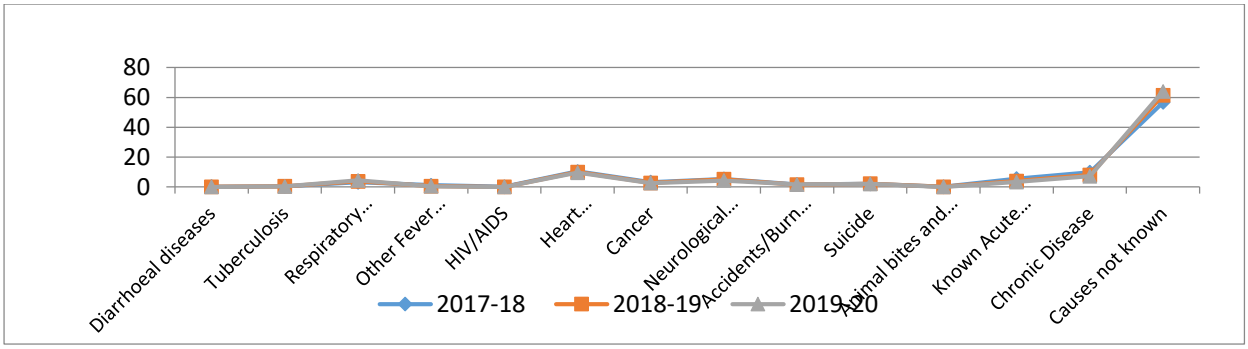
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-202

Figure 11: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Meghalaya



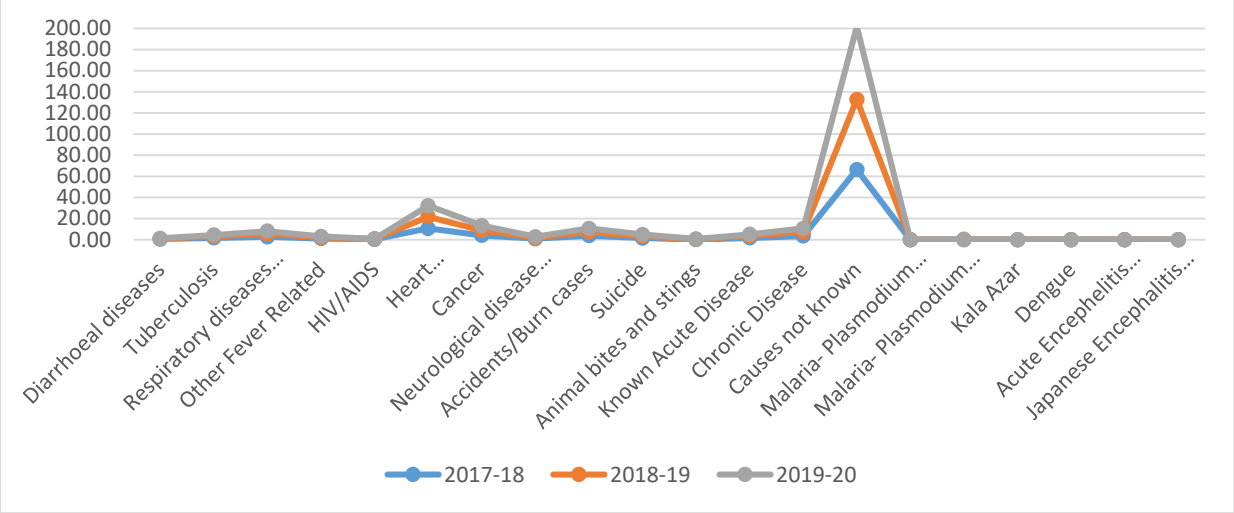
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 12: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Tripura



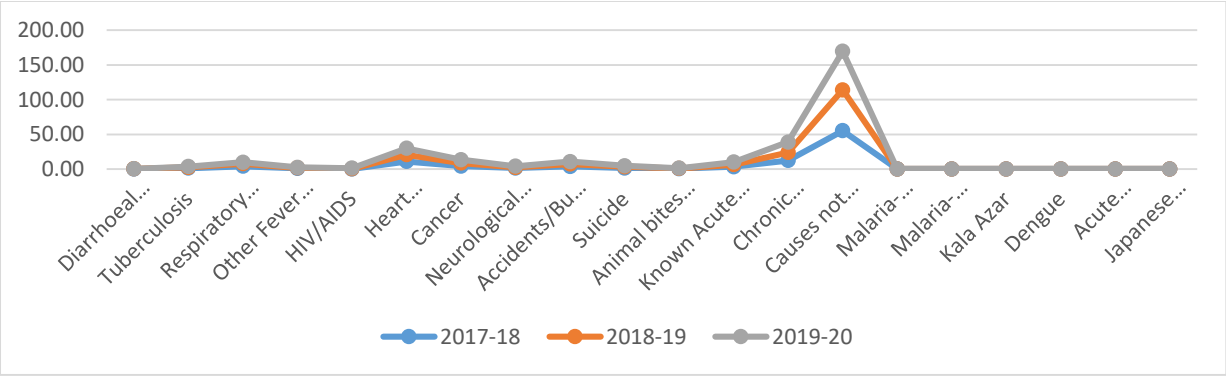
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 13: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Haryana



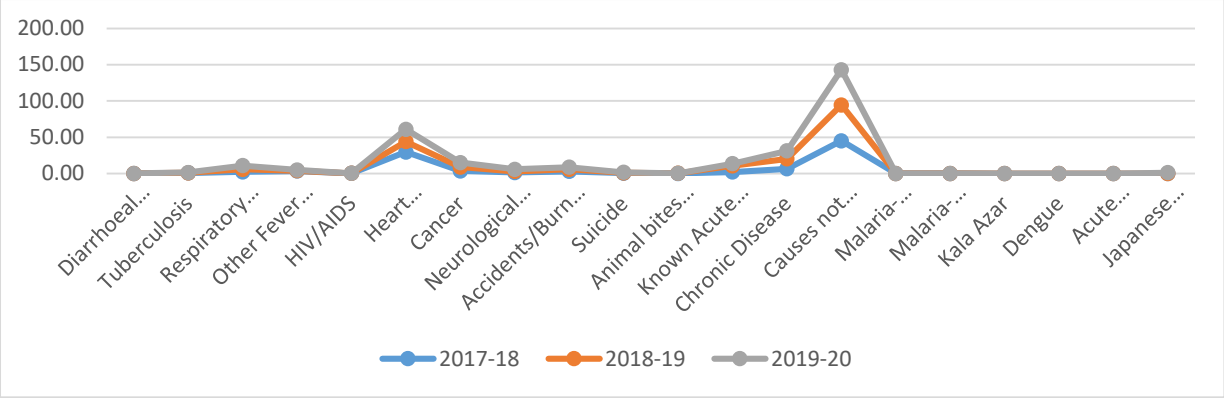
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 14: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Himachal Pradesh



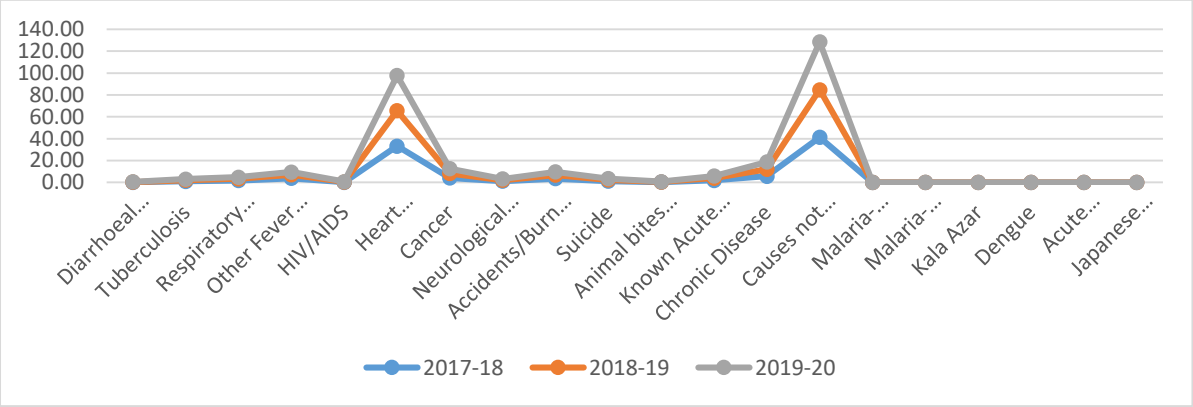
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 15: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Jammu and Kashmir



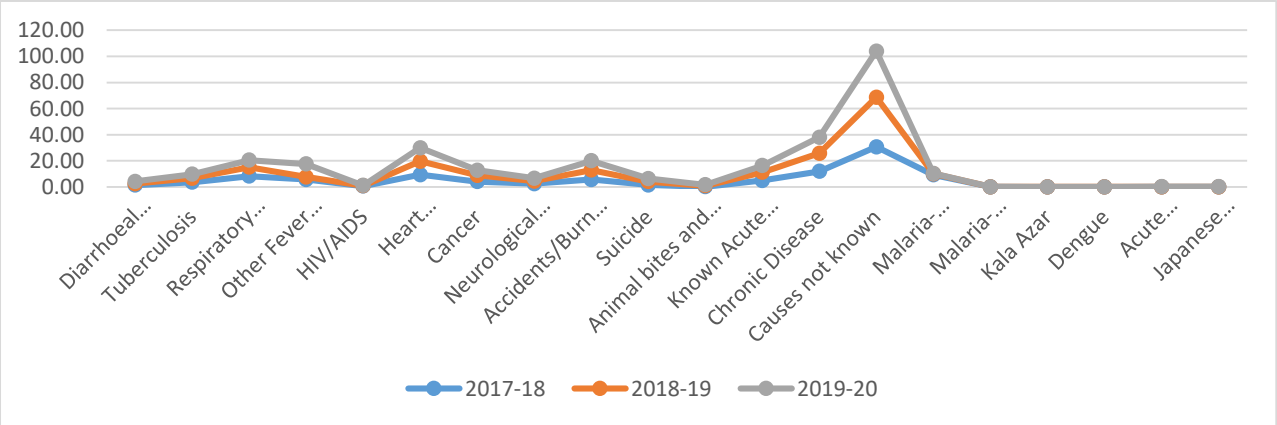
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 16: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Punjab



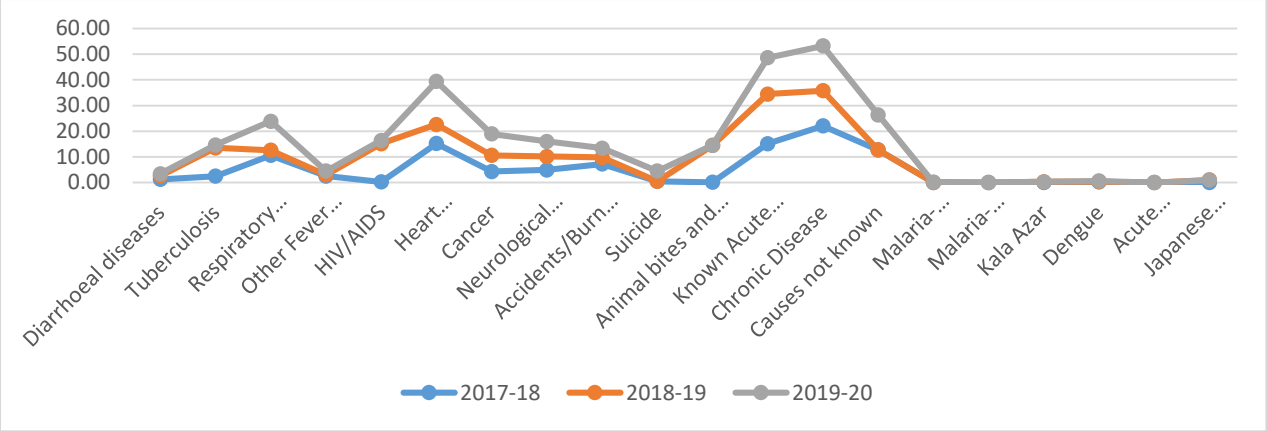
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 17: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Rajasthan



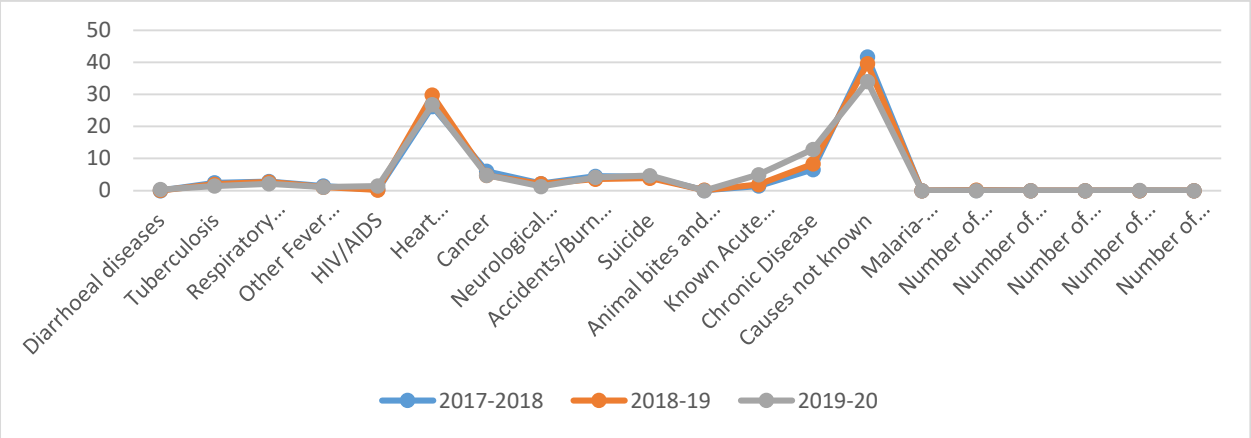
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 18: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Delhi



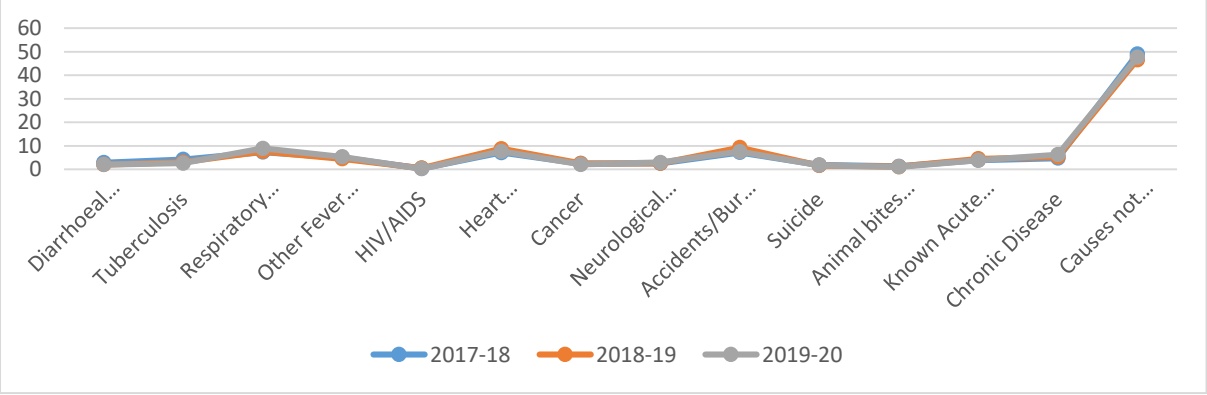
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 19: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Andaman and Nicobar Island



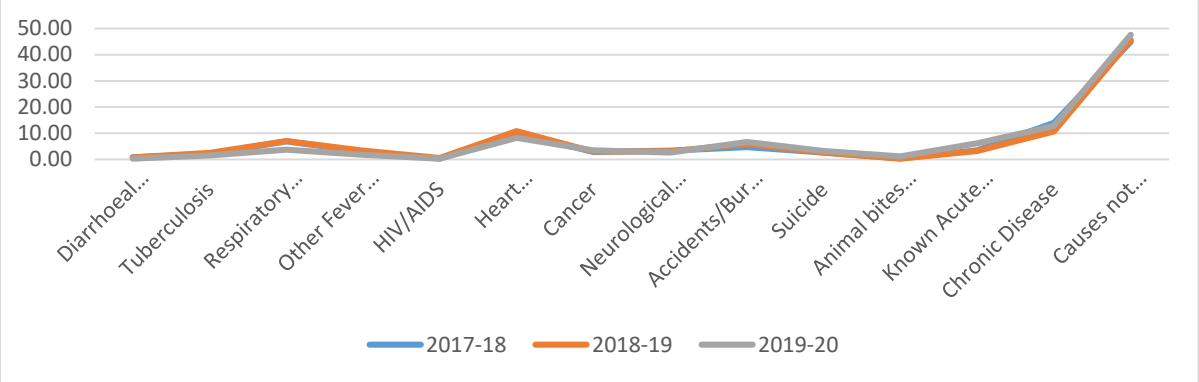
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 20: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Uttar Pradesh



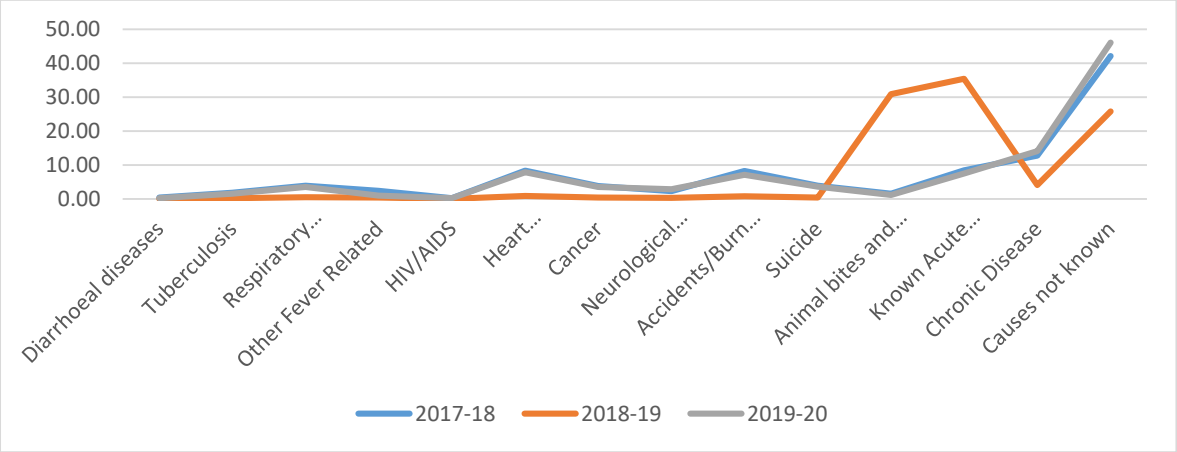
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 21: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Uttarakhand



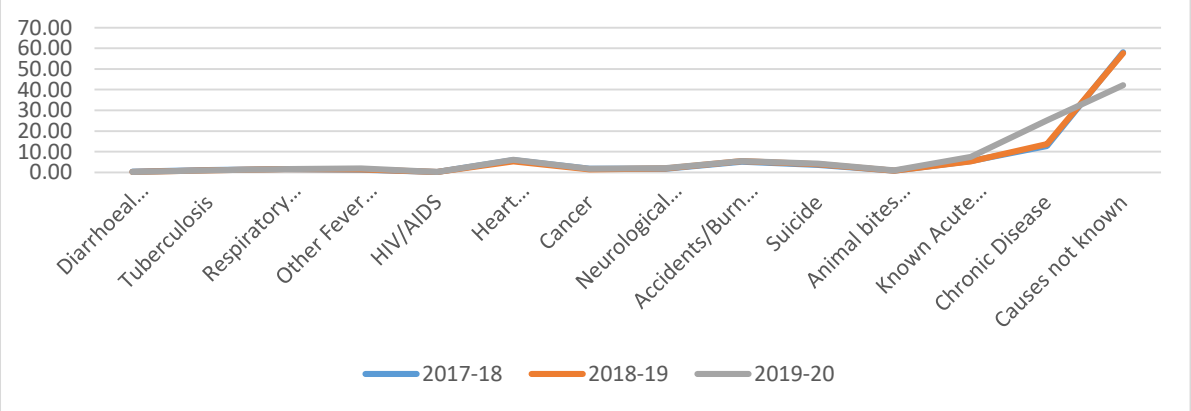
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 22: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Madhya Pradesh



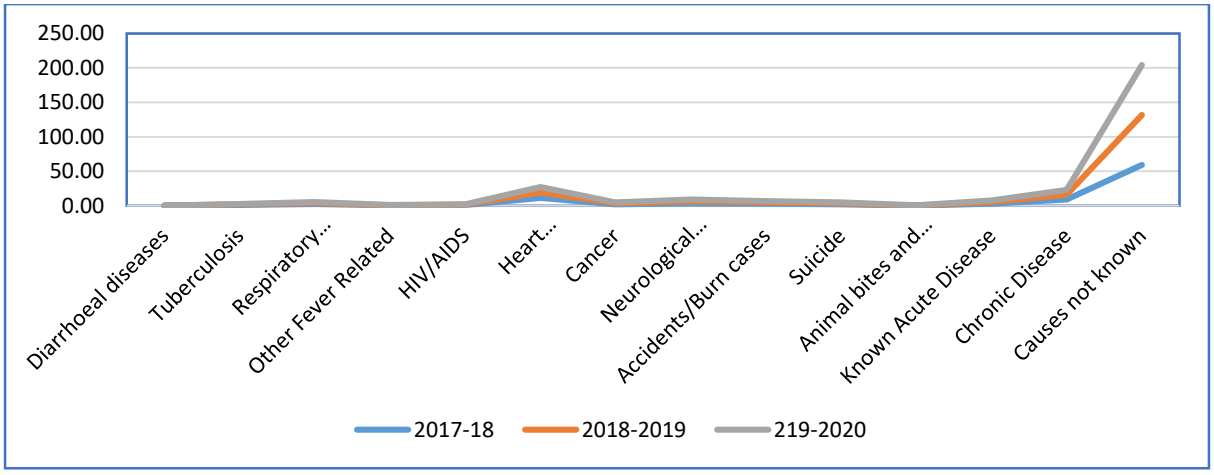
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 23: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Chattisgarh



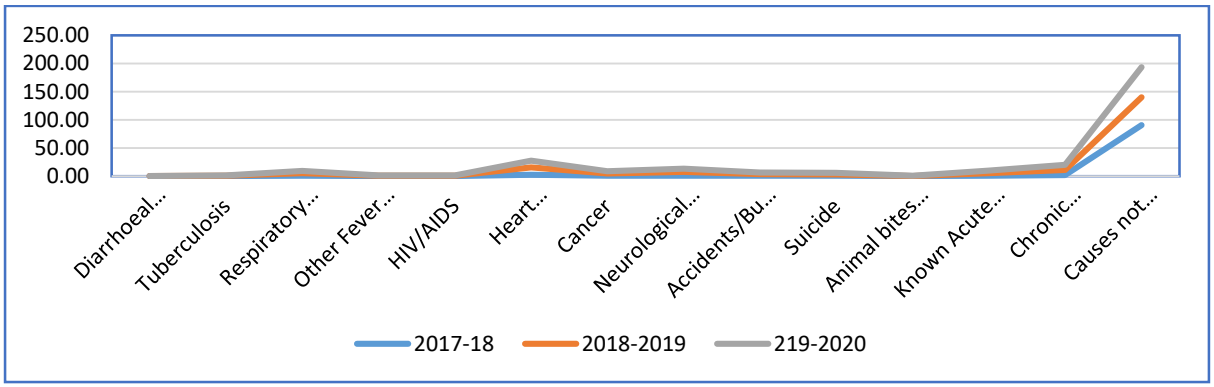
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 24: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Andhra Pradesh



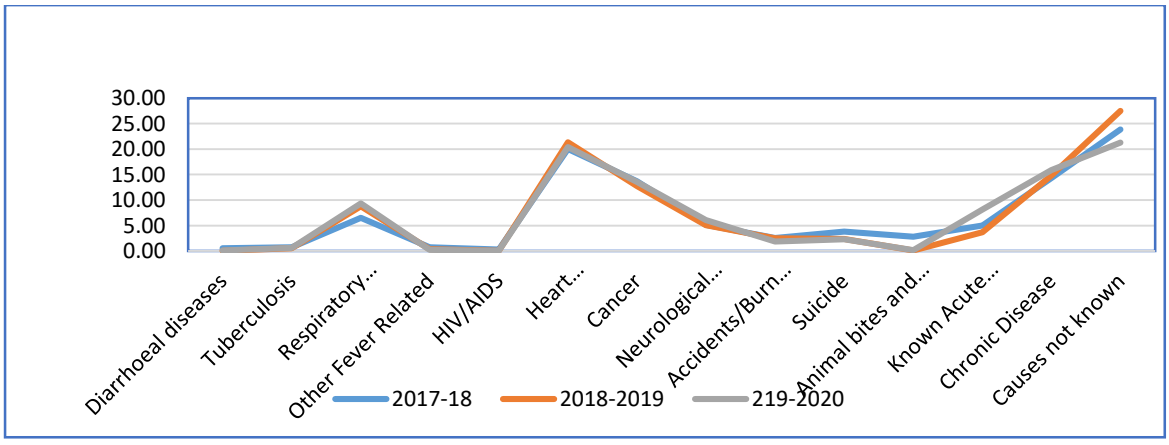
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 25: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Karnataka



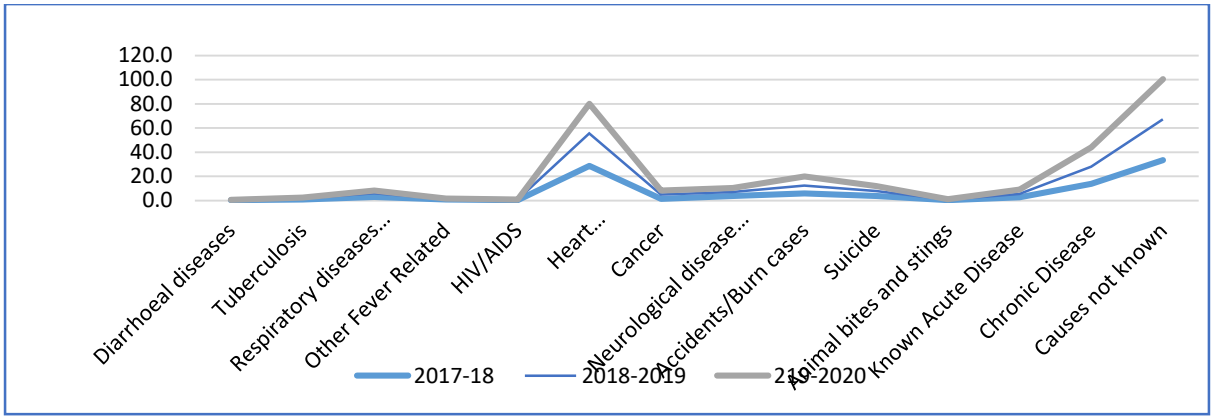
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-202

Figure 26: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Kerala



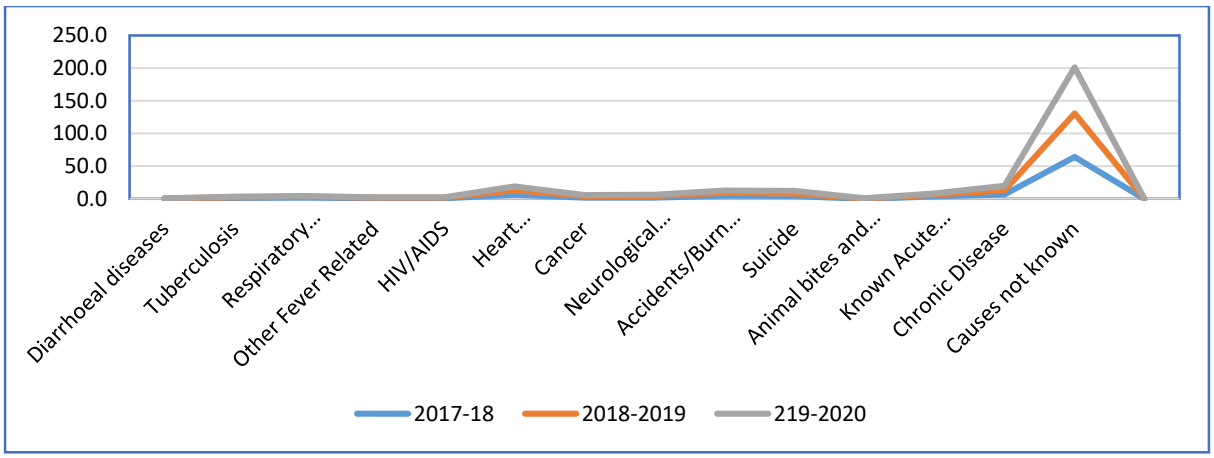
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 27: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Tamil Nadu



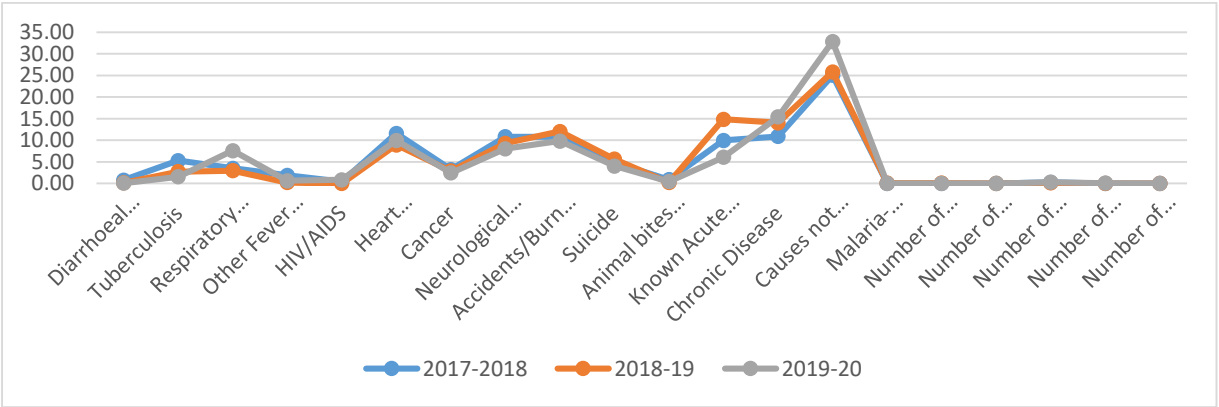
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 28: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Telangana



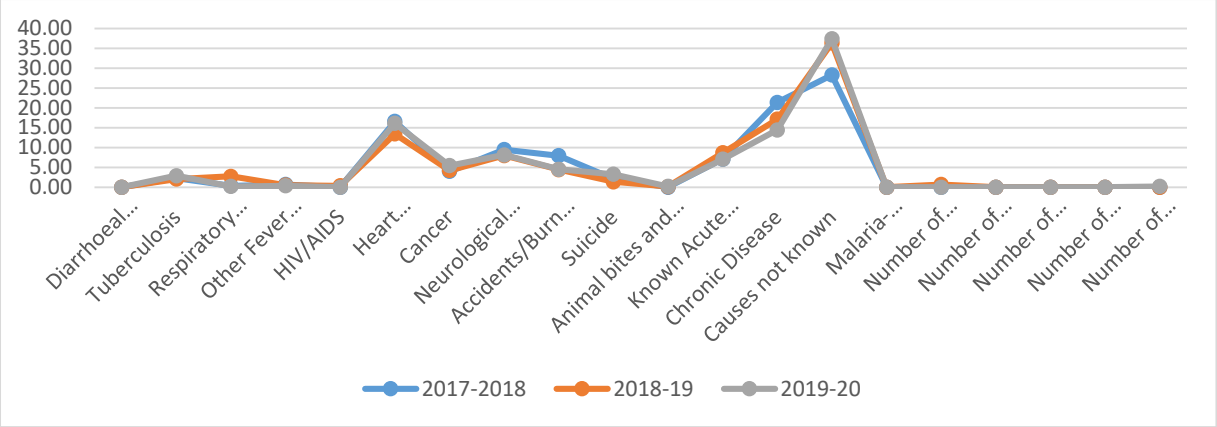
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 29: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Dadra and Nagar Haveli



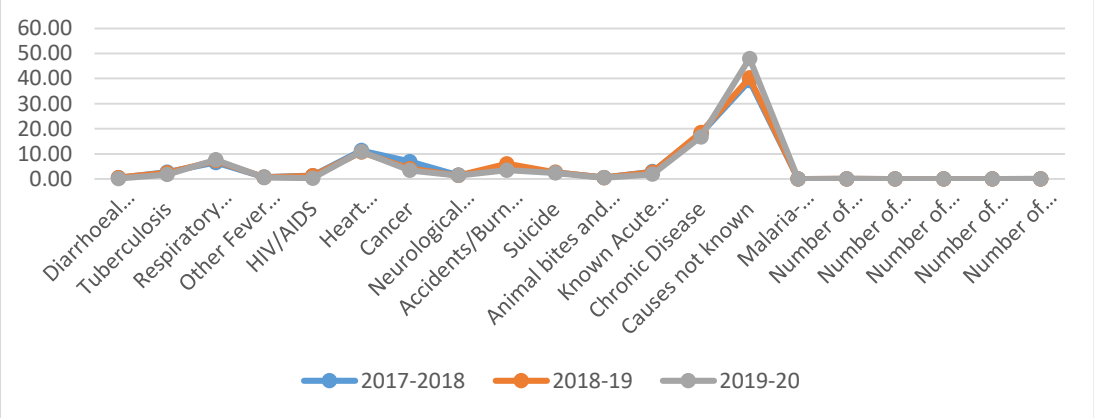
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 30: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Daman and Diu



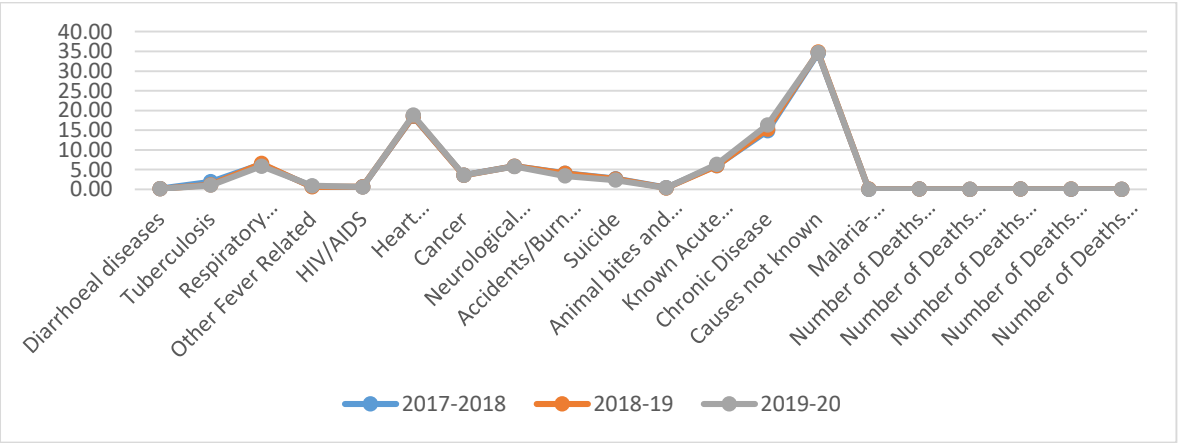
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 31: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Gujarat



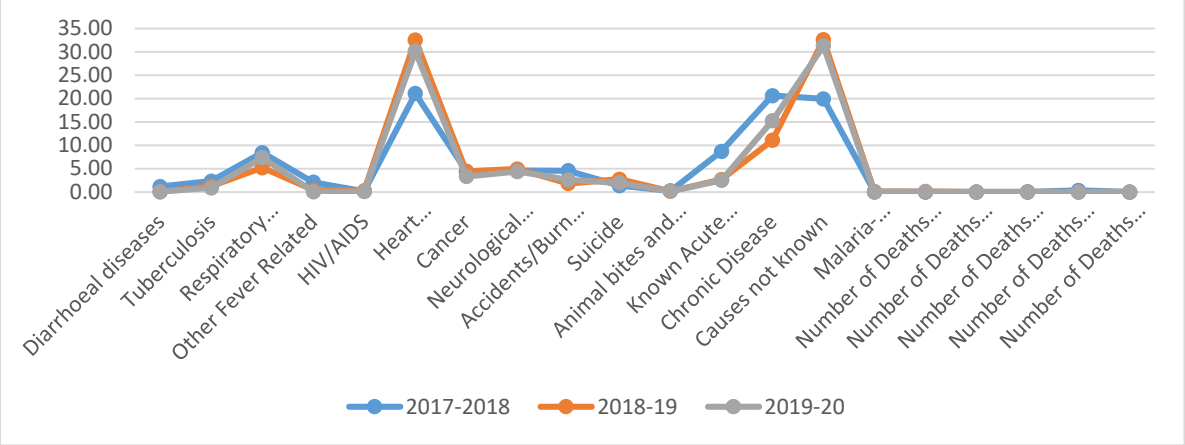
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 32: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Maharashtra



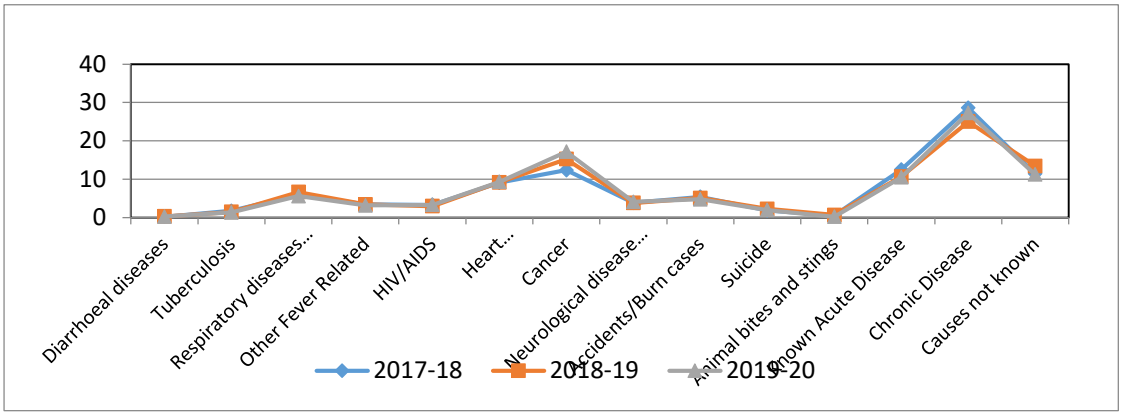
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 33: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Goa



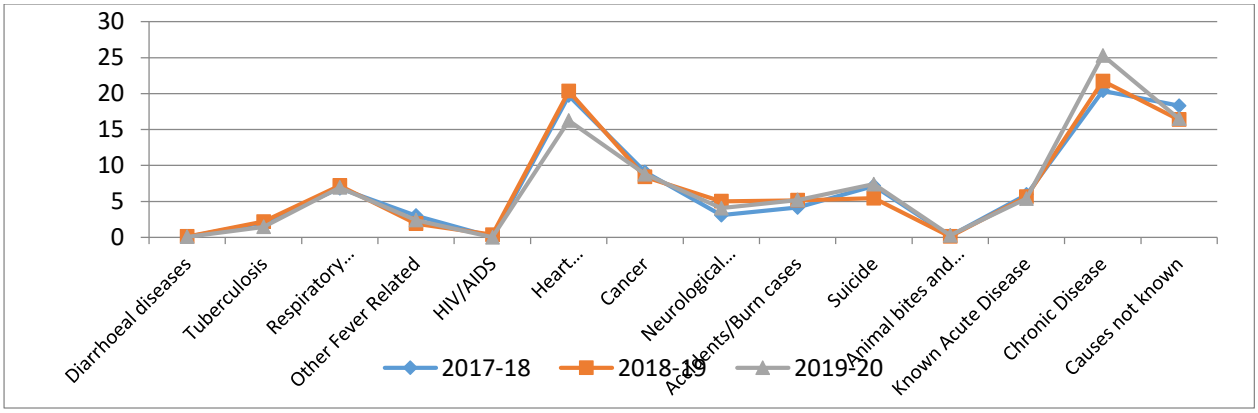
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 34: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Mizoram



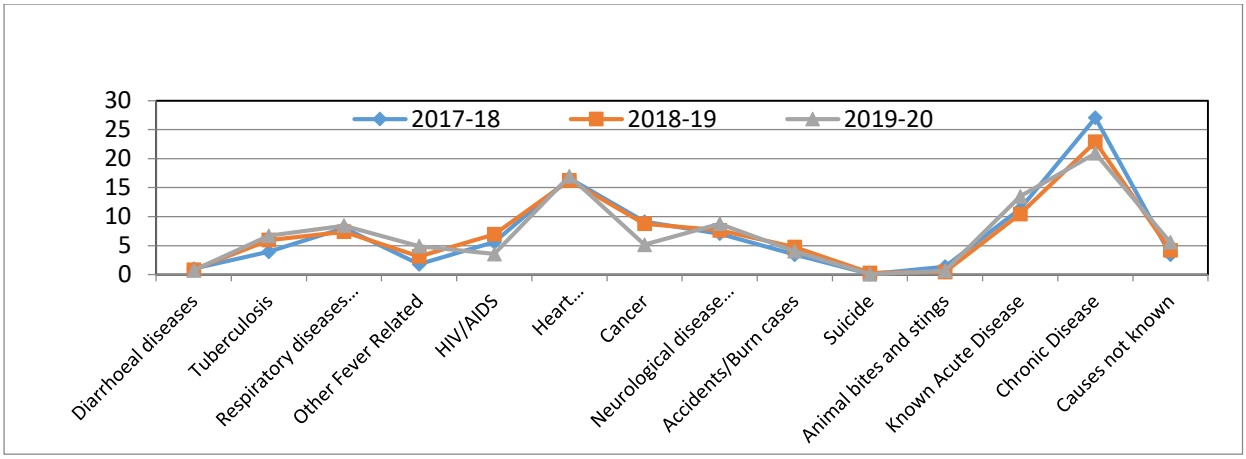
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 35: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Sikkim



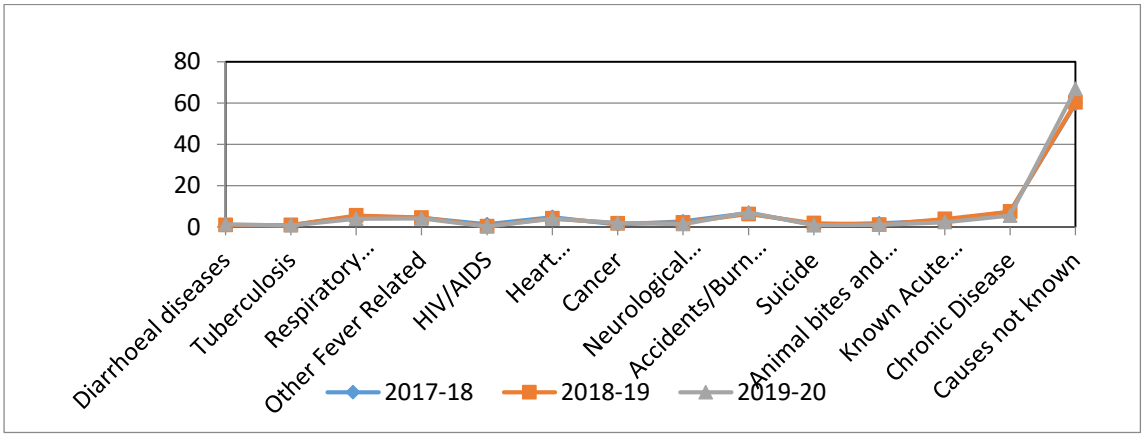
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 36: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Nagaland



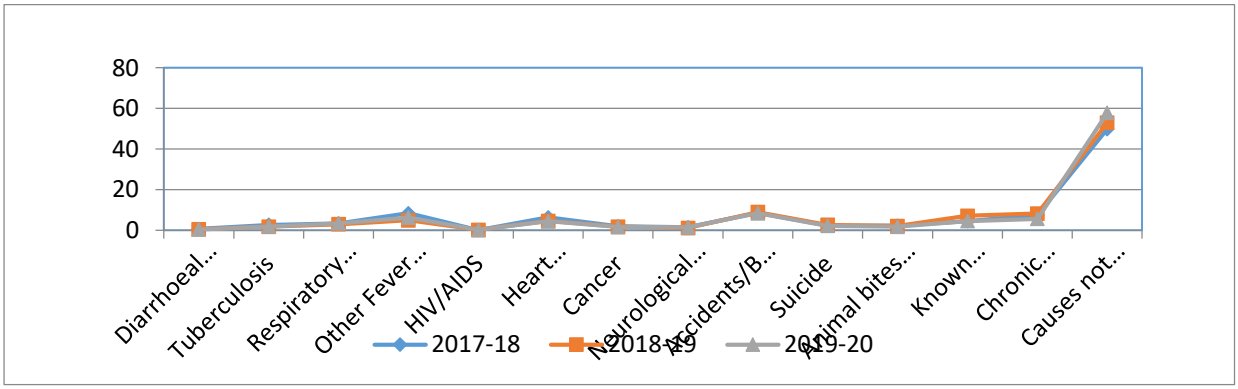
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 37: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Bihar



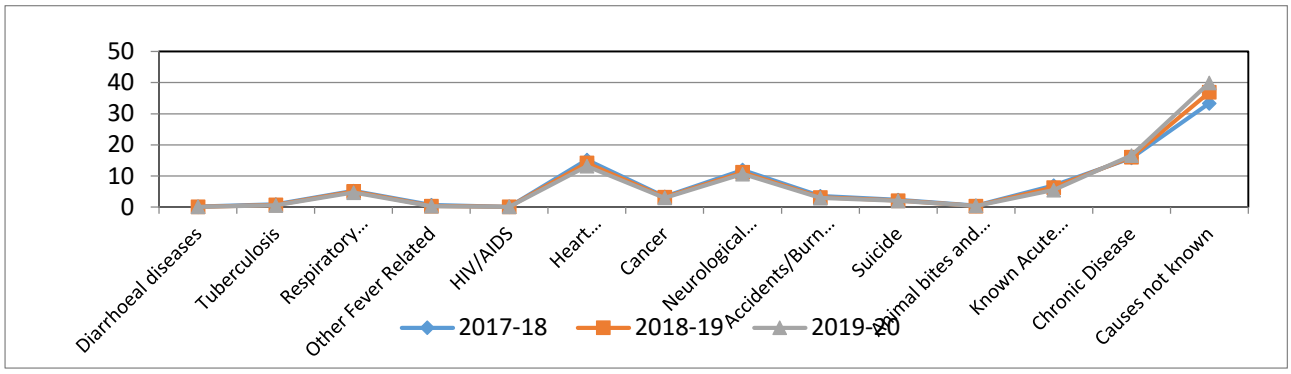
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 38: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Jharkhand



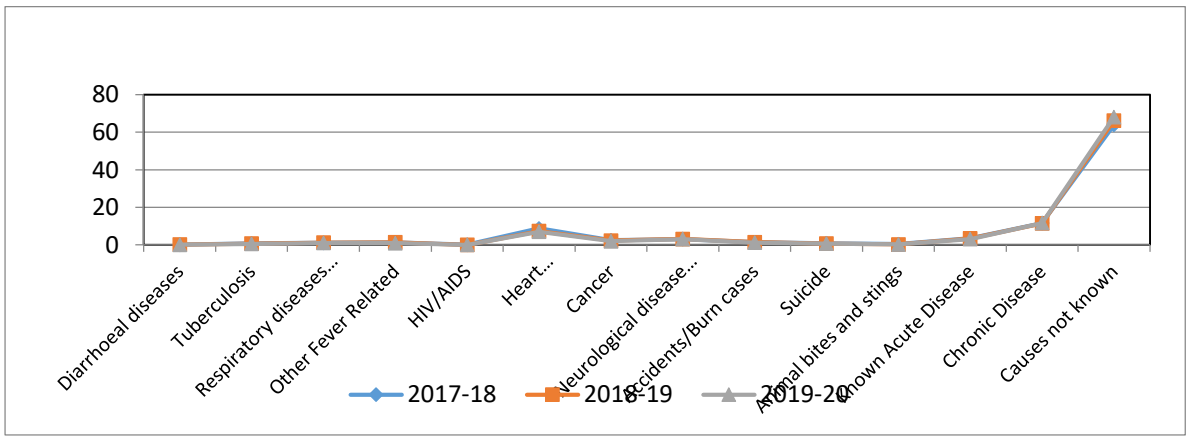
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 39: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, West Bengal



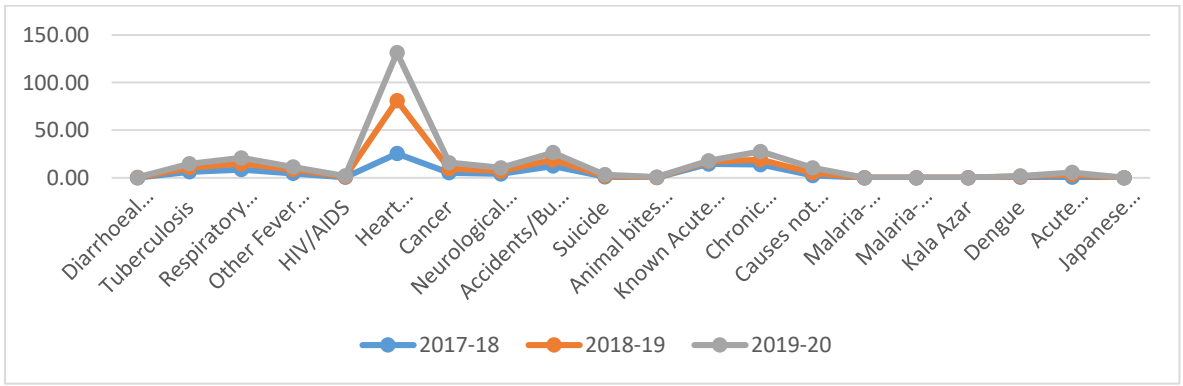
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 40: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Odisha



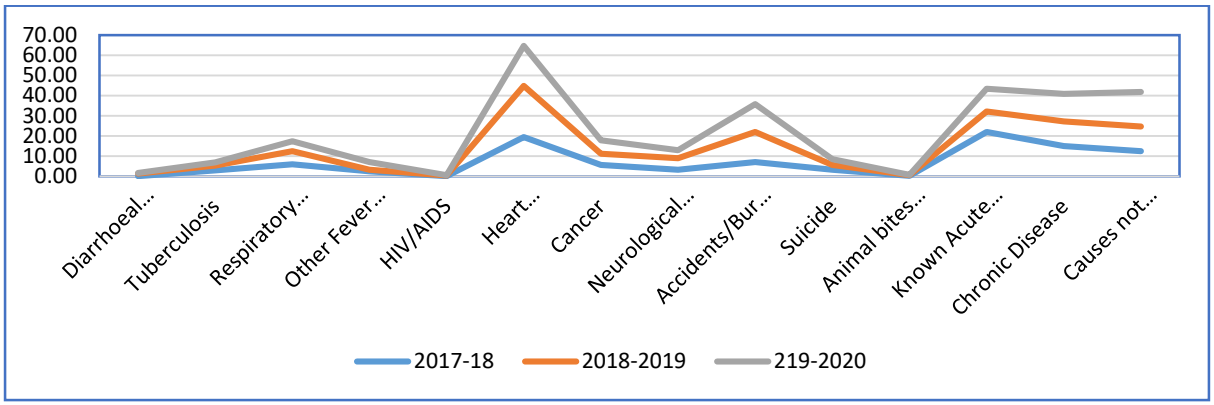
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 41: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Chandigarh



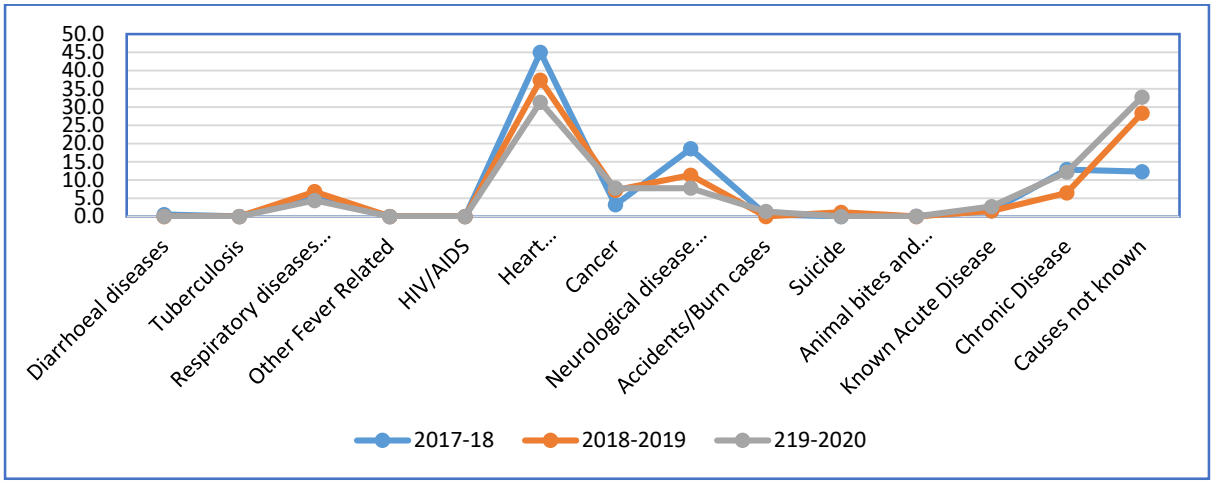
Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 42: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Puducherry



Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

Figure 43: Trends in Percent Distribution of Adolescent death by Cause of Death, 2017-2020, Lakshadweep



Source: Health Monitoring Information System, Ministry of Health and Family Welfare, 2017-2020

The burden of disease and health expenditure among older adults in Maharashtra

By

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[A report prepared for the Ministry of Health and Family Welfare, Government of India, New Delhi]

Abstract

Introduction: Along with other Indian states, Maharashtra faces demographic and epidemiological transitions now borne by the older population. It is essential to determine an individual's health status by factors like individual behaviour, family structure and relationship, health system, and health outcomes. Objective: This study aims to identify the burden of the older population's communicable and non-communicable diseases. It examines the mean expenditure on health and the different sources of payment. Lastly, the study focuses on the awareness and benefits of social welfare programmes. **Data and method**: The present study is extracted from the Longitudinal Ageing Study (LASI),2017-18. Both Bi-variate and multivariate techniques have been used for data analysis. **Findings**: This study highlights the higher rate of NCDs (30% had hypertension, 12.7% had Diabetes, 5.5% had chronic lung disease, 4.8% had chronic heart disease, and 4.3% had anaemia) among the elderly in Maharashtra. The rural populations were at more risk of NCDs than the urban population. One-fifth of the elderly suffers from depression, and the prevalence of depression was positively associated with hypertension. Multivariate analysis shows that age, gender, place of residence, caste and wealth status of the household was significantly associated with NCDs among the elderly. The findings also reflect the increasing expenditure on health through personal and household income. The awareness of social welfare schemes was also very little among the elderly. **Conclusion**: It is recommended to address poor quality care, independently account for infrastructural gaps, human resources and consumables, and Incorporate geographical heterogeneity based on population densities and disease profiles. The study also focuses on the need for better integration of gender in NCD policies, programmes, research and interventions.

Keywords: Disease burden, elderly, health expenditure, social welfare programme

Introduction

The demographic and the epidemiological transition in India has shifted a significant share of the country's burden of disease to the older population. The dramatic and widespread nature of recent and ongoing demographic shifts indicates that the challenges of population ageing that India faces are inevitable and exist enormously. These demographic changes present complex health, social and economic challenges. Thus, efforts are required to understand and use existing knowledge about the prevention and treatment of heart disease, stroke, diabetes, respiratory diseases, and cancer.

With poor social security measures and a weak pension system providing meagre pensions, a significant proportion of the elderly lives in poverty. Such poverty-driven financial insecurities limit the healthcare utilisation capacities for the elderly, leaving a gap in health service provision. Further, the pattern of current health spending in India suggests that households meet more than 68% of health expenditure, 25.3% by the government (Centre, state and local bodies), 6 % by firms and 0.6 % by external flows. While there has been an increase in government health spending over the years, the focus remains on maternal and child health. Projections show that by 2030, 45% of India's health burden will be borne by the older population (WHO, 2010). This high Out of pocket expenditure leads to health vulnerabilities in the ageing population. Self-reports of diagnosed medical conditions are tied to access to healthcare services and, therefore, can cover undiagnosed conditions. In countries like India, wherein access to healthcare is limited, the prevalence of undiagnosed conditions is expected to be greater than in advanced countries.

Nevertheless, literature on some aspects of morbidity burden and health-seeking behaviour among the older population exists, but little is known about the disease burden and health care financing among older adults; how does it vary across the socioeconomic groups in the Maharashtra state. In the context of changing demographics, socioeconomic development, and epidemiological transition, this paper explores the prevalence of the different types of morbidities and sources of financing among older adults in Maharashtra.

Need of the study

The world is facing a situation without precedent: Soon, there will be older people than children will and more people at extreme old age than ever before. Critical questions arise as the proportion of older people and the length of life increase. Will population ageing happen along a more extended period of good health, a sustained sense of wellbeing, and extended periods of social engagement and productivity, or will it be associated with more illness, disability, and dependency? How will ageing

affect health care and social costs? Are these futures inevitable, or can we act to establish a physical and social infrastructure that might foster better health and wellbeing in older age? This brief report attempts to address some of these questions. Above all, it emphasises the central role of health moving forward. A better understanding of the changing relationship between health and age is crucial if we create a future that takes full advantage of the powerful resource inherent in older populations. Many factors like individual behaviour, family structure and relationship, health system, and health outcomes determine an individual's health status. Although medical service utilisation patterns among older persons have steadily increased in recent years, there is no research and shreds of evidence related to an elderly population. To achieve the goals on healthy ageing and as a reflection of momentum generated around the issue of population ageing, assessing the status of health issues is thought to be essential and formed the fundamental research question.

The state of Maharashtra represents a significant portion of the Indian population in terms of size and socioeconomic, demographic, and health transition. It is a leading industrial State and one of the most urbanised states in India. Maharashtra is the second largest state in India and accounts for almost half of the total population that lives in urban areas. About 9.9 per cent of the state's population is 60 years or above, which has the highest number of an elder in terms of numbers. The Human Development Index placed the rank 4th among all the Indian states, and the life expectancy at birth was 72.5 during 2014-18 of the states.

Moreover, states have substantial migrant populations from several states in India. Further, Maharashtra has the third-best health care system in India (NITI Ayog, 2019). These conditions give a suitable environment to study the disease burden, health care financing and awareness of social welfare programmes among older adults. Owing to the states' diverse socioeconomic, demographic, and health transition conditions, the findings based on this population can roughly be generalised to India.

Data and methods

Data source

The present study will be extracted from the Longitudinal Ageing Study in India (LASI) survey, conducted during 2017-18, covering all 30 states and six union territories of India. However, the LASI fieldwork for Maharashtra state was conducted from August 2018 through April 2019. LASI is a national landmark, the largest globally and only in India. LASI is undertaken under the Ministry

of Health and Family Welfare (MoHFW), Government of India. The International Institute for Population Sciences (IIPS), Mumbai, is the nodal institution for implementing LASI in collaboration with the Harvard T.H. Chan School of Public Health (HSPH) and the University of Southern California (USC).

Outcome variables

The dependent variables determine the effect of the cause (independent) variables when changed for different values; these have been taken into account for the study to cover the three objectives of the study. The first objective is to determine the disease and risk burden of communicable and non-communicable diseases, self-reported hypertension, diabetes, anaemia, stroke, heart disease, lung disease, and tuberculosis. Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels. They include hypertension, stroke, and chronic heart diseases such as rheumatic heart disease, congenital/structural disorder, conduction disorder/cardiac arrhythmias, congestive heart failure, and coronary heart disease/ blockage. Hypertension is a long-term medical condition in which the blood pressure in the arteries is persistently elevated. The prevalence of hypertension tends to increase with age. Stroke, also known as cerebrovascular accident, is caused by a sudden partial or total disruption of blood supply to a part of the brain. This may result from either blockage (ischemic stroke) or rupture of a blood vessel (haemorrhagic stroke). It can cause permanent or temporary paralysis (inability to move, usually one side of the body), loss of speech, and unconsciousness. Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in insulin production by the pancreas or by the ineffectiveness of the insulin produced. Such a deficiency results in increased concentrations of glucose in the blood, which in turn damage many body systems, particularly the blood vessels and nerves. Chronic lung disease is the second largest contributor to the burden of mortality and morbidity in India. The self reported prevalence of infectious disease-tuberculosis is also considered. Self reported depressive symptoms based on the Centre for Epidemiologic Studies Depression Scale (CES-D) have been considered. This report uses the Centre for Epidemiologic Studies Depression Scale (CES-D) to understand the prevalence of depressive symptoms across demographic variables in Maharashtra. CES-D is a brief self-report scale designed to calibrate depressive symptoms in the general population(Radloff, 1977). The original CES-D scale is a 20-item scale, while this report follows the steps of LASI Report 2020 and uses a shortened 10-item scale with four scale option categories. The ten items include seven negative symptoms (trouble concentrating, feeling depressed, low energy, fear of something, feeling alone, bothered by things,

and everything is an effort), and three positive symptoms (feeling happy, hopeful, and satisfied). Based on these symptoms, if the responses for negative symptoms were rarely or never (< 1 day), and sometimes (1 or 2 days), then the score was zero, and often (3 or 4 days) and for most or all of the time (5-7 days) categories were scored one—reverse scoring for positive symptoms. The score spans from zero to ten, and the score of four or more determine the prevalence of depressive symptoms (Kumar et al., 2016).

The second objective is fulfilled by considering the dependent variable expenditure on outpatient visits and sources of spending for outpatient visits. Lastly, the third objective considers the awareness and benefits received from four social welfare programmes. The four social welfare programmes are the National old-age scheme, Widow Pension scheme, Annapurna scheme, and other state schemes.

Predictor variables

The predictor variables are the independent variables, including the sample population's demographic characteristics. The sample population of Maharashtra has been considered for older adults and the elderly population. Rural and Urban, both are taken into account. By gender, males and females have been included in the study. All the other religions and Muslims have been clubbed together for better analysis.

Similarly, others except those who are currently married are considered one. To understand the condition of health across education, no education, less than primary, primary, middle, secondary, higher, diploma, graduate, postgraduate and professional degree holders are considered. To access the conditions across Monthly per capita expenditure(MPCE), the sample is divided into the poorest, poorer, middle, more decadent and most prosperous. Lastly, the living arrangement of the model has also been given consideration.

Univariate, bivariate and multivariate techniques have been applied to fulfil the study objectives. In multivariate techniques, binary logistics regression has been used the see the adjusted effect of exposure variables on outcome variables.

Results

Sample distribution

The sample distribution of the study (Table 1) shows the highest number of samples from the 45-54 age group, which are spread almost equally across rural and urban. By gender, the sample includes more females than males. The Scheduled Tribe is the least considered by caste, whereas Hindus are the highest in religion. The ones with no education have taken the most part in the study. The maximum samples are of the ones living with spouses and children.

Disease Burden & Risk Factors (Reported and Measured)

Table 2 measures the prevalence of some non-communicable and communicable diseases across demographic variables for chronic and acute conditions, including hypertension or high blood pressure, diabetes or high blood sugar, anaemia, chronic lung disease, chronic heart diseases, stroke, and tuberculosis. The data shows that hypertension, stroke, and tuberculosis are highest among the 75-84 age group, whereas diabetes and chronic heart disease are highest among 65-74. Lung disease is found chiefly among 85+, while anaemia was most prevalent among 55-64. Hypertension, diabetes, chronic heart disease and stroke were more prevalent in urban than rural areas. The prevalence was higher in rural areas than urban areas for chronic lung disease, anaemia and tuberculosis. Alternatively, most diabetes, lung disease, heart disease, tuberculosis and stroke were higher among men than women.In contrast, hypertension and anaemia were substantially higher among women than men. As per religion, Muslims have a higher prevalence rate than Hindus and others for hypertension, diabetes, heart disease and stroke. By educational attainment, hypertension and heart disease are higher among those with diplomas or certificates.

Prevalence of symptoms of Mental Health

As per the World Health Organization[1], depression is a common mental disorder characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness and poor concentration. The view that there is a need for assessing depression, whether as a symptom, an effect, or a disorder, is evident by the numerous scales and inventories available.

Table 3 shows the overall proportion of older adults in Maharashtra age 45 and above who were coverted positive for depressive symptoms based on the CES-D scale, with the prevalence rate highest among 75+ and lowest older adults aged 45-54. The self-reported prevalence of depressive symptoms

[1] [1] https://www.who.int/news-room/fact-sheets/detail/depression

among older adults is slightly more in rural areas than in urban areas. Depressive symptoms were more prevalent in females than males. Further, the prevalence rate decreases with increasing educational attainment, and the least was self-reported among professional degrees. Depressive symptoms are lesser among people who are currently married than others and higher among those living alone, followed by those living with others. Lastly, it is higher between SC and ST than others are. Within Wealth MPCE, it was the same among extremes-richest and poorest.

Table 4 shows the binary logistic regression, which highlights the effects of socio-economic background on infectious diseases like Tuberculosis and non-communicable diseases like heart disease, lung disease, hypertension, anaemia, stroke and diabetes, and depression. The odds of showing hypertension, diabetes, stroke, heart disease, chronic lung disease, and depression are highly significant across all age groups from the reference category. Males are less likely to suffer from hypertension and extremely unlikely to suffer from anaemia than females, whereas heart disease is higher among males than females. The odds of depression is found to be significantly more likely in ST and SC than OBC. Urban is considerably more prone to hypertension, diabetes, and heart diseases, whereas it is less likely to depression than the reference category. By religion, Muslims show a high significance for hypertension and diabetes than Hindus and others.

Health expenditure

Several studies suggest health expenditure to be higher for the elderly with no systematic effort to keep health spending at par with the elderly population and health-related vulnerability. As a result, a significant share of such expenditure is personal spending. Our results for the mean amount spent on outpatients visits(Rs) by background characteristics depict a similar finding with an average spent Rs. Seven thousand.

Table 5 highlights the mean expenditure on health highest among older adults from 45-54. The mean cost of health falls exorbitantly on the urban older adults and is almost three times more than rural older adults. Elderly females spend more on health than males. By religion and caste, Muslims spend more than five times than Hindus and others, whereas others spend the highest and ST spends the lowest. Those with a professional degree spend the most elevated on health compared to those with no education. As per the mpce quintile, the poorest spend the highest compared to the richest. The currently married and living with their spouse and children spend the highest on their health.

Under India's decentralized approach to health care delivery, the states are primarily responsible for organizing health services. Because of severe staff shortages and supplies at government facilities, many households seek care from private providers and pay out-of-pocket. The different sources of expenditure are personal income, household income excluding personal income, savings, loans, contributions, sold assets, insurance, reimbursement and other sources. The most preferred source of expenditure is a personal income and household income.

As mentioned above, table 6 shows the mode of spending on outpatients visit by background characteristics in Maharashtra.It reflects that the aged group 75-84 and 85+ spend the highest household income. The rural areas pay the most from their household income, whereas those in urban areas spend the most. By gender, males allocate more from their income, and females spend more from their household income. The ones who belong to ST pay the most from their income, followed by OBC, who spend the most from their household income. Education-wise, those with a professional degree pay the most from their gain; those with a post-graduate degree spend the same from sold assets, insurance, and reimbursements. The ones who belong to the middle MPCE spend the most from their household income, whereas the poorest pay the most from their income. People living alone spend the highest, that too from their private expenditure.

Family, Social Network and Social Welfare Programmes

The elderly population suffers from income loss, decreased social role and increased dependence, and physical and mental problems associated with ageing. The focus of the existing social welfare schemes is below the poverty line elderly population. However, if the older adults are aware of these welfare schemes, they can benefit from them. This report covers awareness and helps received from the National old-age pension scheme, Widow Pension scheme, Annapurna scheme, and other state-specific schemes. These schemes are only applicable to the ones aged 60 and above.

Table 7 reflects the awareness and benefits of any social welfare programme. These schemes' maximum attention and help are among the age group 65-74. The ones who belong to the rural areas were more aware and received more benefits than those in urban areas. The study finds similar results for those living alone. Males were comparatively more aware of the schemes; however, more than double females benefited from the schemes than males. ST seems to be more mindful of caste, with the highest percentage of these schemes' beneficiaries. Those who have completed their graduation have more awareness about social welfare schemes; however, those with no education received the

most benefit. The attention of the scheme was moderately same around mpce quintile, but the richest received the maximum benefit.

Discussion

The present study crucially insights over the elderly population of Maharashtra. Socioeconomic conditions influence people's risk and vulnerability to communicable and non-communicable diseases and can influence health outcomes. The significant determinants of these diseases include poverty, illiteracy, poor health infrastructure and social inequality as well as demographic transition in terms of increasing life expectancy and Urbanisation and globalization (Sharma, 2013).

Our study reveals that Non-communicable diseases like Hypertension, Anemia, diabetes, stroke, heart disease, lung disease have been increasing at an alarming rate. Cardiovascular diseases lead to premature deaths and are one of the most common lifestyle 'silent killer' diseases today. Our findings suggest that cardiovascular risk factors were higher in the urban than in the rural population and increased with age; this is in line with a study(Samuel et al., 2012). A major reason behind this is due to overweight and obesity, dyslipidaemia and tobacco use. Tobacco and alcohol use was more common in men, while obesity and low fruits and vegetables were more common in women (Shridhar et al., 2014). There is an increasing nutrition transition that is leading to changes in dietary intake patterns because of the adoption of 'modern' lifestyles due to social and economic development (Shetty, 2002). Experience in the MPCE quintile shows that as the transition progresses, more affluent people start to change their behavior and adopt healthier lifestyles, probably due to multiple factors (greater awareness, greater self-efficacy, better access to healthy diets), to lead to a lowering of their risk, while the burden of disease shifts to the poorest (Anchala et al., 2014).

Risk factors tend to be intensive among the high socioeconomic groups and urban dwellers, who have early access to these 'modern' lifestyles. The socio-economic environment also influences the profile of glucose intolerance and diabetic complications. Many studies suggest that diabetes mellitus among men may be recognized and diagnosed earlier than those in women diagnosed. They are leading to better access to the health system compared to women. This has implications for access to treatment between the sexes and gender equity in general (Kutty et al., 2018).

Anaemia, a severe global public health problem, is increasing with age. Previous work suggests that iron deficiency might have contributed to the high prevalence of anaemia for older adults (Alvarez-Uria et al., 2014; P. Malhotra et al., 2004), whereas others show the destitute bioavailability of vitamin

B12 in a typical Indian vegetarian diet and substantial prevalence of vitamin B12 deficiency(Shridhar et al., 2014). Apart from overall poverty, the health status of women in India reflects gender discrimination from birth, inequitable distribution of health resources, and early and frequent reproductive cycling and reproductive tract infections (Bentley & Griffiths, 2003). The high rates of anaemia among women reflect their social and biological vulnerability within both society and the household.

In Maharashtra, communicable disease like tuberculosis has been most infectious. Our study reveals that it is more commonly found in males and rural areas. Low ventilated accommodation, low nutritious diet, high smoking rate, alcoholic indulgence, excessive physical work, lifestyle changes are certain factors causing TB(Shaikh & Shah, n.d.).

Depression and depressive symptoms are common mental disorders that considerably affect a patient's health-related quality of life and satisfaction with medical care. Still, the prevalence of these conditions varies substantially (Wang et al., 2017). Analysis of mental health indices and data reveals that psychiatric disorder and psychological distress patterns among women are contrasting from those seen among men. Symptoms of depression, anxiety, and unspecified psychological distress are 2–3 times more common among women than among men (S. Malhotra & Shah, 2015). Our results predict a substantial increase in the number of people with mental illness in rural areas with an increase in population, changing lifestyle, unemployment, lack of social support, and increasing insecurities. The critical reasons for improving mental health issues are altered family structure, loneliness, non-kin networks and poor social networks and challenges of urban living(George et al., 2021).

The economic well-being of households is a critical factor of elderly health. In the absence of a robust and universal social security system, the low coverage of old-age pension, a large share of employment in the informal sector, early retirement from formal work, and increasing health expenditure, elderly households are economically vulnerable and prone to financial shocks. Furthermore, increasing Urbanisation, rural-urban migration, and modernization have led to several socioeconomic changes, including changes in the structure of families and living arrangements. The mean per capita health spending is higher in urban areas. With the rise in the elderly population and the commitment to increase public spending on health, there is a greater need to reallocate the resources to reduce the burden of health expenditure (Mohanty et al., 2014; Sahoo et al., 2021).

Social welfare schemes help in achieving economic independence among the elderly. Knowledge of social welfare schemes and their utilisation helps family physicians make informed decisions on

treatment costs. Our findings highlight significant bottlenecks such as inadequate health financing, health infrastructure, skilled human resources, and deformed primary health care to achieve universal health coverage. Elderly-specific challenges are the increasing burden of non-communicable diseases, injuries, inadequate finances, and lack of intersectoral coordination (Goswami et al., 2019) Our finding shows that most respondents know the National Old age pension scheme, which is still less than 50%. The number of people who gained from the schemes is deficient; this indicates they have not been publicised adequately, and proper strategies to reach out to them have not been conceived. Social support takes several forms, including emotional, instrumental, appraisal, and financial support. There is a direct relationship between social support and living satisfaction; as social support increases, living happiness increases(Chou et al., 2006).

Conclusion

The critical requirements for a sound health system include universality, comprehensiveness, equitability, effectiveness, responsiveness, accessibility, and quality (World Health Organization, 2014). There is a need to focus on health care, which is interdisciplinary and multi-sectoral. The introduction of Ayushman Bharat stands as a segmented approach of health service delivery to a comprehensive need-based health care service with the introduction of Health and Wellness Centres(HWCs). However, it is recommended to:

1. Address the poor quality care.
2. Account for infrastructural gaps, human resources and consumables independently.
3. Incorporate geographical heterogeneity based on population densities and disease profile.

Policies and public health efforts have not addressed the gendered impacts of diseases. Hence, It is essential to focus on a gender-responsive healthcare system. Gender stereotypes and inequalities affect access and use of health resources and may be bolstered by health promotion efforts. There is a need for better integration of gender in NCD policies, programmes, research and interventions. Apart from comprehensive strategies, providing employment and increasing the quality and standard of living to improve physical and mental health conditions in rural and urban areas.

Conflict of interest

All the authors reported no conflict of interest.

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Tables

Table 1. Percentage of sample distribution, Maharashtra, LASI Wave 1, 2017-18

Background Characteristics	Percentage	Total
Age groups		
45-54	41.9	**1,663**
55-64	26.2	**1,042**
65-74	22.9	**908**
75-84	7.2	**284**
85+	1.9	**76**
Residence		
Rural	50.3	**1,998**
Urban	49.7	**1,975**
Gender		
Male	40.5	**1,607**
Female	59.6	**2,366**
Caste		
SC	16.9	**634**
ST	8.2	**307**
OBC	36.2	**1354**
Others	38.7	**1448**
Religion		
Hindu	76.5	**3,039**
Muslim	13.6	**540**
Others	9.9	**394**
Education		
No education	36.8	**1,460**
less than primary	14.2	**563**
Primary	14.5	**575**
middle/secondary	28.0	**1,111**
diploma/certificate	0.6	**22**
Graduate	4.0	**157**
Post graduate	1.0	**41**
Professional	1.1	**44**
Wealth (MPCE)		
Poorest	18.9	**751**
Poor	19.4	**770**
Middle	20.8	**828**
Rich	22.1	**877**
Richest	18.8	**747**
Marital status		
Currently married	23.3	**926**
Others	76.7	**3,047**
Living Arrangement		
Living alone	2.7	**107**

living with spouse and/or others	12.3	**490**
living with spouse and children	63.1	**2,508**
living with children and others	17.7	**703**
living with others only	4.2	**165**
Total	**100**	**3973**

Table 2: Self-reported prevalence of non-communicable and communicable diseases by background characteristics, Maharashtra, LASI Wave 1, 2017-18

30% had hypertension, 12.7% had Diabetes 5.5 had chronic lung disease and 4.8% chronic heart disease and 4.3% had anemia.

30.1	**12.7**					**5.5**	**4.8**
			Non-communicable			**Communicable**	
Background Characteristics	**Hypertension**	**Diabetes**	**Chronic lung disease**	**Chronic heart disease**	**stroke**	**Anemia**	**Tuberculosis**	**Total**
Age groups	**%**	**%**	**%**	**%**	**%**	**%**	**%**	
45-54	15.31	7.35	3.18	1.47	0.72	3.74	0.15	**1529**
55-64	31.74	14.12	5.29	5.93	3.05	4.9	0.27	**1030**
65-74	37.5	17.38	7.65	8.22	4.36	3.27	0.38	**982**
75-84	41.61	14.73	9.28	4.71	4.61	3.92	0.68	**325**
85+	32.82	15.31	11.43	4.39	4.25	4.57	0	**91**
Residence								
Rural	8.76	8.8	5.8	3.3	2.21	4.61	0.36	**2307**
Urban	17.46	17.5	5.1	6.5	3.22	3.05	0.16	**1651**
Gender								
Male	26.19	14.6	6.6	6.69	3.4	1.92	0.35	**1585**
Female	28.65	10.9	4.81	3.27	2.1	5.32	0.23	**2373**
Caste								
SC	24.03	11.13	5.72	4.28	2.63	2.5	0.2	**621**
ST	22.28	7.07	4.82	2.22	1.52	5.1	0.3	**303**
OBC	28.13	10.73	6.67	4.66	2.95	4.21	0.3	**1432**
Others	28.54	14.75	4.1	4.83	2.2	3.87	0.32	**1375**

Religion								
Hindu	26.03	11.42	5.24	4.37	2.53	4.16	0.3	**3151**
Muslim	38.34	19.68	6.28	6.21	3.02	4.11	0.06	**454**
Others	28.49	11.69	7.1	5.03	3.04	1.98	0.32	**354**
Education								
No education	24.31	9.02	6.89	3.24	2.38	4.94	0.27	**1581**
less than primary	28.15	12.89	6.4	4.77	2.93	4.76	0.3	**618**
Primary	31.9	13.19	4.32	5.05	3.56	4.53	0.18	**509**
middle/secondary	31.21	16.36	4.06	5.91	2.53	2.36	0.38	**1020**
diploma/certificate	49.29	16.81	7.18	28.74	5.46	3.36	0	**22**
Graduate	20.51	17.1	2.83	5.18	2.4	1.07	0	**139**
Post graduate	17.34	3.63	3.97	0.54	0	0	0	**39**
Professional	32.27	17.2	0	10.09	0	0	0	**34**
Wealth (MPCE)								
Poorest	32.5	17.47	6.38	9.99	3.31	6.15	0.39	**687**
Poor	30.43	13.51	4.9	4.67	3.18	4.7	0.26	**743**
Middle	25.41	12.02	4.96	3.36	2.28	3.3	0.13	**791**
Rich	25.44	9.18	5.94	2.73	3.52	3.39	0.5	**896**
Richest	25.77	11.04	5.47	3.49	0.98	2.74	0.11	**841**
Marital status								
Currently married	24.51	12.78	5.15	4.55	2.33	3.6	0.21	**2976**
Others	37.23	11.23	6.67	4.92	3.55	5.06	0.48	**982**
Living Arrangement								
Living alone	30.77	6.43	4.41	5.04	3.56	5.36	0	**125**
living with spouse and/or others	27.79	16.49	5.63	5.81	2.22	4.02	0.13	**526**
living with spouse and children	23.93	12.03	5.08	4.36	2.4	3.54	0.23	**2403**
living with children and others	38.92	12.32	7.13	4.79	3.48	5.67	0.63	**737**
living with others only	29.05	9.29	5.29	4.03	2.83	1.11	0	**167**
Total	**30.1**	**12.7**	**5.5**	**4.8**	**2.9**	**4.1**	**0.2**	**3958**

Table 3 Results for the self-reported prevalence of depressive symptoms by background characteristics, Maharashtra, LASI Wave 1, 2017-18

Background Characteristics	Depressed	Total
Age groups		
45-54	13.7	**1,496**
55-64	19.2	**1,020**
65-74	20.8	**973**
75-84	27.0	**311**
85+	27.9	**85**
Residence		
Rural	20.0	**2,277**
Urban	16.0	**1,608**
Gender		
Male	15.5	**1,561**
Female	20.2	**2,324**
Caste		
SC	21.7	**612**
ST	21.6	**298**
OBC	17.5	**1,411**
Others	15.5	**1,339**
Religion		
Hindu	18.6	**3,101**
Muslim	15.1	**434**
Others	19.7	**350**
Education		
No Education	23.7	**1,546**
less than primary	17.7	**609**
Primary	15.2	**503**
middle/secondary/higher secondary	14.1	**1,008**
diploma/certificate	28.2	**22**
Graduate	7.3	**125**
Post graduate	0.5	**37**
Professional	9.5	**34**
Wealth (MPCE)		
Poorest	20.2	**663**
Poor	19.8	**732**
Middle	15.3	**775**
Rich	16.4	**887**
Richest	20.4	**827**
Marital status		
Currently married	14.4	**2,926**
Others (divorced/separated/	30.3	**959**
Living Arrangement		
Living alone	49.5	**124**
living with spouse and/or others	18.9	**496**
living with spouse and children	13.5	**2,385**

living with children and others	25.4	**726**
living with others only	32.0	**167**
Total	**19.5**	**3,898**

Table 4 Results of Binary Logistic Regression (Odd Ratio) Analysis Showing the Determinants of communicable diseases, non-communicable diseases and depression by background characteristics, Maharashtra, LASI Wave 1, 2017-18

	Hypertension	Diabetes	Heart disease	Lung disease	Anemia	Stroke	Tb	Depressed
Age group								
45-54[SM]								
55-64	2.58	2.18	4.00*	1.77*	1.05	3.26*	1.85	1.09
65-74	3.69	3.46	6.67*	1.95*	0.77	6.20*	2.38	1.31*
75-84	5.3	3.13	4.19*	3.15*	1.15	6.86*	2.39	1.78*
85+	3.06	3.74	2.41	3.15*	0.58	6.67*	1	1.88*
Gender								
female [SM]								
male	0.74	1.02	1.71*	1.53	0.36*	1.29	1.81	0.99
Caste								
others [SM]								
OBC	1.24	0.86	1.03	1.57	1.05	1.69*	0.97	1.23
ST	1.1	0.66	0.78	1.03	1.18	1.46	0.64	1.49*
SC	0.88	0.98	1.22	0.99	1	1.34	0.26	1.47*
Living								
Others only [SM]								
Children & others	1.41	1.31	0.8	1.72	3.53	1.23	1	0.74
Spouse & children	2.04	1.4	#	2.99	3.93	#	0	0.84
With spouse/others	2.02	1.44	#	3.27	4.55	#	1.79	1.12
Living alone	1.25	0.54	0.53	0.62	3.51	0.9	1	1.99*
Residence								
Rural [SM]								
Urban	1.9	2.1	2.01*	0.84	0.75	1.16	0.5	0.71*
Religion								
Hindu [SM]								
Muslim	1.32	1.61	1.76	1	0.58	1.24	0.66	1.01
others	1.37	1.06	0.76	1.45	0.67	1.31	1.54	0.86
Education								
Higher [SM]								
middle/secondary	1.58	1.5	1.08	0.58	0.64	0.94	1.94	0.8
primary	1.59	1.38	1.14	0.66	1.23	1.32	0.63	0.73*
less than primary	1.12	1.12	1.63*	0.99	1.1	0.78	1.53	0.86
MPCE								
poorest [SM]								
poorer	1	0.93	0.35*	0.86	1.11	0.79	0.99	0.8
middle	0.78	0.79	0.38*	0.81	0.88	0.68	0.61	0.68*
richer	0.73	0.62	0.28*	0.84	0.64	0.79	1.36	0.73*
richest	0.71	0.62	0.29*	0.7	0.54*	0.26*	0.33	0.93
Marital								
others [SM]								
currently married	0.54	1.2	0	0.42	0.72	0	0	0.52

Notes: [SM] is reference category,*p<0.05

Table 5 Results for mean amount spent on out patients visits (Rs) by background characteristics, Maharashtra, LASI Wave 1, 2017-18

Background Characteristics	Mean amount spent on out patients visits(Rs)	Number of observations
Age groups		
45-54	9946.6	834
55-64	5188.9	645
65-74	5549.3	649
75-84	6544.2	207
85+	8890.6	59
Residence		
Rural	4434.8	1452
Urban	11346.6	941
Gender		
Male	5104.7	864
Female	8308.1	1529
Caste		
SC	4384.8	380
ST	2693.6	174
OBC	5164.3	917
Others	11948.0	776
Religion		
Hindu	4907.1	1949
Muslim	28115.2	230
Others	5070.3	214
Education		
No Education	4002.6	982
Less than primary	5580.1	390
Primary	4391.4	321
Middle/secondary/higher secondary	4941.1	574
Diploma	23460.0	15
Graduate	81385.8	70
Post Graduate	6414.9	19
Professional	25430.5	22
Wealth (MPCE)		
Poorest	22403.4	391
Poor	5260.0	468
Middle	4802.1	514
Rich	3633.8	568
Richest	3007.9	452
Marital status		
Currently married	7899.7	1783
Others (divorced/separated/	4965.0	610
Living Arrangement		
Living alone	3674.6	90
living with spouse and/or others	7389.0	329

living with spouse and children	8099.9	1427
living with children and others	5442.8	458
living with others only	3402.8	90
Total	**7892.7**	**2393**

Table 6 Results for source of expenditure on out patients visits (Rs) by background characteristics, Maharashtra LASI Wave 1, 2017-18

Background Characteristics	Household income	Personal income	Savings	Loans	Contribution	Sold assets	Insurance	others	total
Age groups									
45-54	71.6	76.1	51.3	51.2	52	57.6	58	49.2	**834**
55-64	79.4	72	54.6	53.4	54.3	60	60.3	51.4	**645**
65-74	76.3	73.3	56.9	54.4	55.4	61.6	62.7	52.3	**649**
75-84	81.2	70.6	59.2	58.9	62.6	62	62.3	53.4	**207**
85+	83.2	65.7	67.8	57.3	59.3	64.4	64.4	54.1	**59**
Residence									
Rural	73.7	70.1	47.6	47	48.2	54.6	55	44.9	**1453**
Urban	79.8	78.7	65.9	63.4	64.5	68.1	68.8	61.4	**941**
Gender									
Male	69.1	80.1	54.7	52.9	53.3	60.7	61.5	50.7	**865**
Female	80.1	69.7	54.9	53.8	55.4	59.4	59.8	51.4	**1529**
Caste									
SC	70.4	71.3	46.9	45.4	47.3	50.6	50.8	43.1	**380**
ST	68.2	81.1	53.7	52.3	52.5	61.6	61.6	48.8	**174**
OBC	77.5	73.7	56.5	55.2	56.1	62.8	63.6	51.7	**917**
Others	78.2	74.3	56.9	55.5	56.7	61.1	61.3	54.6	**776**
Religion									
Hindu	76.2	73.3	54.2	53	54	60.1	60.6	50.4	**1950**
Muslim	82	76.4	63.8	62.3	63.6	63.9	65.3	62.5	**230**
Others	69.1	72.7	50.9	48.4	50.9	53.7	53.8	45.4	**214**
Education									
No Education	76.2	71.8	53.1	51.8	53.3	58.4	59	49.7	**982**
less than primary	79.8	71.2	57.5	55.7	56.7	61.2	61.2	51.3	**391**
Primary	77.8	70.8	52.7	52.8	54	59.5	60.2	50.5	**321**
middle/secondary/higher secondary	74.4	77.6	56.5	55	55.8	61.6	62.2	53.2	**574**
diploma	55.1	79	60.2	44.6	44.6	52.5	52.5	43.8	**15**
Graduate	71	75.4	50.3	50.3	50.6	53.9	54.6	51.2	**71**
Post Graduate	66.7	92.8	70	64.7	64.7	77.6	77.6	62.9	**19**
Professional	64.2	95	67.6	63.4	63.4	74.4	74.4	64.7	**22**
Wealth (MPCE)									
poorest	78.2	77.2	59.5	58.6	60.4	63.2	63.7	57.5	**392**

Poor	80.2	69.7	56.8	54.4	55.6	63.5	64	52.4	**468**
Middle	79	72.6	53.8	54.5	55.1	59.2	60.2	52.7	**514**
Rich	76	74.4	54.7	53.9	55.1	60.3	60.7	51	**568**
Richest	66.9	74.2	50	46.4	47.5	53.5	53.7	42.4	**452**
Marital status									
Currently married	75.5	73.6	53.6	52.4	53	59.2	59.9	50.4	**1783**
Others (divorced/separated/	78	73.1	58.4	56.5	59.4	61.9	62	53.3	**611**
Living Arrangement									
Living alone	57.9	85.7	59.2	56.9	66.8	60	60	53.3	**90**
living with spouse and/or others	76.8	73.4	58.4	56.2	56.9	61.4	62	53.2	**329**
living with spouse and children	75.6	73.5	52.6	51.7	52.1	58.9	59.6	49.9	**1427**
living with children and others	83.5	69.1	58.1	56.5	58.5	62.2	62.3	53.2	**458**
living with others only	63.1	84.2	55	52.6	53.7	58.2	58.2	51.3	**90**
Total	**74.2**	**75.4**	**56.7**	**54.5**	**57.6**	**60.1**	**60.4**	**52.2**	**2393**

Table 7 Results for awareness of social welfare programmes by background characteristics, Maharashtra, LASI Wave 1, 2017-18

Background Characteristics	Awareness (any schemes)	Total	Benefit (any schemes)	Total
Age groups				
45-54		-		
55-64	36.0	**488**	10.7	**174**
65-74	39.7	**898**	22.7	**346**
75-84	34.1	**290**	25.3	**99**
85+	35.5	**84**	24.5	**30**
Residence				
Rural	39.3	**1056**	24.1	**406**
Urban	34.8	**704**	13.0	**244**
Gender				
Male	38.4	**787**	11.4	**284**
Female	36.8	**973**	26.6	**366**
Caste				
SC	41.7	**279**	27.4	**118**
ST	44.3	**130**	43.5	**57**
OBC	36.9	**644**	20.7	**225**
Others	35.2	**592**	9.7	**206**
Religion				
Hindu	38.1	**1394**	20.6	**519**
Muslim	28.1	**201**	11.0	**57**
Others	44.2	**166**	22.2	**75**
Education				
No Education	35.3	**837**	28.0	**296**
less than primary	38.2	**309**	25.6	**113**

Primary	31.0	**196**	14.6	**61**
middle/secondary/higher secondary	42.6	**348**	6.3	**143**
diploma	31.8	**10**	0.0	**3**
Graduate	63.06	**41**	0.0	**27**
Post Graduate	37.9	**6**	0.0	**3**
Professional	50.2	**12**	0.0	**5**
Wealth (MPCE)				
poorest	39.4	**269**	5.4	**107**
Poor	38.79	**326**	17.1	**125**
Middle	38.03	**349**	17.7	**130**
Rich	36.62	**423**	24.5	**155**
Richest	35.61	**393**	31.3	**133**
Marital status				
Currently married	37.0	**1099**	12.1	**391**
Others (divorced/separated/	38.4	**661**	31.8	**259**
Living Arrangement				
Living alone	60.6	**89**	45.9	**55**
living with spouse and/or others	36.1	**299**	15.5	**108**
living with spouse and children	37.5	**788**	10.6	**280**
living with children and others	37.7	**501**	26.5	**193**
living with others only	17.8	**83**	49.1	**14**
Total	**37.5**	**1760**	**20.0**	**650**

References

Alvarez-Uria, G., Naik, P. K., Midde, M., Yalla, P. S., & Pakam, R. (2014). Prevalence and severity of anaemia stratified by age and gender in rural India. *Anemia, 2014*.

Anchala, R., Kannuri, N. K., Pant, H., Khan, H., Franco, O. H., Di Angelantonio, E., & Prabhakaran, D. (2014). Hypertension in India: A systematic review and meta-analysis of prevalence, awareness, and control of hypertension. *Journal of Hypertension*, *32*(6), 1170.

Bentley, M. E., & Griffiths, P. L. (2003). The burden of anemia among women in India. *European Journal of Clinical Nutrition*, *57*(1), 52–60.

Chou, K.-L., Ho, A., & Chi, I. (2006). Living alone and depression in Chinese older adults. *Aging and Mental Health*, *10*(6), 583–591.

George, M. S., Gaitonde, R., Davey, R., Sukumaran, V., Mohanty, I., & Upton, P. (2021). Social networks and their impact on access to health care: Insights from older widows living alone in Kottayam, South India. *Ageing & Society*, 1–23.

Goswami, A. K., Ramadass, S., Kalaivani, M., Nongkynrih, B., Kant, S., & Gupta, S. K. (2019). Awareness and utilization of social welfare schemes by elderly persons residing in an urban resettlement colony of Delhi. *Journal of Family Medicine and Primary Care*, *8*(3), 960.

Kumar, S., Nakulan, A., Thoppil, S. P., Parassery, R. P., & Kunnukattil, S. S. (2016). Screening for depression among community-dwelling elders: Usefulness of the center for epidemiologic studies depression scale. *Indian Journal of Psychological Medicine*, *38*(5), 483–485.

Kutty, V. R., Dilip, T., Archana, A., Gopinathan, S., & Ramanathan, M. (2018). Shifting pattern of diabetes among the elderly in India: Evidence from the national sample survey organization's data, 2004–2014. *International Journal of Noncommunicable Diseases*, *3*(2), 67.

Malhotra, P., Kumari, S., Kumar, R., & Varma, S. (2004). Prevalence of anemia in adult rural population of north India. *Journal-Association of Physicians of India*, *52*, 18–20.

Malhotra, S., & Shah, R. (2015). Women and mental health in India: An overview. *Indian Journal of Psychiatry*, *57*(Suppl 2), S205.

Mohanty, S. K., Chauhan, R. K., Mazumdar, S., & Srivastava, A. (2014). Out-of-pocket expenditure on health care among elderly and non-elderly households in India. *Social Indicators Research*, *115*(3), 1137–1157.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385–401.

Sahoo, H., Govil, D., James, K., & Prasad, R. D. (2021). Health Issues, Health Care Utilization and Health Care Expenditure among Elderly in India: Thematic Review of Literature. *Aging and Health Research*, 100012.

Samuel, P., Antonisamy, B., Raghupathy, P., Richard, J., & Fall, C. H. (2012). Socio-economic status and cardiovascular risk factors in rural and urban areas of Vellore, Tamilnadu, South India. *International Journal of Epidemiology*, *41*(5), 1315–1327.

Shaikh, S. A. R., & Shah, R. (n.d.). *Study the Effect of Shatavari Ksheerpak in Patients of Pulmonary Tuberculosis*.

Sharma, K. (2013). Burden of non communicable diseases in India: Setting priority for action. *Int J Med Sci Public Health*, *2*(1), 7–11.

Shetty, P. S. (2002). Nutrition transition in India. *Public Health Nutrition*, *5*(1a), 175–182.

Shridhar, K., Dhillon, P. K., Bowen, L., Kinra, S., Bharathi, A. V., Prabhakaran, D., Reddy, K. S., & Ebrahim, S. (2014). Nutritional profile of Indian vegetarian diets–the Indian Migration Study (IMS). *Nutrition Journal*, *13*(1), 1–9.

Wang, J., Wu, X., Lai, W., Long, E., Zhang, X., Li, W., Zhu, Y., Chen, C., Zhong, X., & Liu, Z. (2017). Prevalence of depression and depressive symptoms among outpatients: A systematic review and meta-analysis. *BMJ Open*, *7*(8), e017173.

World Health Organization. (2014). *Vector-borne diseases*. WHO Regional Office for South-East Asia.

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