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# Assessing the Quality of Data from Medical Certification of the Cause of Death (MCCD) in India and its Applicability to Sample Registration System (SRS) Data

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## Overview and Measurement Challenge

Mortality statistics compiled from death certificates are used to measure health quality, set public health goals and policy, and to direct research and services. The death certificate provides important information about the decedent, the circumstances of death, and the cause of death.[1,2] Several factors prevent a precise understanding of epidemiological transitions and impede policy formulation. Paramount among these is the absence of good quality data on mortality.[3] Cause of death data are either unavailable or are unreliable in most developing countries, including India.[4,5] The Medical Certificate of Cause of Death (MCCD) plays an important role in providing mortality patterns of different causes of death, and has been ingrained with the Registration of Births and Deaths Act, 1969 of India.[1] Although the MCCD scheme has been operationally functional in almost all states and union territories across India, its levels of efficiency vary considerably.

The Government of India has implemented the MCCD under the Civil Registration System in a phased manner to provide annual data on medically certified deaths. However, so far, it has been implemented only in certain hospitals (mostly in urban settings) notified by the Chief Registrar of Births and Deaths. Prior research[6-8] has identified significant regional discrepancies in medically certified deaths; however, their analysis was based on either observational study or by using hospital data. A systematic assessment of the MCCD data as provided by the Registrar General of India, however, remains missing. While, the Sample Registration System (SRS) provides major cause of deaths only in major and minor states across India; age, sex and state specific cause of death is available only in the MCCD data. This necessitates the need to assess whether the MCCD data can be used with the SRS data to provide reliable age and sex specific cause of deaths for India and all its states.

We examine this gap by assessing changes in the percentage of medically certified deaths in India as a whole and across states and union territories over time. Next, we examine whether the MCCD proportions can be applied to mortality data from the Sample Registration Survey (SRS), which is the largest demographic survey in India mandated to provide reliable annual estimates of fertility and mortality at the national and state levels.

### KEY RESULTS

- **Less than a quarter of deaths** (22.5%) during 2020 were medically certified in India.
- **Improvements** in the percentage of medically certified deaths in India were statistically significant at 10% level of significance.
- **Increases** in percentage of MCCD between 2010 and 2020 was seen for Andaman & Nicobar Islands, Chhattisgarh, Jharkhand, Mizoram, Punjab, Rajasthan, Sikkim, Tamil Nadu and West Bengal. **Declines** were observed in Kerala and Tripura.
- The applicability of using MCCD proportions on SRS data is a **tradeoff** between selecting sensitivity and false positives.

## Method

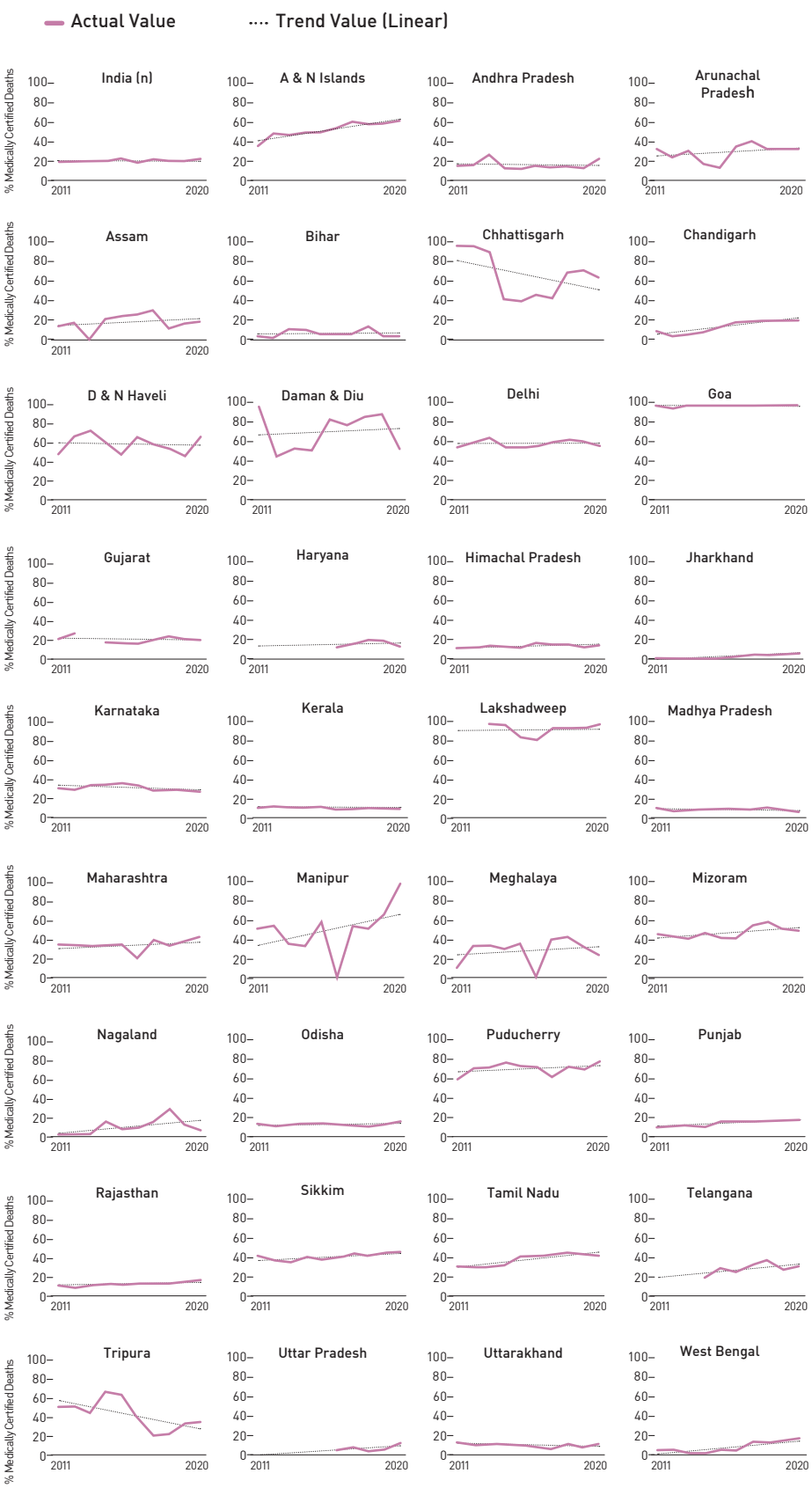
We used data from the Report on Medical Certification of Cause of Death (MCCD) between 2011 to 2020, provided by the Office of Registrar General Census Commissioner, India. The MCCD data is collected in prescribed Form No.4-Institutional Deaths which is filled by the concerned hospital authority. A separate Form No. 4A-Non institutional deaths has been prescribed for non-institutional deaths, which are attended by medical practitioners. Both forms conform to the international format of medical certification of cause of death as evolved by the World Health organization (WHO) comprising two parts—immediate and antecedent causes of death along with the identification and other particulars of the deceased. Part I provides for entering the diseases in a specific sequence of events leading to death, so that the immediate cause is recorded first and the underlying cause is recorded

## Table 1: Availability of MCCD Data in India Across States over Time Between 2010 to 2020

| State/Union territory | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| India (n) | 27 | 32 | 30 | 31 | 33 | 33 | 35 | 35 | 35 | 35 | 34 |
| Andhra Pradesh | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Arunachal Pradesh | ---- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| A & N Islands | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Assam | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bihar | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Chhattisgarh | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Chandigarh | ---- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| D & N Haveli | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Daman & Diu | ---- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | *included in D&N Haveli* |
| Delhi | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Goa | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Gujarat | ✓ | ✓ | ✓ | ---- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Haryana | ✓ | ---- | ---- | ---- | ---- | ---- | ✓ | ✓ | ✓ | ✓ | ✓ |
| Himachal Pradesh | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Jammu & Kashmir | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| Jharkhand | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Karnataka | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Kerala | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Lakshadweep | ---- | ---- | ---- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Madhya Pradesh | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Maharashtra | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Manipur | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Meghalaya | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mizoram | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Nagaland | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Odisha | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Puducherry | ✓ | ✓ | ----- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Punjab | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Rajasthan | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sikkim | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Tamil Nadu | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Tripura | ----- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Telangana | *state not formed* | | | ----- | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Uttarakhand | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Uttar Pradesh | ----- | ----- | ----- | ----- | ----- | ----- | ✓ | ✓ | ✓ | ✓ | ✓ |
| West Bengal | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Note: -----:not included**

## Figure 1: Change in Percentage of Medically Certified Deaths in India and States Between 2010 and 2020




| | Time Trend Analysis Coefficient |
|---|---|
| India (n) | **0.20#** |
| A & N Islands | **2.48*** |
| Andhra Pradesh | **-0.15** |
| Arunachal Pradesh | **1.07** |
| Assam | **0.76** |
| Bihar | **0.01** |
| Chhattisgarh | **2.02*** |
| Chandigarh | **-3.50** |
| D & N Haveli | **-0.40** |
| Daman & Diu | **0.83** |
| Delhi | **0.08** |
| Goa | **0.12** |
| Gujarat | **-0.20** |
| Haryana | **0.35** |
| Himachal Pradesh | **0.26** |
| Jharkhand | **0.75*** |
| Karnataka | **-0.41** |
| Kerala | **-0.16*** |
| Lakshadweep | **0.25** |
| Madhya Pradesh | **-0.15** |
| Maharashtra | **0.66** |
| Manipur | **3.97** |
| Meghalaya | **1.13** |
| Mizoram | **1.20*** |
| Nagaland | **1.47** |
| Odisha | **0.23** |
| Puducherry | **0.69** |
| Punjab | **0.87*** |
| Rajasthan | **0.45*** |
| Sikkim | **0.78*** |
| Tamil Nadu | **1.79*** |
| Tripura | **-3.27*** |
| Telangana | **1.55** |
| Uttarakhand | **-0.33** |
| Uttar Pradesh | **1.17** |
| West Bengal | **1.44*** |

**Note: Level of significance: "#" -10%; "*" -5%**

later. The underlying cause is usually the morbid condition that initiated the chain of events leading to death. There is also provision for recording the approximate intervals between onset of disease and death in the sequence of events. Part II of the form allows recording of information on other significant morbid conditions, but not directly related to the cause of death. Doctors attending the deceased during his/her terminal illness are required to fill the forms.

We use basic descriptive analysis to show number of states and union territories that have provided MCCD data since 2010. We use time regression analysis to assess the significance of changes in the percentage of medically certified deaths to total registered deaths from 2011 to 2020 for India as a whole and across 36 states and union territories. Since SRS is considered the most reliable source of mortality data across India, we used the Wilcoxon Mann-Whitney test to assess whether the percentage of medically certified deaths to total deceased who received any kind of medical attention at the time of death was similar between MCCD and SRS data for 2020. We did this to test the future applicability of medically certified cause of death proportion on the SRS data, in order to provide more reliable cause of mortality statistics for India and its states and union territories.

## Results

Approximately 27 states provided MCCD data during 2010, which increased to 34 states during 2020. The distribution of states providing MCCD data are given in Table 1 (on Page 3). The state of Jammu & Kashmir has not supplied any MCCD data, while North Indian states of Haryana and Uttar Pradesh have only provided data since 2016.

Figure 1 (on Page 4) shows the changes in the percentage of medically certified deaths in India and across its states between 2010 and 2020. India, on average, had only 20% of its deaths medically certified between 2010 and 2020. The percentage of medically certified deaths varied significantly between states over time. While change in the percentage of medically certified deaths over time for India was significant at 10% level of significance, most states observed insignificant changes in MCCD-registered deaths. Significant increases (at 5% level of significance) in percentage

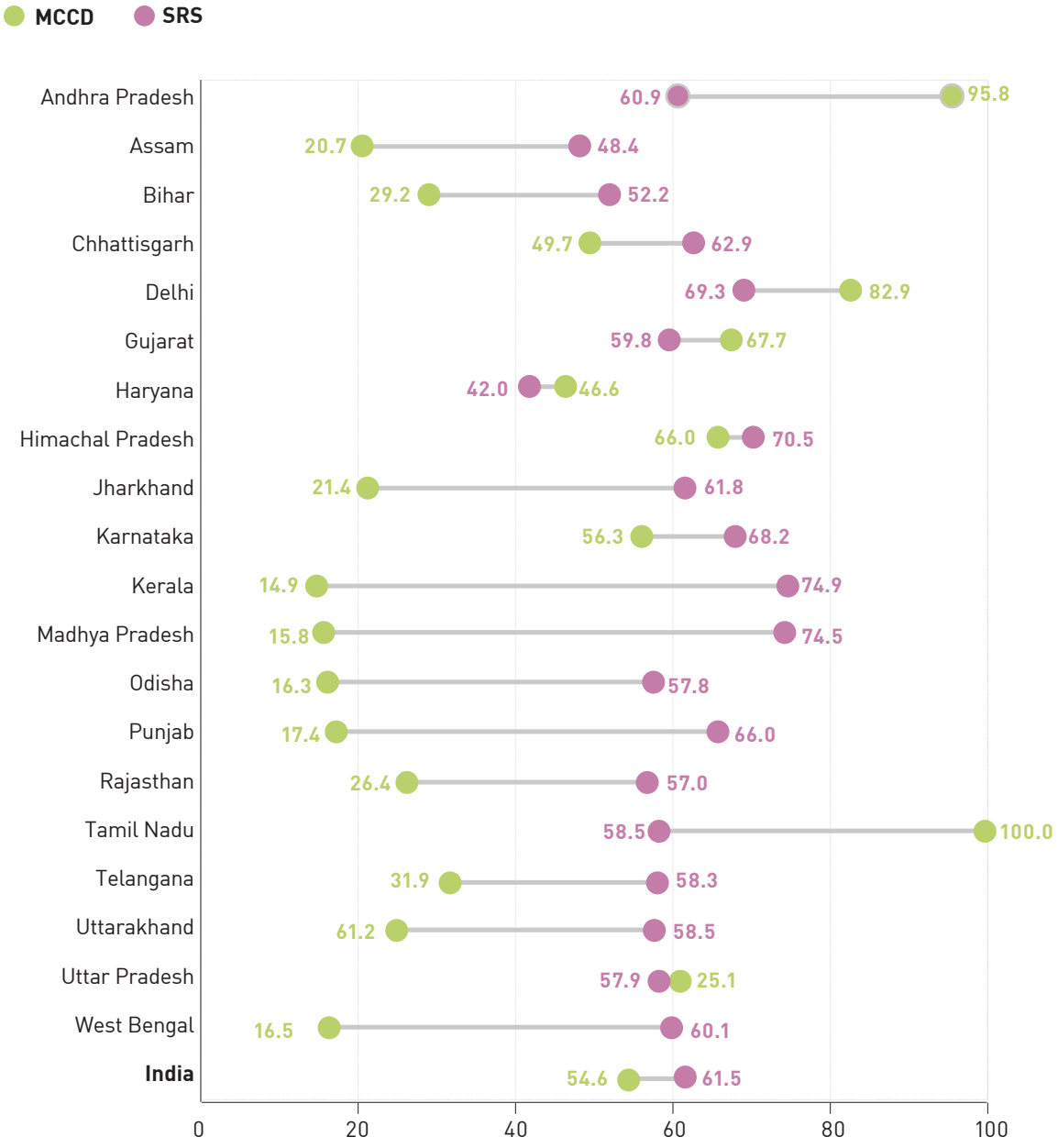
### Table 2: Percentage of MCCD Registered Deaths Among Total

| State/ Union Territory | %MCCD |
|---|---|
| India | 22.5 |
| Bihar | 3.4 |
| Jharkhand | 6.1 |
| Madhya Pradesh | 6.7 |
| Nagaland | 7.6 |
| Kerala | 11.2 |
| Uttarakhand | 11.7 |
| Uttar Pradesh | 12.6 |
| Haryana | 14.0 |
| Himachal Pradesh | 14.5 |
| Odisha | 16.3 |
| Rajasthan | 16.3 |
| West Bengal | 16.5 |
| Punjab | 17.2 |
| Assam | 19.7 |
| Gujarat | 20.6 |
| Chhattisgarh | 21.5 |
| Andhra Pradesh | 22.3 |
| Meghalaya | 23.8 |
| Karnataka | 28.7 |
| Telangana | 30.9 |
| Arunachal Pradesh | 33.4 |
| Tripura | 35.3 |
| Maharashtra | 42.8 |
| Tamil Nadu | 43.0 |
| Sikkim | 46.5 |
| Mizoram | 49.7 |
| Delhi | 56.6 |
| A & N Islands | 63.4 |
| Chandigarh | 66.4 |
| Dadra & Nagar Haveli | 66.5 |
| Puducherry | 79.2 |
| Lakshadweep | 99.7 |
| Goa | 100.0 |
| Manipur | 100.0 |

of medically certified deaths were observed for Andaman and Nicobar Island, Chhattisgarh, Jharkhand, Mizoram, Punjab, Rajasthan, Sikkim, Tamil Nadu and West Bengal, whereas declines were noticed for Kerala and Tripura.

Despite the increase in the number of states providing MCCD data, the percentage of medically certified deaths in 2020 remains relatively low compared to the total number of deaths (Table 2). Only 22.5% of total

## Table 3: Percentage of Medically Certified Deaths to Total Deceased Who Received Any Kind of Medical Attention at the Time of Terminal Illness in MCCD and SRS During 2020




registered deaths during 2020 was medically certified. While Bihar in the north had the lowest MCCD reporting at 3.4%, Goa in the south-western part of the country had 100% registration of medically certified deaths. Despite this north-south divide, differences in medical certification exist within regions. For example, Chandigarh and Delhi in the north have 66.4% and 56.6% of their deaths medically certified; Kerala, on the other hand in south India had only 11.2% medically certified deaths.

To assess the applicability of MCCD data, we used the percentage of medically certified deaths who received medical attention at the time of terminal illness and compared it with percentage of deaths receiving medical attention at terminal illness in the SRS data (Table 3).

While analysing the applicability of MCCD on SRS data, the Wilcoxon Mann-Whitney test was insignificant at the 5% level of significance (Table 4) but was statistically significant at the 10% level of significance. The applicability of using MCCD proportions on SRS data is a **tradeoff** between selecting sensitivity and false positives. This implies that cause-specific death proportions from the MCCD data on the SRS data which fails to provide information on the cause of death, when we widen our confidence interval from 95% to 90%. This is very important from a policy implication point of view. While this approach makes our test less sensitive to detecting differences, it decreases the chance of false positives from 5% to 10% and is therefore worth the trade-off.

## Policy Lessons

In recent years, the Government of India has made substantial efforts to improve the quality of medically certified deaths; however, it remains largely under-represented, with less than a quarter of total deaths being medically certified in India. Significant regional differences exist in the percentage of medically certified deaths in India. Understanding how mortality patterns and their underlying risk factors are changing requires timely empirical data of sufficient scale (representativeness), quantity, and quality to inform national health policy, and gauge responses to epidemic and pandemic disease.

Medical certification of deaths generally provides the majority of cause of death (COD) data in a population and is an essential component of civil registration and vital statistics (CRVS) systems[9]. COD data is essential for measuring how most health conditions are changing, both with respect to magnitude and distribution in a population and forms a key measure of development progress.

Further, monitoring of country's progress towards the Sustainable Development Goals (SDGs) will be impossible without reliable mortality and cause of death data provided by the civil registration and vital statistics (CRVS) systems: 7 goals and 17 of their corresponding indicators require cause-specific mortality data, the optimal source of which are functioning CRVS systems.

### Table 4: Wilcoxon Signed Rank Test to Assess the Applicability of MCCD Data on SRS Data

**Wilcoxon Signed Rank test/Mann-Whitney U test**

| | |
|---|---|
| W value | 47.5 |
| Sample Size | 21 |
| Critical Value (21,5%los) | 58 |
| Critical Value (21,10%los) | 42 |

In the unlikely event of significantly low MCCD data, and the utmost necessity of cause of death data for health planning and policy perspective, we assessed the applicability of MCCD data to SRS data. Although our estimate was not statistically significant at the 5% level, it was significant at 10% level of significance, and therefore necessitates researchers and policymakers to choose between sensitivity and false positive reporting. In cases of death, a false positive report on the cause of death is highly risky from the health and policy planning perspective. Increasing the amount of evidence required by changing the alpha value from 5% to 10%, makes our test less sensitive to detecting differences, but it decreases the chance of false positives from 5% to 10% and is therefore worth the trade-off.

While understanding that there will be a long lag between the implementation of stronger policies to improve further MCCD data representation, it would be effective to apply state-specific MCCD proportions on more reliable SRS data across India. In the meantime, the combination of electronic health information systems with new methods for data quality monitoring can facilitate quality assessments and help target quality improvement9. The accurate completion of the MCCD should be a relatively straightforward procedure for physicians. Training on medical certification of cause of death among health care providers in developed and other developing countries has shown positive effects on improving the quality of MCCDs3 and, consequently, on the quality of country mortality statistics.

## Further Reading


1. The Registration of Birth and Deaths Act, 1969 [Act No. 18 of 1969].

2. Physicians" Manual on Medical Certification of Cause of Death, Vital Statistics Division, Office of the Registrar General, India, Ministry of Home Affairs, New Delhi, 4th Edition.

3. Hart, J.D., Sorchik, R., Bo, K.S. et al. Improving medical certification of cause of death: effective strategies and approaches based on experiences from the Data for Health Initiative. *BMC Med* 18, 74 (2020).

4. Gupta M, Rao C, Lakshmi PV, Prinja S, Kumar R. Estimating mortality using data from civil registration: a cross-sectional study in India. Bull World Health Organ. 2016 Jan 1;94(1):10-21.

5. Pandey A, Roy N, Bhawsar R, Mishra RM. Health information system in India: issues of data availability and quality. Demogr India. 2010;39(1):111–8.

6. Gupta M, Rao C, Lakshmi P, Prinja S, Kumar R. Estimating mortality using data from civil registration: a cross-sectional study in India. Bull World Health Organ. 2016;94(1):10–21.

7. Agarwal SS, G VKA, Kumar L, Bastia BK. Original research paper A Study on Appraisal of Effectiveness of the MCCD Scheme Corresponding Author : Results : Conclusion : Discussion : 32(4):318–20.

8. Patel AB, Rathod H, Rana H, Patel V. Assessment of Medical Certificate of Cause of Death at a New Teaching Hospital in Vadodara. Natl J Community Med. 2011;2(3):349–53.

9. Nyondo T, Msigwa G, Cobos D, Kabadi G, Macha T, Karugendo E, Mugasa J, Semu G, Levira F, Fruchtman CS, Mwanza J, Lyatuu I, Bratschi M, Kumalija CJ, Setel P, de Savigny D. Improving quality of medical certification of causes of death in health facilities in Tanzania 2014-2019. BMC Health Serv Res. 2021 Sep 13;21.

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