**Survey Methodology and Estimation Procedure**
**(CMS: Education)**

## 1. Introduction

The National Sample Survey (NSS) undertook the Comprehensive Modular Survey - Education (CMS-E) as a part of its 80th round during the period April, 2025 to June, 2025.

**1.1 Geographical coverage:** The survey covered the whole of the Indian Union except the villages in the Andaman and Nicobar Islands, which remain extremely difficult to access throughout the year.

**1.2 Schedule of enquiry:** The following Schedules of enquiry were canvassed for the survey on CMS-E.

| | |
|---|---|
| Schedule 0.0 | List of Households |
| Schedule CMS-E | Comprehensive Modular Survey-Education |

**1.3 Participation of States:** There was no State participation in the CMS-E.

## 2. Sample Design, Sampling Frame, Stratification Criteria

### 2.1 Formation of sub-units (SUs):

**2.1.1.1 Rural areas**: The projected population of a village with a Census 2011 population of 1000 or more was determined by applying suitable growth rates to the census 2011 population. Thereafter, it was notionally divided into a number of sub-units (SU) of more or less equal population. The number of SUs to be formed in a village was determined *a priori*. The following criteria were adopted for deciding the number of SUs to be formed:

| projected population of the village | no. of SUs to be formed |
|---|---|
| less than 1200 | 1 |
| 1200 to 2399 | 2 |
| 2400 to 3599 | 3 |
| 3600 to 4799 | 4 |
| .....and so on | .... |

**2.1.1.2 Special case**:

For rural areas of (i) Himachal Pradesh, (ii) Sikkim, (iii) Andaman & Nicobar Islands, (iv) Uttarakhand (except the districts Dehradun, Nainital, Hardwar and Udham Singh

Nagar), (v) Punch, Rajouri, Udhampur, Reasi, Doda, Kishtwar, Ramban of Jammu and Kashmir (vi) Leh and Kargil districts of Ladakh region and (vii) Idukki district of Kerala, numbers of SUs to be formed in a village were determined in such a way that each SU contains 600 or less projected population. Further, SUs were not formed in the villages of the above-mentioned districts/States with a population of less than 500 as per Census 2011. In the remaining villages, the criteria for deciding the number of SUs to be formed were as below:

| projected population of the village | no. of SUs to be formed |
|---|---|
| less than 600 | 1 |
| 600 to 1199 | 2 |
| 1200 to 1799 | 3 |
| 1800 to 2399 | 4 |
| 2400 to 2999 | 5 |
| .....and so on | .... |

For rural parts of Kerala, a similar procedure as mentioned in para 2.1.1.1 above was adopted with the modification that the SUs were formed within Panchayat Wards instead of villages.

**2.1.1.3 Urban areas**: SUs were formed in the urban sector also. The procedure was similar to that adopted in rural areas except that the criteria for determining the number of SUs to be formed were based on the number of households in the UFS frame, as the UFS frame did not have information on population. Each UFS block with a number of households more than or equal to 250 was divided into a number of SUs. The following criteria were adopted for deciding the number of SUs to be formed in the UFS blocks of the frame, and the number of SUs to be formed was decided before the selection of the samples:

| number of households in the UFS block | no. of SUs to be formed |
|---|---|
| less than 250 | 1 |
| 250 to 499 | 2 |
| 500 to 749 | 3 |
| 750 to 999 | 4 |
| 1000 to 1249 | 5 |
| .....and so on | .... |

**2.2 Sample design**: A stratified multi-stage design was adopted in the 80$^{th}$ round survey. *The first stage units (FSU) were villages/UFS blocks/sub-units (SUs) as per the situation.* The ultimate stage units (USU) were households in both sectors.

**2.3 Sampling Frame for First Stage Units (FSUs)**:

2.3.1 There was no SU formation in uninhabited villages and villages (Panchayat wards for Kerala) with a population of less than 1000 as per Census 2011 (less than 500 as per Census 2011 for the areas mentioned in para 2.1.1.2), and the entire village was considered as one FSU. All such villages (Panchayat wards for Kerala) were regarded as the First Stage Units (FSUs).

2.3.2 In the remaining villages, notional sub-units (SUs) were formed using the procedure as described above in para 2.1. Such SUs were considered as the First Stage Units (FSUs).

2.3.3 For the UFS blocks with less than 250 households, the entire UFS block was considered as one FSU. In the remaining UFS blocks, the SUs were considered as the First Stage Units (FSUs).

2.3.4 The list of FSUs described above constitutes the sampling frame for respective sectors, i.e., rural and urban areas.

**2.4 Stratification of FSUs**:

**2.4.1 Rural areas:**

A Special Rural stratum, at all-India level, was formed comprising all the uninhabited villages as per the Census 2011 belonging to all States/UTs.

For the remaining villages which are inhabited as per the Census 2011, districts were the basic geographical unit for stratum formation. Within each district, two strata were formed:

(a) The villages (i) within a distance of 5 Kms from the district headquarters or (ii) within a distance of 5 Kms from a city/town with more than 5 lakh population, form a stratum (stratum 1).

(b) The rest of the villages constitute another stratum (stratum 2) of the particular district.

**2.4.2 Urban Sector:**

Two or more strata were formed in the urban areas of each district:

(i) Each million-plus city as per the Census 2011 constituted a separate stratum.

(ii) The rest of the urban areas of the district formed another stratum.

**2.5 Sub-stratification of FSUs**:

**2.5.1 Rural sector:** Three groups of villages were formed within each stratum, except the special rural stratum, at the all-India level, as mentioned in para 2.1.1.2.

Group 1: all villages (Panchayat wards for Kerala) with Census 2011 population less than 250

Group 2: all villages (Panchayat wards for Kerala) with Census 2011 population more than or equal to 250 but less than 500

Group 3: remaining villages

The sample size for a rural stratum was allocated among 3 groups in proportion to the population. Let $r_1$, $r_2$ and $r_3$ be the allocations to Group 1, Group 2 and Group 3, respectively. The villages within each group were first arranged in ascending order of population. For all the three groups within each stratum, '$r_1/8' > 1$, '$r_2/8' > 1$ and '$r_3/8' > 1$ imply formation of 2 or more sub-strata in each group. Sub-strata were demarcated in Group 1, Group 2 and Group 3, respectively, in such a way that each sub-stratum comprised a group of villages (all SUs of a village considered together) of the arranged frame and had more or less equal population.

If the number of FSUs in a particular Group was very small or a sufficient number of samples were not allocated, no sub-stratum was formed in that Group.

**2.5.2 Urban sector**: Let 'u' be the sample size allocated for an urban stratum. For all strata, if 'u/8' >1, implying formation of 2 or more sub-strata, all the UFS blocks within the stratum were first arranged in ascending order of total number of households in the UFS blocks as per the urban frame. Then sub-strata were demarcated in such a way that each sub-stratum comprised a group of UFS blocks (all SUs of a block considered together) having a more or less equal number of households. If the number of blocks in a particular stratum was very small, no sub-stratum was formed in that stratum.

**2.3.6 Total sample size (FSUs)**: 4409 FSUs were allotted at the all-India level for the CMS-E survey. State/UT-wise allocation of sample FSUs is given in Table 1.

### 2.3.6.1 Allocation of total sample to States and UTs

The total number of sample FSUs allocated to the States and UTs in proportion to the projected population figures as on 1st October 2024 as available from the report, 'Population Projections for India and States 2011-2036' of the Technical Group on Population Projections, Ministry of Health and Family Welfare, Government of India, subject to a minimum sample allocation to each State/UT. A minimum of 4 FSUs (2 each for the rural and urban sectors) was allocated to each State/ UT.

### 2.3.6.2 Allocation of State / UT level sample to rural and urban sectors

The State/ UT level samples were allocated between two sectors in proportion to the projected population figures as on 1st October 2024, as available from the report mentioned earlier.

Within each sector of a State/ UT, the respective sample size was allocated to the different strata in proportion to the population as per the Census 2011. The stratum level allocation was adjusted to multiples of 2 for the quarter, with a minimum allocation of 2 FSUs. For the special stratum (stratum code '999') formed in rural areas, 6 FSUs were allocated.

**2.3.7 Selection of FSUs within a stratum/sub-stratum**:

From all the sub-strata in both rural and urban sectors within each stratum, the required number of FSUs was selected by the Simple Random Sampling without Replacement (SRSWOR) scheme.

**2.3.8 Formation of Sub-divisions in the selected SU**: It has been experienced in the previous NSS surveys that there happen to be some extreme cases where the approximate ascertained present population in the selected SU was very high and listing becomes very difficult. To deal with such extreme situations, a SU was sub-divided into a number of smaller units (sub-divisions) each having more or less equal population content and one of them was randomly selected. Listing and selection of households were done in the selected sub-division unit only. The procedure for the

formation of sub-divisions was the same as that of the formation of SUs within a village/block.

The criteria for determining the number of sub-divisions ($D_1$) to be formed in the selected rural/urban SUs was as follows:

| approx. population of the SU | no. of sub-divisions ($D_1$) to be formed |
|---|---|
| less than 1500 | 1 |
| 1500 to 2399 | 2 |
| 2400 to 3599 | 3 |
| 3600 to 4799 | 4 |
| .....and so on | .... |

**2.3.9 Special case**:

**2.3.9.1** For rural areas of (i) Himachal Pradesh, (ii) Sikkim, (iii) Andaman & Nicobar Islands, (iv) Uttarakhand (except four districts Dehradun, Nainital, Hardwar and Udham Singh Nagar), (v) Punch, Rajouri, Udhampur, Reasi, Doda, Kishtwar, Ramban of Jammu (vi) Leh and Kargil districts of Ladakh region and (vii) Idukki district of Kerala, the criteria for determining the number of sub-divisions ($D_1$) to be formed in rural SUs was as follows:

| approx. population of the SU | no. of sub-divisions to be formed |
|---|---|
| less than 750 | 1 |
| 750 to 1199 | 2 |
| 1200 to 1799 | 3 |
| 1800 to 2399 | 4 |
| 2400 to 2999 | 5 |
| .....and so on | .... |

**2.3.10 Formation of second-stage strata (SSS) of households and allocation among SSS:** 4 SSS with the following criteria were formed:

- SSS1: any member of the household aged 3 years and above currently enrolled in school education and Usual Monthly Per Capita Expenditure (UMPCE) of the household was greater than a cutoff value 'A'.

- SSS2: any member of the household aged 3 years and above currently enrolled in school education and UMPCE of the household was less than or equal to a cutoff value 'A'.
- SSS3: no member of the household aged 3 years and above currently enrolled in school education and UMPCE of the household was greater than a cutoff value 'A'.
- SSS4: no member of the household aged 3 years and above currently enrolled in school education and UMPCE of the household was less than or equal to a cutoff value 'A'.

A total of 12 households from a selected FSU were surveyed: 4 from SSS1, 4 from SSS2, 2 from SSS3, and 2 from SSS4.

**2.3.11 Listing of households:** All the households of the sample FSU were included in the list of households. Temporarily locked households were also included after ascertaining the temporariness of the absence of the households through local enquiry.

**2.3.12 Selection of households:** The sample households from each SSS were selected by Simple Random Sampling Without Replacement (SRSWOR).

## 3. Estimation Procedure

### 3.1. Notations:

| | |
|---|---|
| s | subscript for $s^{th}$ stratum |
| t | subscript for $t^{th}$ sub-stratum |
| i | subscript for $i^{th}$ FSU [SU/ village/ panchayat ward/ UFS block] |
| j | subscript for $j^{th}$ second-stage stratum in an FSU |
| k | subscript for $k^{th}$ sample household within an FSU |
| $D_1$ | total number of sub-divisions formed in the sample FSU. $D_1$=1, if no sub-division is formed in the SU |
| N | total number of FSUs in any rural/urban sub-stratum |
| n | number of sample FSUs surveyed including 'uninhabited' and 'zero cases' but excluding casualty for a particular sub-stratum |

| | |
|---|---|
| H | total number of households listed in a second-stage stratum of an FSU |
| h | number of households surveyed in a second-stage stratum of an FSU |
| x, y | observed value of characteristics *x*, *y* under estimation |
| $\hat{X}$ , $\hat{Y}$ | estimate of population total X, Y for the characteristics x, y |

Let $y_{stijk}$ be the observed value of the characteristic y for the k-th household of the j-th second-stage stratum of the i-th FSU for the t-th sub-stratum of s-th stratum.
For ease of understanding, a few symbols have been suppressed in the following paragraphs where they are obvious.

### 3.2. Formulae for Estimation of Aggregates for a stratum × sub-stratum:

#### 3.2.1. Schedule 0.0 (Rural/Urban):

**3.2.1.1.** For estimating the number of households in a stratum × sub-stratum possessing a characteristic:

$$\hat{Y} = \frac{N}{n} \sum_{i=1}^{n} D_1 \times y_i$$

where, $y_i$ is the total number of households possessing the characteristic $y$ in i-th FSU.

#### 3.2.2. Schedule CMS-E:

**3.2.2.1.** For j-th second-stage stratum of a stratum × sub-stratum:

$$\hat{Y}_j = \frac{N}{n_j} \sum_{i=1}^{n_j} \left[ D_1 * \frac{H_{ij}}{h_{ij}} * \sum_{k=1}^{h_{ij}} y_{ijk} \right]$$

where $n_j$ is the number of sample FSUs with non-void j-th second-stage stratum.

**3.2.2.2.** Aggregate $\hat{Y}$ is obtained by combining all the second-stage strata:

$$\hat{Y} = \sum_{j} \hat{Y}_j$$

Note: for Schedule CMS: E, j = 1, 2, 3, 4.

### 3.3. Overall Estimate of Aggregates for a stratum:

**3.3.1.** Overall estimate for a stratum ( $\hat{Y}_s$ ) will be obtained as

$$\hat{Y}_s = \sum_t \hat{Y}_{st}$$

### 3.4. Overall Estimate of Aggregates at State/ UT/ all-India level:

The overall estimate $\hat{Y}$ at the State/UT/ all-India level is obtained by summing the stratum estimates $\hat{Y}_s$ over all strata belonging to the State/UT/ all-India.

### 3.5. Estimates of Ratios:

Let $\hat{Y}$ and $\hat{X}$ be the overall estimates of the aggregates *Y* and *X* for two characteristics *y* and *x*, respectively, at the State/ UT/ all-India level.

Then, the combined ratio estimates $(\hat{R})$ of the ratio $\left(R = \frac{Y}{X}\right)$ will be obtained as $\hat{R} = \frac{\hat{Y}}{\hat{X}}$.

### 3.6. Estimation of Errors:

#### 3.6.1. Formula for estimated variance (for Rural / Urban):

**3.6.1.1.** Here, the required number of FSUs was selected by SRSWOR within the given stratum x sub-stratum. Subsequently, USUs are selected by SRSWOR within each of the selected FSUs. If the ith FSU has been selected, $h_{ij}$ households are selected from this particular FSU × SSS ($j^{th}$) by SRSWOR method.

**(a) Formula for aggregate $\hat{Y}$ (for Rural/Urban):**

$$\hat{Y}_{ij} = H_{ij} * \bar{y}_{ij} * D_{1si} \quad \text{and} \quad \bar{y}_{ij} = \frac{\sum_1^{h_{ij}} y_{ijk}}{h_{ij}}$$

$$\hat{Var}(\hat{Y}) = \sum_S \hat{Var}(\hat{Y}_s) = \sum_s \sum_t \sum_j \hat{Var}(\hat{Y}_{stj})$$

$$\hat{Var}(\hat{Y}_{stj}) = N_{st}^2 \left(\frac{1}{n_{stj}} - \frac{1}{N_{st}}\right)\left(\frac{1}{n_{stj}-1}\right)\sum_1^{n_{stj}}(H_{stij} * D_{1sti} * \bar{y}_{stij} - \frac{1}{n_{stj}}\sum_1^{n_{stj}} H_{stij} * D_{1sti} * \bar{y}_{stij})^2 + \frac{N_{st}}{n_{stj}}\sum_1^{n_{stj}} H_{stij}^2 * D_{1sti}^2 * (\frac{1}{h_{stij}} - \frac{1}{H_{stij} * D_{1sti}})s_{wij}^2$$

where $s_{wij}^2 = \frac{1}{(h_{stij}-1)}\sum_{k=1}^{h_{stij}}(y_{stijk} - \bar{y}_{stij})^2$

**(b) Formula for ratio $\hat{R}$ (for Rural/Urban):**

Note that $MSE\ (\widehat{R})$ is unbiasedly estimated by $V(\widehat{Y} - \ R\widehat{X}) * \frac{1}{\hat{X}^2}$

$V(\widehat{Y} - \ R\widehat{X}) = v(\hat{u})$ where $u_{ijk} = (y_{ijk} - Rx_{ijk})$,

$U_i = (Y_i - RX_i)$ and $U = (Y - RX) = 0$ at the domain level (State).

$\hat{X}^2 M\hat{S}E(\hat{R}) = \hat{V}\ (\hat{U})$ at $R = \hat{R}$

$\hat{Y}_{stij} = \frac{1}{N_{st}} * \sum_k y_{stijk} * n_{stj} *$ multiplier

$\hat{X}_{stij} = \frac{1}{N_{st}} * \sum_k x_{stijk} * n_{stj} *$ multiplier

$M\hat{S}E(\hat{R}) = \frac{1}{\hat{X}^2} \sum_s \sum_t M\hat{S}E_{st}(\hat{R})$

Finally;

$$M\hat{S}E_{st}(\hat{R}) = \sum_j N_{st}^2 \left(\frac{1}{n_{stj}} - \frac{1}{N_{st}}\right) \frac{1}{(n_{stj} - 1)} \sum_1^{n_{stj}} (H_{ij} D_{1sti} \bar{u}_{ij} - \frac{1}{n_{stj}} \sum_i^{n_{stj}} H_{ij}\, D_{1si} \bar{u}_{ij})^2$$

$$+ \sum_j \frac{N_{st}}{n_{stj}} \sum_1^{n_{stj}} H_{ij}^2 * D_{1si}^2 \left(\frac{1}{h_{ij}} - \frac{1}{H_{ij} * D_{1sti}}\right) s_{uij}^2$$

where $s_{uij}^2 = \frac{1}{(h_{ij}-1)} \sum_{k=1}^{h_{ij}} (u_{ijk} - \bar{u}_{ij})^2$

$\bar{u}_{ij} = \bar{y}_{ij} - \hat{R}\bar{x}_{ij}$

The formulae for multipliers are as given in Section 4.

### 3.6.2. Estimates of Relative Standard Error (RSE):

$$R\hat{S}E\ (\hat{Y}) = \frac{\sqrt{V\hat{a}r\ (\hat{Y})}}{\hat{Y}} \times 100$$

$$R\hat{S}E\ (\hat{R}) = \frac{\sqrt{M\hat{S}E\ (\hat{R})}}{\hat{R}} \times 100$$

## 4. Multipliers:

**4.1.** The formulae for multipliers at stratum/sub-stratum/second-stage stratum level for different schedules are given below.

| Schedule | Sector | Formula for multipliers |
|---|---|---|
| 0.0 | Rural / Urban | $\frac{N_{st}}{n_{st}}$ |
| CMS-E | Rural / Urban | $\frac{N_{st}}{n_{stj}} * D_1 * \frac{H_{stij}}{h_{stij}}$ |
| | j=1, 2, 3, 4 | |

**Note:**

(i) For estimating any characteristic for any domain, not specifically considered in sample design, indicator variable was used.

(ii) Multipliers were computed on the basis of information available in the listing Schedule, irrespective of any misclassification observed between the listing Schedule (Schedule 0.0) and the detailed enquiry Schedule (Schedule CMS: E).

**4.2.** The multipliers were computed using the sample allocated for the period April–June 2025 only.