

# NUTRITION MONITORING AND SURVEILLANCE

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Adequate nutrition is a major prerequisite for the good health of a population and it is the end result of the operation of a complex set of factors cutting across a number of economic sectors. For the purposes of formulating a realistic national nutritional policy and planning a comprehensive food and nutrition related action programme, a well-organized national nutrition monitoring and surveillance system is necessary.

The terms 'monitoring' and 'surveillance' are often used as synonyms in nutrition assessment. However, it is important to understand the difference between these two terms.

'Monitoring' refers to the collection, analysis and feedback of quantitatively precise measures from a relatively large representative sample of a population – at the national and state levels – essentially for the purposes of tracking time trends and understanding population sub-group differences in diet, nutritional status and nutrition related health and disease risks.

'Surveillance', on the contrary, is concerned with data on the current status/ activities at local levels for initiating action in response to events occurring during specific programme implementation in the population. The measures collected for surveillance purposes are often less precise compared to measures collected in monitoring systems. In surveillance, the early detection of the occurrence of adverse events and prompt intervention gets precedence over scientific completeness of measurements.

The timely feedback of information to influence nutritional policy is the key feature of successful monitoring. The timely feedback to plan, target and carryout needed programmatic activities, and corrections in them, to achieve set objectives/ goals is the key feature of surveillance.

## **Nutrition monitoring system**

The prerequisite for creating a well-planned nutrition monitoring system is the recognition that the food and nutrition systems form a coherent entity. Information from all sectors of these two systems should be brought together through nutrition monitoring and presented to the decision makers (at national and state levels) concerned with food, nutrition and nutrition related health status. The monitoring system should also help in identifying current information gaps and new information that needs to be consistent with the demographic and epidemiological changes that may take place in the population.

A well-planned and integrated national nutrition monitoring system should cover the following content areas:

- Food and nutrient consumption at household and individual levels
- Nutritional status by anthropometry and clinical nutritional deficiency conditions
- Nutrition – related risks of selected chronic diseases
- Food security, particularly at the household level
- The above information focused on selected high risk sub-population groups like Below Poverty Line (BPL) population, population in chronically drought prone area and tribal populations.
- Identification of vulnerable sub-groups of the population at higher risk of nutrition-related health problems.
- Food supply – agricultural and horticultural.
- Food safety

Information on all the above should be available at national and state levels to guide policy development for food production and

**Text Box 1 Major Sources of Data on Nutrition Monitoring**

- Periodic surveys of the National Nutrition Monitoring Bureau (NNMB) at the National Institute of Nutrition under ICMR, Hyderabad
- National Institute of Nutrition under ICMR, Hyderabad.
- Quinquennial Consumer Expenditure Surveys of the National sample survey Organization (NSSO) of the Government of India
- National Family Health Survey I & II (1991 & 1998, respectively) of the Ministry of Health and Family Welfare, Government of India
- District Level household survey (DLHS) under Reproductive and Child Health Phase 1 Round 2 (2002)

distribution as well as for setting and assessing nutrition related health goals.

### **National Nutrition Monitoring Bureau (NNMB)**

A major data source on the diet and nutritional status of the Indian population is the surveys carried out by the National Nutrition monitoring Bureau (NNMB) established by Indian Council of Medical Research (ICMR) in 1973 in the National Institute of Nutrition (NIN), Hyderabad.

Until about 1971, 'Nutrition Divisions' of state governments used to collect data on nutrient intake and nutritional status in India. The data collected were generally of poor quality due to the lack of standardized procedures for sampling and data collection. Recognizing the need for reliable data on nutrient intake and nutritional status, the ICMR decided in 1972 to establish the NNMB at the the NIN, Hyderabad. In the beginning, NNMB units were established in nine states- Andhra Pradesh, Tamil Nadu, Uttar Pradesh and West Bengal, Kerala, Gujarat, Maharashtra and Karnataka. In 1976, a unit was established in Orissa. To date these are the only ten states covered by the NNMB on a continuous basis.

The objectives of NNMB are:

- To collect data on the dietary intake and nutritional status of the population on a continuous basis

- To monitor the ongoing national nutrition programmes and to recommend mid-course corrections to improve their effectiveness

In pursuance of the first objective, the NNMB conducted surveys and has published 21 scientific reports between 1975 and 2003. From 1974 to 1981 annual surveys<sup>1</sup> on a probability sample; a total of about 500 households each year (rural and urban) were carried out in each state. The state was divided into four developmental areas based on variations in agricultural activities. From each of the four developmental areas, one district was selected randomly. Prior to 1979<sup>1</sup>, a cumbersome sampling scheme was used to decide the number of households from each district, which on occasions made the samples too small in some districts and was given up in 1979<sup>1</sup> in favour of an equal number of households in each district. The villages in each district were classified into three groups based on their population (< 1000, 1000 to 2999 and 3000 or more) and number of villages to be selected by a linear systematic random sampling from each of the three groups of villages was arrived at in proportion to the total population. From the selected villages, in the three population categories, a fixed sample of 5, 10 and 20 households respectively were selected. This final selection of households was left to the survey team based on local information gathered by them regarding the number of harijans, artisans, landless labourers, small or medium land owners and the well to do. In the report published for the survey in 1979<sup>1</sup>, the rural sample of households covered varied considerably from a minimum of 141 in West Bengal to a maximum of 505 in Karnataka. The urban households covered varied from a minimum of 50 in Tamil Nadu to 200 in Gujarat and Andhra Pradesh. No details are given in the report as to how the urban sample of households were selected. On the whole, the sampling procedure was not satisfactory and the sample size was quite small in these surveys.

In 1983<sup>2</sup>, NNMB decided to link its sampling plan to that of the National Sample Survey Organisation (NSSO) of the Government of

India. The reason was that the NSSO sampling plan was more representative. In 1983, the survey with the NSSO linked sampling plan was carried out in only four states due to resource limitations. In subsequent years a sample of about 750 households in rural areas and 250 households in the urban areas of each of the ten states have been surveyed. The sample of households is a sub-sample of the latest round of annual surveys of the NSSO. In 80% of the rural sample of households, data on dietary consumption have been collected using one day weighing method on the day of the survey. In the remaining 20% of households individual dietary intakes were assessed using a single 24-hour recall for estimating the intra-familial distribution of food. In the urban sample of 250 households, a 3-day weighing method was adopted for assessing the dietary intake. Anthropometric data – height, weight, mid upper arm circumference and fat fold at triceps - and data on clinical signs of nutritional deficiencies were collected on all individuals in the selected households.

In 1985-87, a survey was conducted exclusively in the Integrated Tribal Development Project (ITDP)<sup>3</sup> areas in the states of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Orissa and West Bengal. This survey had the same objectives as all the previous surveys. This survey was repeated in 1998-99<sup>4</sup> among the tribal populations living in the same ITDP areas. In the repeat survey a total of 120 villages were selected, 90 being common between 1985-87 and 1998-99 surveys and 30 being newly selected villages. From each selected village, 40 households were selected with the probability proportional to the size of different tribes. Household dietary intake, anthropometry and clinical signs of nutritional deficiency signs were assessed from all the households in the sample. In 25% of the households, individual dietary intakes by a single 24-hour recall was done.

In 1988-90<sup>5</sup> and in 1996-97<sup>6</sup>, two repeat surveys were carried out of the rural areas surveyed in 1975-79 to generate longitudinal data on dietary intake, anthropometry and clinical nutritional deficiency conditions in the rural population. In the first repeat survey in 1988-90, about a 100

to 120 villages were surveyed in each state. Of these, 75% were those covered during 1975-79 survey and the remaining were newly selected villages. In the second repeat survey, in 1996-97, a sample of 120 villages was surveyed, 90 villages being common to the previous two surveys and 30 being newly selected villages. Approximately 90 villages in each state were covered in all three surveys. In 2000, using data from the surveys above, a separate report was produced on the diet and nutritional status of adolescents, (10 to 17 years of age)<sup>7</sup> and the elderly (beyond 60 years of age).

In 2001, the NNMB took a decision to carry out diet and nutritional status surveys quinquennially instead of annually. Intervening years between the quinquennial surveys were to be utilized for carrying out surveys of special interest. Accordingly, in 2001-2003 a survey of the prevalence of micronutrient deficiencies – Bitot Spots in children 1-4 years, Iodine Deficiency Disorders in children 6-11 years and haemoglobin level in pre-school children, adolescent girls and pregnant and lactating women – was carried out<sup>8</sup>. Iodine content of salt samples from a sub-sample of households was studied. These surveys were carried out in the same 80 villages covered for rural diet and nutritional status survey in 2000-2001 in the states covered by NNMB. The villages selected were a sub-sample of the villages covered by the NSSO during its 54<sup>th</sup> round of the Consumer Expenditure Survey in 1998.

Currently, the first quinquennial survey of diet, nutritional intake and anthropometry in the rural areas of the ten states is being carried out. For the first time, this survey is also estimating the prevalence of obesity (using BMI, waist circumference and waist-hip ratio) and hypertension among adult men and women. Haemoglobin levels among adult males and non-pregnant, non-lactating women are also being estimated.

District level surveys to assess the food and nutrient intakes have also been carried out in the states of Punjab, Haryana, Himachal Pradesh, Assam, Orissa and West Bengal between 1995 and 2001. However, the reports

on these surveys are not readily available for review.

### **National Sample Survey Organisation (NSSO)**

The NSSO, a permanent survey organization, set up in the Department of Statistics of the Government of India in 1950, to assist in socio-economic planning and policy making, by collecting data on various facets of the Indian economy through nationwide large-scale sample surveys. The NSSO has been carrying out Consumer Expenditure Surveys quinquennially since 1972-73<sup>10</sup>. As a part of these quinquennial surveys data on dietary intake at the national and state level, and monthly per capita expenditure on food are collected. The sixth of such surveys was carried out in July 1999-June 2000. In this survey, a large probability sample of 71, 385 and 48, 924 households in the rural and urban areas of the country were surveyed. The number of persons surveyed were 3,74,856 in rural areas and 2,25,160 in urban areas. The sampling design was a two-stage stratified one and at the household selection stage affluent and others were sampled separately.

This survey provides calorie, protein, and total fat intake per capita and per consumption unit, using the two reference periods of 7 and 30 days immediately preceding the day of the survey. The survey is carried out in sub rounds covering the four seasons. The results presented in the report are based on the 30-day reference period. It appears from the report that the food intake over the 30-day reference period was collected at a single interview both at the household and at individual level.

The NSSO data on nutritional intake gives data by rural and urban areas of states and India on

- Average quantity of consumption of different cereals per 30 days.
- Average value of these in rupees.
- Food security at the household level.
- Per capita and per consumption unit intake of calorie, protein and fat per day.
- Percentage of total intake of protein and

calorie from different groups of food item.

- Distribution of households and individuals by calorie intake level.
- Cross-tabulations of the above by monthly consumption expenditure classes.

The NSSO, after conducting exploratory morbidity surveys in the 7<sup>th</sup> (1953-1954) and the 11<sup>th</sup> to 13<sup>th</sup> rounds (1956-59), carried out the first full-scale survey on morbidity in the 28<sup>th</sup> round (1973-74). After that, no full-scale morbidity survey has been carried out. However, some morbidity data was collected as a part of the decennial surveys of social consumption. The results of the first of such survey in the 35<sup>th</sup> round (1980-1981) have not been published for unknown reasons. The second and third decennial surveys on social consumption <sup>(11)</sup> (1986-1987 and 1995-1997) present results on the prevalence of illness using a reference period of 15 days prior to the day of interview. The data were collected using a set of four questions put to individual respondents (mothers in case of children) from each selected household. Illnesses were classified as acute (less than 30 days) and chronic (30 days or more) on the basis of the duration of illness. Data on medical treatment and hospitalization was also obtained. These data, are not of much use in context of the assessment of nutrition-related risks of diseases.

### **National Family Health Surveys I and II<sup>12</sup>**

The Ministry of Health and Family Welfare, Government of India, initiated the first National Family Health Survey (NFHS – I) in 1991 (Text Box 2). The main objective of the survey was to provide state and national level estimates of fertility, infant and child mortality, contraception prevalence, maternal and child health care and the utilization of services provided by the government health system for mothers and children. As part of this survey, data on infant feeding and child nutrition were also collected. Anthropometric data were collected on children under 4 years of age.

The sample design, uniform in all states, was a two-stage systematic stratified sample of

#### Text Box 2 NFHS- I and II

- NFHS-1 (1991) provides data on
  - Infant feeding, child nutrition and anthropometry on children below 4 years.
- NFHS-II (1998-99) In addition to above data, provides data on
  - Food consumption, anthropometry and anemia in women in reproductive age group.
  - Anemia in children aged 6 to 35 months is also presented.

households in rural areas and a three-stage sample in urban areas. The sample size was specified in terms of a target number of completed interviews of eligible women. The number of household targeted interviews varied from a 1000 in the six small northeastern states to 3000 in states with less than 25 million population and to 4000 in larger states. In Bihar, Uttar Pradesh, Rajasthan and Madhya Pradesh – the targeted number of completed interviews were higher - the highest being 8000 in Uttar Pradesh. The targeted number of households for interviews was allocated taking into account population proportion in rural and urban areas.

A second National Family Health Survey (NFHS –II) was carried in 1998-99 with the same objective. However, in addition to data on infant feeding and anthropometry and prevalence of anaemia in children below 4 years, this survey collected data on food consumption. Data on anthropometry and anaemia in women in the reproductive age group was also collected.

### District Level Household Survey (RCH – 2)<sup>13</sup>

The International Institute for Population Sciences, Mumbai, at the request of the Government of India, carried out a district level household survey (DLHS – RCH) covering 300 districts was carried out 2002-03 (Text Box 3). The main focus of the DLHS was to create a database on reproductive and child health at district level. In the subjects covered in this survey was a component on the Nutritional Status (weight/age) of children below 72 months. Haemoglobin levels were estimated in preschool children, adolescent girls (10-14 years) and pregnant women of 15 to 44 years of age. Consumption of iodised salt (at

concentration of 7 ppm and 15 ppm) at household levels was also assessed.

A systematic, three stage-sampling plan was used selecting approximately 50% of districts in each state in the first stage. In the second stage, villages and urban blocks were chosen as primary sampling units (PSU). The villages in each selected district were stratified by population and female literacy and the required sample of PSU's by a systematic sample with probability proportional to size of population. The urban PSU's were selected by the NSSO, from a frame they have used for their previous surveys. All 40 PSU's (urban and rural) were selected and 28 households per PSU were selected for the survey.

### Data on Nutritional Surveillance in India

These data are too scattered in programme-based reports at local and state levels, and are not readily available for critical review. Hence, no attempt is made here to review these.

### Strengths and shortcomings of the current set of activities in nutrition monitoring

The above brief examination of the current nutrition monitoring activities in the country shows that a considerable amount of information is being generated. Unfortunately, however, these activities do not constitute a well co-ordinated and integrated system of nutrition monitoring collecting, data of consistent quality, and comparability while avoiding duplication. At best, they are no more than good patchwork.

The NNMB activity constitutes the heart of nutrition monitoring in India. The scientific and technical backing that the National Institute of Nutrition provides across the entire range of

#### Text Box 3 DLHS (RCH) 2002

- Data on anthropometry of children below 72 months and adolescent girls of 10-19 years of age are available in addition to haemoglobin levels in these two groups.
- Hemoglobin levels in pregnant women 15 to 44 years are also available.

nutrition research and knowledge is a great strength, which cannot be replicated elsewhere in the country (Text Box 4). However, the NNMB is a temporary set up with inadequate staffing and high staff turnover; this is inconsistent with the responsibilities it has to shoulder. This has resulted in the NNMB carrying out surveys on relatively small samples, the results of which do not lend themselves to disaggregated analysis and appropriate cross-tabulations both at the state level and national level. The data, with some incompleteness, covers only ten states in the country.

Data on individual intake collected by a single 24-hour recall cannot represent the usual diet of persons because of intra-individual variability. The intra individual variability may be small in the case of the poorer sections of the population, but is likely to be large in better off segments of populations. The single 24-hour recall data cannot be used to classify individuals into nutrition consumption categories and this makes it difficult to use this data to study relationship between diet and risk of disease. The 24-hour recall data usually exhibits what is called the 'flat-slope' syndrome - subjects with true low intakes may tend to report higher than usual intakes and those with high intakes may report lower than their normal intakes. This will underestimate the variation between individuals.

The identification of vulnerable individuals and households has not received attention. In providing data on clinical nutritional deficiency signs, the sample sizes have been computed for estimating their prevalence rather than for disaggregated analyses and appropriate cross-tabulations. Considerably larger samples would be needed for identifying vulnerable groups and assessing time trends in them.

The dietary data from the NSSO, though strong on sampling design, sample size, explicitly stated estimation procedure, national coverage and length of reference period (7 and 30 days) has a potential shortcoming (Text Box 5). The reliability and validity of data collected on consumption expenditure on food by a single interview with a reference period of 30 days is open to criticism. Further, it is not stated if standard measures were used to assess the

**Text Box 4 Strengths and Short-comings of Current Nutrition Monitoring: NNMB**

- Strengths
  - Scientific and technical backing from the National Institute of Nutrition
  - Experience in monitoring for a continuous period of over 30 years
- Shortcomings
  - NNMB is a temporary setup with consequent high turn over of staff
  - Surveys carried out on relatively small samples due to limited staff. The data do not lend themselves to disaggregated analysis and cross-tabulations with adequate precision in the estimates
  - NNMB covers only ten States, and some years all the ten States are not covered
  - Single 24-hour recall data, though gives precise estimates of averages at the community level, cannot be used for classifying individual consumptions. A single 24-hour recall data tends to underestimate between individual variability apart from not representing the 'usual' intake
  - The data do not lend themselves to identification of vulnerable individuals and households
  - Sample sizes for clinical nutritional deficiency signs are computed for estimating prevalence and not for disaggregated analysis and meaningful cross-tabulations

quantities purchased, if memory aids and conceptualization in the form of food lists and photographs or models were used. The nutrient intake analysis is confined only to calorie, protein and total fat. No anthropometric data have been collected along with the consumption expenditure on food.

The NSSO data on morbidity based on self-reporting is also of limited use. The classification of diseases as acute and chronic based simply on the duration of less than 30 days or more is open to criticism. The focus of the morbidity survey was not related to nutrition assessment, but to the utilization of government curative care services. The NSSO probably does not have the expertise to carry out morbidity surveys of relevance in the context of nutrition related risks of disease.

The nutrition related data in the NFHS I and II and in the DLHS are programme specific and therefore, narrow in scope in the context of national and state level nutrition monitoring.

**Text Box 5 Strengths and Short-comings of Current nutrition monitoring: NSSO**

➤ **Strengths**

- Very strong on sampling design, sample size, explicitly described estimation procedures and national coverage

➤ **Shortcomings**

- Reliability and validity of data collected on individual intakes for a reference period of 30 days by (presumably) a single interview has not been examined
- No details are given about the methodology used to collect individual intakes – like use of standard measures, aids to memory and conceptualisation in the form of food lists and photographs of models
- The dietary intake analysis is confined to only calories, protein and total fat
- No anthropometric data are available

## Conclusions

Nutrition monitoring and surveillance are a set of planned activities necessary to provide timely information on contributions that food and nutrient consumption and nutritional status make to the health of the people. These activities have to be systematic and continuous – regular, periodically repeated surveys in monitoring or a continuous watch over occurrences in programmes in surveillance; they should be seen as goals in themselves and not as mere processes or methods. These activities should be accepted as a critical governmental activity at the highest level. To be successful, these activities must be well co-ordinated by a co-coordinating committee consisting of top-level administrators from the Ministries of Health, Women and Child Development, Agriculture and Statistics at the centre. Representation of state administrators on this committee and corresponding committees at the state level may be needed since health is a state subject. At the central level, the co-coordinating committee should be assisted by an Expert Advisory Group drawn from NIN, NSSO, NFI, Medical Colleges and research institutions with a strong interest in the interactions between health and nutrition, epidemiologists and public health specialists. The advisory group should provide the scientific and technical inputs necessary for the development and implementation of nutrition monitoring system. In particular, the advisory

group should be charged with the responsibilities of

- Identifying gaps in the knowledge and shortcomings in the methodology in the current nutrition monitoring system.
- Laying down priority objectives for monitoring. These could be considered as medium term (say 10 years) and long term (>10 years) priorities.
- Selecting a set of indicators that are relevant, sensitive, specific and cost-effective. Cut-off levels for these also need to be specified.
- Describing standardized procedures for the required measurements.
- Describing procedures for quality assurance at field and laboratory level.
- Specifying types of data analyses required for generating information for policy makers and programme implementors.

## References

1. National Nutrition Monitoring Bureau (NNMB). Reports (Annual) for the years 1974 to 1981
2. National Nutrition Monitoring Bureau. Report of the NNMB-NSSO linked survey 1983-84
3. National Nutrition Monitoring Bureau. Report on the Tribal Survey, 1985-1987
4. National Nutrition Monitoring Bureau. Report of the first repeat survey – Tribal, 1998-1999
5. National Nutrition Monitoring Bureau. Report of the first repeat rural surveys, 1988-1990
6. National Nutrition Monitoring Bureau. Report of the second first repeat survey – Rural, 1996-97
7. National Nutrition Monitoring Bureau. Special report on diet and nutritional status of adolescents, 2000
8. National Nutrition Monitoring Bureau. Prevalence of Micronutrient Deficiencies, 2003

9. National Institute of Nutrition, Annual Report, 2001-2002.
10. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Govt. of India, Household Consumer expenditure in India – quinquennial reports from 1972-73 to 1999-2000.
11. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Govt. of India: Morbidity and Treatment of Ailments, 1995-1996.
12. International Institute for Population Sciences, Mumbai, National Family Health Survey -I, 1992- 93 and National Family Health Survey – II, 1998-99
13. District Level Household Survey under Reproductive and Child Health, Phase –I, Round –2, 2002 (Personal Communication)