

## **Background**

India has long experienced one of the highest burdens of infectious diseases in the world, fueled by factors including a large population, high poverty levels, poor sanitation, and problems with access to health care and preventive services. It has traditionally been difficult to monitor disease burden and trends in India because of the high disease burden and poor surveillance infrastructure. It has been even more difficult to detect, diagnose, and control outbreaks until they had become quite large.

In an effort to improve the surveillance and response infrastructure in the country, in 2004 the Integrated Disease Surveillance Project (IDSP) was initiated with funding from the World Bank. This project seeks to improve (1) reporting of a series of reportable diseases and syndromes, (2) laboratory capacity to diagnose these priority diseases, (3) recording and transmission of the information, and (4) the ability to spot outbreaks, and promptly investigate and control them. This national program is to accomplish these goals by improving the completeness, reliability, and timeliness of information collected at the peripheral levels of the health care system, engage the large private health care sector in disease reporting, conduct training of surveillance personnel, equip and staff public health laboratories, build information technology infrastructure for data transmission, and improve capacity of rapid response teams.

Given the surveillance challenges in India, the project seeks to accomplish its goals through relatively easy to implement activities. These include having a small list of priority conditions, many of which are syndrome-based and easily recognizable at the lowest levels of the health care system, a simplified battery of laboratory tests, and reporting of largely aggregate data rather than individual case reporting. In contrast, some project activities are relatively high technology, such as computerization, electronic data transmission, and distance-based learning. The project will be implemented all over the country covering different states of India in a phased manner during the first three years. The initial implementation experiences suggest a slow take off even among the phase I states which are known to have good capacities.

During November 2006, Dr. Steve Ostroff<sup>1</sup> undertook a detailed technical review of the IDSP. Based on this review, it was agreed that the project would focus on a limited number of states to demonstrate the operational feasibility of integrated disease surveillance especially in terms of strengthening local analysis and action, including promotion of private sector participation in disease surveillance. Since November 2006,

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<sup>1</sup> Former CDC Expert supporting the Bank operations in the South Asia Region

- 14 focus states have been identified for intensive follow-up to demonstrate successful implementation of IDSP; an officer has been designated as a focal point for each of the focus state to provide technical support and help resolve implementation bottlenecks.
- The National Informatics Centre (NIC) has been identified by the MOHFW for implementing the IT component of the project.
- The IDSP and the Indian Council of Medical Research (ICMR) signed a formal Memorandum of Understanding (MOU) on March 19, 2007 for implementing NCD risk factor surveys and detailed implementation schedule has been agreed.

An Implementation Support Mission team in May 2007 noted significant improvement in surveillance reporting by the districts (from 43% in November 2006 to 87% by March 2007) in the focus states. Nearly two thirds of the 270 districts now share data with the Central Surveillance Unit within one week of reporting period. There is also a steady improvement in reporting by the private providers and 63 districts (23%) are now able to capture data from this important sector. In the states of Gujarat, Tamil Nadu, Goa, and Uttaranchal some district and sub-district hospitals are also reporting data regularly.

As the mid term review of the project is scheduled in November 2008, another technical review of the progress made by the project by Dr. Claire Broome <sup>2</sup>was requested to provide additional guidance on specific activities and changes in project design (if required) to enhance the project impact following the initial guidance provided by Dr. Steve Ostroff.

Dr. Broome visited India during June 20 to 29, 2007 and reviewed the IDSP implementation as per the attached Terms of Reference. In addition to extensive consultations with the senior officers of GOI, Central Surveillance Unit and WHO, she also visited the states of Gujarat, Maharashtra and Madhya Pradesh to get a better understanding of operational challenges for IDSP implementation. The Honorable Minister of Health & Family Welfare, who has been taking very keen interest in the IDSP, himself has chaired the debriefing session on June 29, 2007 where the Secretary and several senior officers of MOHFW and IDSP were present.

### **Summary of Key Recommendations:**

- 1) Strengthen IDSP capacity for early outbreak detection by emphasis on prompt outbreak reporting to the district surveillance officer. Special emphasis is required on seeking such information from the health providers and different options such as giving mobile telephones to the reporting units; implementing the 24/7 call center for health care providers etc. may be tried in addition to systematic media scanning
- 2) Enhance IDSP analytic capacity and use of data for local action by making full time epidemiologic technical expertise available at the district level and provide adequate

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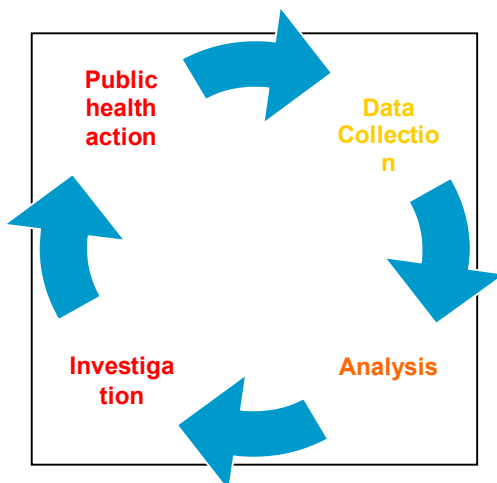
<sup>2</sup> Former Deputy Director of CDC and currently Adjunct Professor, Department of Global Health, Rollins School of Public Health, Emory University

mentoring to district epidemiologists through positioning experts such as graduates of the Field Epidemiology Training Program at the State Surveillance Unit.

- 3) Ensure active participation of IDSP personnel at national, state, and district level with National Informatics Center in defining analytic software needs and evaluating options for development vs acquisition of software.
- 4) Target large and strategically located hospitals for priority attention as reporting units such as Medical Colleges, private hospitals, and Infectious Disease Hospitals. Similarly, target large and strategically located laboratories for priority attention and strengthening, including accelerated distribution of IDSP rapid reagents
- 5) Consider removing conditions such as “only fever <7 days”; cough< 3 weeks; acute diarrhea (without blood or dehydration) from the IDSP reporting as these categories are non-specific and high volume creating a large burden of data collection on the system, but the data are difficult to interpret
- 6) Encourage IDSP to better engage with National Disease Control Programs in harmonizing surveillance data collection and prevention and control activities.
- 7) Implement and publicize effective epidemiologic investigations through monthly videoconferences and special reports in national and state bulletins
- 8) Implement in a few locations and evaluate the Videoconferencing/broadband hybrid satellite network for IDSP before its large scale application.
- 9) Complete the action items agreed to in the Implementation Support Mission of May 2007

### **Framework for Disease Surveillance:**

Disease surveillance has many purposes. These include ascertaining disease burden and monitoring trends, determining risk factors for illness so prevention and control activities can be properly targeted, evaluating the impact and effectiveness of control programs, and outbreak recognition. But whatever the objective of the surveillance system, an inherent component of surveillance is the utilization of the data collected for an appropriate public health action. It is helpful to consider surveillance as a cycle, as indicated in figure 1. Collected data are regularly and promptly analyzed; if abnormalities are detected, an appropriate investigation is initiated. Results of the investigation inform selection of a public health action. Subsequent data collection is then used to assess the impact of the action. Understandably, most of the initial activities of IDSP have been directed toward data collection; however, in the absence of evidence that the data



are being analyzed and used for public health action, even the most dedicated reporting units can lose motivation for reporting; conversely, the sense that the data collected lead to real and meaningful actions can be a powerful motivation to maintain and improve reporting.

## Objectives for IDSP

To date, the primary objective for IDSP has been **rapid detection of outbreaks and epidemics—the “early warning” function**. This is particularly critical for diseases like plague, dengue, chikungunya, cholera, Japanese Encephalitis, pandemic influenza, meningococcal meningitis, and new diseases (including eg toxic events). Based on substantial experience, there are various ways in which outbreaks can be detected promptly.

- The most common continues to be an informed, aware health provider (medical officer, laboratory, community health worker) who notifies a 24/7 public health contact. In **IDSP**, this could occur based on an **urgent “outbreak” report** from routine reporting units to their respective district or state surveillance unit.
  - (a) This option would be enhanced if **mobile telephones** were available to reporting units throughout the system
  - (b) IDSP could also support this function through the proposed **Call Centre**. Although the current Call Centre proposal focuses on reports from the public, it also envisions accepting reports from medical providers. I recommend that the **priority** should be supporting reporting from **providers**, as they are more likely to identify accurately epidemic disease. This will require **strategic marketing** of the system to the providers in the area covered by the call center. It will also require **links to DSU or SSU for promptly evaluating** the information, and giving **feedback to the provider** (eg expedited access to reference diagnostic tests, information about clinical presentation of rare conditions, access to limited therapy—eg diphtheria anti-toxin) and initiating appropriate **actions**.
- The IDSP could also identify an outbreak based on prompt analysis of **routine surveillance data detecting disease above “trigger” level** for a particular condition. This most frequently occurs for a smaller outbreak spread across multiple reporting units, where no single unit notices anything unusual.
- **Media scanning can detect possible outbreaks**, as well as identify rumors which need addressing. Although it can be the responsibility of an SSU to systematically monitor local newspapers, web pages, etc, media scanning can also be done by a contracted service. The benefit of a contracted service is systematic, prompt scanning which is not contingent on public health personnel; also, any items noticed can be routed immediately to the appropriate (and possibly multiple) district, state, or national units.

In addition to supporting early detection of outbreaks, IDSP also currently includes data collection for many of the conditions for which India has national disease control programs:

- Polio; AFP; TB; malaria; HIV; measles; diphtheria;

- Other conditions in IDSP that warrant investigation and prevention activities include hepatitis A, B, C, E ; rabies; neonatal sepsis; bacterial sepsis and meningitis (note—the Government of India has just endorsed use of *Haemophilus influenzae* type b conjugate vaccine for infant immunization)

I recommend further consideration of how **IDSP can better support and collaborate with disease control activities**. I make this recommendation not only because disease control activities have important public health impact, but also because surveillance for “endemic” diseases provides critical support to an effective early warning system, as reports of endemic diseases are more frequent than epidemics:

- Helps detect ineffective reporting units—those with no reports or consistently “nil”
- Action taken on disease control surveillance data for prevention and control activities shows reporting units that surveillance data collection is used for action
- Insures reporting units know who to contact with information about an urgent outbreak or unusual cases

However, as Dr. Ostroff noted, there is an inherent difficulty in using IDSP data for disease control objectives since IDSP data are collected and reported principally in aggregate form. Without data on individual cases including gender, age, address, etiology, and risk factors, targeted prevention activities cannot be undertaken. However, there are some approaches which would permit greater harmonization of data collection activities between IDSP and National Disease Control Programs at the local level which I will discuss below under “more strategic information collection”.

### **Strengthening IDSP analysis and use of data for local action**

IDSP activities to date have focused primarily on the data collection phase of surveillance, rather than the analysis, investigation and action phases. However, during the field visits, the team observed some analysis of IDSP data at Kheda District surveillance unit in Gujarat using what was described as “NIC” software, and heard about investigations at all district or municipal sites visited, including several outbreaks of hepatitis, chikungunya cases, and a toxic cooking oil exposure cluster, demonstrating some utilization of the collected data. In some instances, case finding and mapping had been done; in others, causes and sources of outbreaks appeared to be predetermined before the field investigation was even conducted. As Dr. Ostroff noted, “investigation is a core competency to be developed as part of IDSP, as rapid response teams and their training is an integral component of IDSP. India is not lacking in well-trained investigators as a result of the field epidemiology training programs (FETP) at NICD and in Chennai. These assets should be engaged to assist in upgrading investigative competence at the state and district level. *Determining the quality of outbreak investigations should be an essential evaluation component of the project, and the project should be able to demonstrate improvements in this area.*” This will require tracking outbreaks investigated: the number, cause, results and public health response. In addition, analysis and use of data for local action will be facilitated by efforts to recruit, train, and support district and state epidemiologists for analysis and use of data.

- This effort will be improved by assuring **experienced mentoring resources** available to support the newly assigned district epidemiologists, who are likely to have limited experience and training. I suggest hiring more experienced epidemiologist such as an FETP graduate as “officer on special duty” to be a technical resource at each SSU; it would also be useful to assess the potential role of epidemiology faculty from Departments of Community Medicine; academic epidemiologists may have excellent technical skills, but it will be important that they are able to support the kind of applied public health epidemiology needed for IDSP success.
- In addition to epidemiologic consultation, formal **Rapid Response Teams (RRT)** must be available for participating in substantial investigations, with a clear mandate and budget agreed upon before an epidemic occurs
  - (a) Includes relevant specialists and capacity—laboratory, entomology, sanitary personnel, reference services, etc
  - (b) Request NICD assistance (epidemiology, laboratory) if appropriate
- **Short courses** at NICD, such as the 2 week epidemiology training course planned for July 2007, and by **ongoing “continuing education”** supported by distance learning (Edusat Network)
  - (a) **Monthly videoconferences** a) for all state epidemiologists with the Central Surveillance Unit and b) for all district epidemiologists with their State Surveillance Unit to present and discuss investigations using the Edusat Network. In addition to disseminating information about investigations, the knowledge that one will be presenting information tends to motivate more thoughtful investigations
  - (b) Include pertinent **outbreak investigation reports** in national and state **IDSP bulletins**; an opportunity to reinforce importance and utility of outbreak investigation and public health response. Initially, could feature investigations done by FETP trainees.
  - (c) Communications appropriate for State Minister, Principal Secretary should feature reports of investigations and likely or measured public health impact

In addition to improved analysis and investigations, IDSP needs to assure support for implementing needed actions

- (a) Ongoing communication with District Medical Officers and District Health Officers to support appropriate actions based on investigation
- (b) Increased collaboration between IDSP and relevant National Disease Control Programs to consider how IDSP data can support NDCP prevention activities (an example: the Pediatrics department at Gandhi Medical College in Bhopal mentions seeing tetanus cases in unimmunized and partially vaccinated children, which may help the childhood immunization program identify areas with inadequate childhood immunization )

## **Information Technology support for IDSP:**

### **Video conferencing/broadband hybrid satellite network for IDSP**

This component of the IT system (known as Edusat) has been largely viewed by IDSP as an educational tool for distance based learning, and, as noted above, this is an important use of this technology. Videoconferencing should also be viewed as an “essential public health tool” for outbreak management. It allows public health officials in different locations to share information, display data, and develop plans of action in the midst of an outbreak. It reduces travel and allows managers to spend more time at their offices and in the field. It also should be a routine form of communication for IDSP managers in the states and NICD to discuss program status and seek solutions to problems. The National Informatics Center (NIC) has begun implementation of the network, and we observed one node between Nadiad, Kheda Districts, Gujarat and Delhi. Unfortunately server difficulties resulted in only one way audio and visual connection.

- (a) **Technical performance** of the network in the states where it is initially installed should be **evaluated**
- (b) If performance is satisfactory, **rapid completion of the network** is urgently needed. It will be crucial that the necessary staff and infra-structure are available at sites so that this relatively complex technology is well used; the involvement of the NIC in assuring ongoing staffing and maintenance is important
- (c) As the network becomes functional in several states, I recommend creation of a “**working group**” of interested district, state, and central IDSP personnel to monitor performance (from IDSP perspective), trouble shoot “management” issues, and to pioneer useful applications (training, conferencing, communications). The group would be advisors and “champions” for the system, interfacing both with NIC technical personnel, and with their colleagues in IDSP
- (d) The broadband connectivity aspect of the network is also crucial for IDSP data entry and sharing among the district, state and national levels. The selection of NIC to implement and support the network hopefully will address ongoing **performance, security, and maintenance** issues.

### **Software to support IDSP**

NIC is tasked with developing (or acquiring) the software needed to support IDSP—presumably including data collection, analysis, display, investigation, and program monitoring. Although the need for software is clearly identified in IDSP documents, I did not see documentation of a process involving IDSP for determining the functionality software should have; obtaining user input during development/acquisition; user acceptability testing at beta stage, and a systematic ongoing change management process, all of which are necessary stages for the highly complex task of software development/acquisition/utilization. Software can be key to IDSP success, supporting functions such as

- 1) easy to use data display templates so that temporal and geographic trends in collected data can be easily visualized by district surveillance personnel, ideally flagging disease rates above expected

- 2) analytic capacity to support more experienced epidemiologists
- 3) use of data to track IDSP program performance indicators
- 4) robust support for data entry, “cleaning”, and management

Therefore IDSP should commit staff resources to assure IDSP gets software that will meet the program needs.

*Observations on current resources for IDSP software:*

The “NIC” software I saw in Kheda District was appreciated by the surveillance unit, and it was encouraging to see **graphing and mapping tools** in use that had been identified as needed in previous review missions. The recently hired district data manager also had been provided access to MS Excel. I was not in a position to evaluate the NIC software, although it appeared to support an analysis based on numbers rather than rates (definitely better than no visualization, but can be misleading if districts have substantially different populations). Comparisons were to the number of cases in the preceding 5 weeks (which may just reflect the absence of data entered from the previous year which could serve for comparison). Working with small data sets, the response time in this web based system seemed reasonable.

The two week field epidemiology training course proposes to train epidemiologists using MS Excel (and other Office products). This training course may provide an excellent opportunity to assess the utility of Excel to meet analytic needs for IDSP.

- I recommend obtaining **formal input** from a group of trainees after the pilot short course. They could provide critically useful input not only on Excel, but also the “NIC” software, and any other candidate packages. The group could also be supplemented with other key “end users”.

I was also impressed in Gujarat with the publication of data in the state IDSP Alert bulletin on reporting status by reporting units within districts, municipalities, and medical colleges, an example of displaying data on program performance. Another source demonstrating extensive and creative **use of surveillance data for program monitoring** is the data system for the National Polio Surveillance Program.

- I recommend participation from NPSP as well as IDSP when considering design of appropriate performance monitoring systems for IDSP

Several other National Disease Control Programs have software to support their surveillance and control activities. The Principal Secretary of Health in Gujarat strongly encouraged IDSP to work together with the National Disease Control Programs to **harmonize data collection strategies and systems** since frontline health workers at PHC’s and in the community will be reporting cases to most if not all these programs.

- I recommend active participation by IDSP personnel at national, state, and district level with NIC in defining software needs and evaluating options for development vs acquisition



- For projects with substantial software development, I recommend that IDSP identify appropriate person(s) to actively monitor NIC products throughout the development life cycle—ie use cases, software project plans, as well as early versions of actual software.

## More strategic information collection

IDSP should continue to refine strategies for improving the interpretability of data by emphasizing a) reporting units/data sources most likely to provide usable and important information b) enhancing specificity of case definitions, especially by laboratory confirmation and c) encouraging consistency in reporting

- **Target large and strategically located hospitals** for special attention as reporting units such as **Medical College and Infectious Disease Hospitals; private hospitals which meet these criteria should also be targeted**. These sources are likely to draw more severely ill patients from a large population, thus efficiently providing “sentinel” information about a large area. In addition, they are likely to have, or can be supported to have, better laboratory and clinical diagnostic facilities.
  - a. However, data collection from hospitals may require extra effort. A medical records unit or pharmacy may be able to report ; if this is not feasible, as Dr. Ostroff suggested “One option may be to place project-funded data collectors in major private-sector facilities (large hospitals) or in medical college hospitals to collect the data and pass it on to district and state surveillance units” Note that the private sector surveillance data are analyzed together with that obtained from the public sector
- **Target large and strategically located laboratories** for special attention and strengthening
  - a. Support for laboratory strengthening at Infectious Disease hospitals may be particularly needed, as they may be under the medical education organizational structure, rather than health services
- The above two targets (strategic hospitals and laboratories) are reasonable priorities in all sites, but they may be particularly important in states that are less advanced in their IDSP activities
- Emphasis on **laboratory confirmation** will help improve specificity of cases reported
  - b. Accelerate laboratory strengthening activities in key **L2-L4 labs**
  - c. Accelerate distribution of **IDSP rapid reagents**— dengue rapid test, meningococcal antigen detection kits, leptospirosis rapid dot, Typhidot, etc
- Improve strategies for **laboratory reporting**. During the field visits, we discovered that in many instances, laboratory results were NOT reported to IDSP independent of the overall patient diagnosis/record, so it was generally not possible to determine if a case were laboratory confirmed, or even the total number of laboratory confirmed cases. In other instances, there was parallel reporting of positive laboratory tests and clinical diagnoses, leading potentially to two reports of the same case. Linkage of clinical and laboratory records is probably not feasible outside of the individual patient record, so one may need to address some degree of duplication in order to have information on the number of laboratory confirmed cases.

- **Consider removing conditions such as** “only fever <7 days”; cough< 3 weeks; acute diarrhea (without blood or dehydration) as targets of IDSP--these categories are non-specific and high volume, so they create a large burden of data collection on the system, but the data are difficult to interpret. For malaria eg one would be better served using blood smear results and/or clinical diagnosis by a medical officer, rather than fever alone.
  - a. These are important conditions, but need targeted surveillance approach—eg special studies with improved diagnostics, health services utilization data etc
  
- Encourage IDSP to better engage with National Disease Control Programs in harmonizing surveillance data collection and prevention and control activities. There are a number of efforts currently underway which could lead to some harmonization and synergies, such as:
  - a. Pilot collaborations with NPSP surveillance officers in districts where polio cases are absent and not likely to be imported
  - b. Continue efforts to collaborate with Vector Borne Disease Control Program on revised forms and disease surveillance systems
  - c. As Dr. Ostroff noted, “ As part of the avian influenza sub-project of IDSP, a network of 30 sentinel sites will be established for monitoring of seasonal patterns of influenza and sample collection for virus isolation. Sentinel surveillance is an important adjunct to routine surveillance efforts, as it allows higher quality information to be collected (including demographics and risk factor data), and specimens to be collected to define etiology and enhance data specificity. *Once these sentinel sites are up and running, IDSP should consider expanding the range of activities in these sentinel sites to include other syndromes under surveillance (e.g. diarrheal disease, febrile illness).*”
  - d. Leverage/learn from TB control program collaboration with private sector for case reporting and administration of DOT

However, a more complete collaboration/integration will require addressing collection of the more extensive data on a case needed for disease control activities vs the aggregate data reported by IDSP. At the local and district level, one could envision minimal “core” information collected on all cases, with an “extended record” collected on the smaller number of cases for reporting to the National Disease Control Programs . One might consider pilot projects in a district, where collaboration would involve both the district personnel, but also representation from the state and national programs. And as noted above, it would be useful to consider potential for “convergence” (or just facilitating data import/export) among the various data systems, both for ultimate efficiency, and to decrease burden on system to provide surveillance data

## **Conclusion:**

IDSP is an important project for improving surveillance for key diseases in India, particularly focused on improving early detection of outbreaks. Substantial progress has been made in recruiting and training staff, creating guidance and manuals, but the challenge of changing “culture”-- the long-standing experience of data collection not linked to action -- and changing reporting behavior in a system with limited resources and overwhelming demands is enormous. The challenge is multiplied by the size of the population and the different capacities in different states.

- The current “Focus state” strategy is an excellent approach to achieve successes, as well as to assess implementation strategies as the project proceeds
- For maximum impact of the Focus State approach, it will be important to communicate “successes” effectively

At the same time, one can strategically strengthen surveillance activities at key sites throughout the country, as well as providing a Call Center and media scanning capacity to complement the surveillance infra-structure. This provides some capacity nationwide, while building the more in depth surveillance, investigation, and action capability.

*Annex 1:*

**Places visited and Persons met**

Ministry of Health and Family Welfare: Dr. Anbumani Ramdoss, Minister; Naresh Dayal, Secretary

National Institute of Communicable Diseases (NICD): Dr. Shiv Lal, Additional Director General MOHFW, Director for the IDSP and National Institute for Communicable Diseases; Dr. RL Ichhpujani (National Project Officer for the IDSP), Dr. Jagvir Singh (Public Health), Dr. Shashi Khare (laboratory strengthening), Dr Shah Hossein, Chief Medical Officer, National Vector Borne Disease Control Program (NVBDCP)

National Informatics Center: Dr. Y.K. Sharma, JRD Kailey

National Polio Surveillance Project (NPSP): Dr. Hamid Jafari Project Manager, Tim Peterson, program staff, and data manager

WHO India office: Dr. Sampath Krishnan, Dr. Samuel , Dr Ritu Chauhan

WHO Field Epidemiology Training Program (FETP) Delhi and Chennai: Dr. Yvan Hutin

USAID: Robert Clay, Director Office Population, Health, and Nutrition; Dr. Sanjeev Upadhyaya, advisor

Dr. Broome and Dr. Suresh made field visits to Gujarat (with Dr. Ichhpujani), Mumbai, and Madhya Pradesh (with Dr Shah Hossein). The visits included State Surveillance Units (Dr. WR Hegan, Gujarat, Dr. Ashok Virang, M.P.), District Surveillance Units (Kheda District, Gujarat; Hoshangabad, M.P) 3 PHC's , sub-centre, 2 District Hospitals (District General Hospital Nadiad, District General Hospital, Hoshangabad) , 2 Infectious Disease Hospital (Ahmedabad Municipal Corporation)/wards Medical College(Gandhi Medical College, Bhopal), private hospital (Sterling Hospital, Ahmedabad) , a Municipal Outbreak Preparedness Center in Mumbai (Dr. Neera Kewalramani, Deputy Executive Health Officer, Epidemiology), laboratories L2-L4 in visited institutions, and a reference Molecular Diagnostics laboratory at Kasturba Hospital, Mumbai; state offices for the NPSP in Gujarat and M.P.; Principal Secretary, Health, Gujarat; Commissioner of Health, Principal Secretary, M.P.