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Review Article

Health Management and Policy Section

Health Surveillance in India: Current and Future Prospects

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ABSTRACT

Surveillance is an information for action. India has created considerable improvement in control, prevention and eradication of certain communicable diseases. Few such diseases that have been effectively controlled are polio, smallpox, vector-borne illness, nipah, Coronavirus Disease-2019 (COVID-19) and so on. These achievements are the outcome of an active surveillance system incorporated at community, facility, and health system level. Any of these progresses is impossible without a robust public health surveillance structure. Therefore, enhancing the public health surveillance system further will be helpful in managing upcoming pandemics at its earliest. Improvements in public health surveillance should be synchronised with the goals of Universal Health Coverage and its regulating standards of safe guarding universal health as a right besides privilege, ensuring equity, non-discrimination, guarding the affected individual's rights and respect their choice and placing health in people's hand. In alignment with the National Digital Health Mission, the new Integrated Health Information Platform (IHIP) aims to substitute traditional surveillance data-entry system with modern advances in digital health and technology. This platform also initiates various sector collaboration, including public and private healthcare organisations and civil societies. Recommendations to strengthen the surveillance system starts with enhancement of laboratory infrastructure, referral networks and health organisations at the block level with the aim of strengthening community-based surveillance and responding in a timely manner for upcoming outbreaks.

Keywords: Integrated health information platform, Public health, Unique health information identifier

INTRODUCTION

Early in 1963, Alexander Langmuir–established modern concept of surveillance as continued watchfulness over the distribution and trends of occurrence through systemic collection, consolidation and evaluation of mortality and morbidity reports and other relevant data which was later defined as ongoing systemic collection, analysis and interpretation of health data essential to health planning, implementation and evaluation of public health practice, closely integrated with timely dissemination of these data to those who need to know [1]. However, in times of hardship for a developing country like India which has an increased burden of communicable and non communicable diseases, enhancing existing surveillance system will be of greater support to overcome the crisis.

Types of Surveillance

There are five different types of surveillance namely:

1) Active surveillance; 2) Passive surveillance; 3) Sentinel surveillance; 4) Laboratory surveillance; 5) Syndromic surveillance

Active surveillance: Usually conducted for rare diseases, during outbreaks and for diseases on its way to eradication. Data are obtained by searching for cases/periodically contacting those who may know of cases (GPs). It is the most accurate but expensive method. For example: Health worker goes into community, search for cases of fever and collect blood slides for malarial parasite or search for cases of acute diarrhoeal disease [2].

Passive surveillance: It is simple, acceptable and relatively inexpensive and most commonly used method in surveillance. Data recipients wait for the data providers to report regarding the concerned disease/event. For example: District headquarters waits for malaria report raised by Primary Health Centres (PHCs)/hospitals, Food and Drug Administration's (FDA) Adverse Events Reporting System has passive surveillance reporting systems [3].

Sentinel surveillance: This method is used to monitor disease trends over a period of time. Data is obtained from selected hospitals who agree to report all cases of the particular disease. Also, this method is excellent for detecting large health problems whereas insensitive for rare events/new disease. For example: High risk groups- Sexually Transmitted Disease (STD) clinic attenders, intravenous (i.v.) drug users [4].

Laboratory surveillance: It allows for the use of molecular epidemiological kits, comprehensive evaluation of microbe strains and scrutinizing drug sensitivity. For example: Viral hepatitis outbreak, Avian influenza virus outbreak are reported through the Integrated Disease Surveillance Programme (IDSP) in India [5].

Syndromic surveillance: This method is based on monitoring trends of relatively non specific syndromes or manifestation of illness based on clinical features without clinical or laboratory diagnosis. It is relatively inexpensive and faster method. It lacks specificity. Useful in bioterrorism epidemics. For example: Cases of diarrhoea instead of cholera/ rash illness rather than measles/medication purchases [6].

PUBLIC HEALTH SURVEILLANCE IN INDIA (HISTORICAL PERSPECTIVE)

During 1988, Delhi experienced an outbreak of cholera between July-August which resulted in a total of 1824 laboratory confirmed cholera cases at ID Hospital, Delhi alone [7]. Similarly in 1994, between 26th August and 5th October, 5150 alleged cases of pneumonic or bubonic plague were reported from eight states of India of which 2,793 were from Maharashtra, 1,391 were from Gujarat, 749 were from Delhi and 169 were from five other states. An aggregate of 167 plaque cases were confirmed by serology on 5th October, with 53 mortalities of which 49 were from Surat [8]. Following plague outbreak in 1994, to strengthen the disease surveillance across the country Government of India (GoI) constituted boards like Technical Advisory Committee on Plague in 1994, Committee to convey a comprehensive National Programme on Sanitation and Environment Hygiene on the lines of Technology Mission (1995) and Expert Committee on Public Health System in 1996. Thereafter, the GoI constituted NAAC (National Apical Advisory Committee) beneath the leadership of Union Health Secretary in 1999 to

look into strengthening of disease surveillance [9]. In 1985, India piloted a sero-surveillance in search of the virus causing Acquired Immunodeficiency Syndrome (AIDS), by April 1986 the first case of Human Immunodeficiency Virus (HIV) was identified. This sero-surveillance progressed into the HIV sentinel surveillance (HSS), which was first steered in 1994 and then enacted into the annual surveillance system under the National AIDS Control Programme (NACP) in 1998 [10]. Likewise, the GoI in 1997-98, launched the National Surveillance Programme for Communicable Diseases (NSPCD) in 101 districts. All state/Union Territories (UT) and the 101 districts had a skilled Rapid Response Team (RRT) to ascertain and support early warning and response system [11].

In 2004 November, with the aid of World Bank, the Integrated Disease Surveillance Project was made functional to identify and respond to disease outbreaks rapidly [12]. Integrated Disease Surveillance Project was continued during 12th Plan Period (2012-17) as IDSP, a central scheme which was sanctioned by NRHM's Empowered Programme Committee (EPC) on 04.10.2012 [13]. Subsequently, to follow up the tuberculosis patients throughout the country, the government has commenced a web enabled application approach called (NI-KSHAY: eradication of tuberculosis). This application has been established mutually by the Central TB Division of the Ministry of Health and Family Welfare and National Informatics Centre (NIC). It was unveiled through the GoI in June 2012. A periodical notice was issued to healthcare establishments mandating notification of all tuberculosis patients nursed by them to NIKSHAY repository [14]. In order to address the existing situation of 'electronic silos' in the health system and increase the efficiency of data exchange, the IHIP under IDSP was initiated to integrate various health programmes. It was first inaugurated in certain districts of seven states (Andhra Pradesh, Kerala, Odisha, Uttar Pradesh, Himachal Pradesh, Karnataka and Telangana) as a pilot project by the Ministry of Health and Family Welfare (MoHFW), GoI in 2018 [15].

THE SURVEILLANCE SYSTEM

The IDSP collects, compiles, analyses and uses information on several epidemic prone diseases for surveillance and hasty feedback to avert or limit the spread of illnesses among people. The organisation structure of IDSP consists of CSU (Central Surveillance Unit) at New Delhi, SSU (State Surveillance Unit) at State Head Quarters of 36 states/Union Territory, DSU (District Surveillance Unit) at District Head Quarters of 670 districts and PRU (Peripheral Reporting Unit) [16]. Through this organisation structure,essential data on epidemic prone diseases are collected on weekly basis using standardized forms for documenting and reporting information at various levels. They are 'S' form (suspected cases)- Reporting Format for Syndromic Surveillance, filled by Health Worker to report information on suspected cases/syndromes. 'P' form (presumptive cases) - Reporting Format for Presumptive Surveillance, filled by Medical Officer to register information on probable/clinically suspected cases. 'L' forms (laboratory confirmed cases)- Reporting Format for Laboratory Surveillance designed to collect data on laboratory confirmed cases [17].

SURVEILLANCE AND COVID-19 PANDEMIC

During the recent COVID-19 pandemic, a Rapid Response Team (RRT) was set which consisted of an epidemiologist, a microbiologist and a health worker as per need to identify the geographically defined containment and buffer zone for cluster containment, listing of cases and contacts tracing, implementing containment strategy, transferring samples to nearest laboratories, setting-up COVID-19 control room and reviewing and analysing COVID-19 data on daily basis. Additionally, entry points such as airports were brought under strict surveillance by providing Standard Operating Procedures (SOPs) through Integrated Disease Surveillance Project (IDSP) [18]. Persons suspected of having COVID-19 were tested for Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) through direct viral detection methods {e.g., Nucleic Acid Amplification Test (NAAT) or antigen detection tests}. Those tested positive, characteristically start to acquire measurable antibody 7–14 days after the onset of illness and by three weeks majority of the infected patients will turn positive for antibody [19]. Antibody detection can be advantageous to aid diagnosis of the infection or its complications such as multisystem inflammatory syndrome or other post COVID-19 sequelae [20]. However, recent Emergency Use Authorization (EUA) suggestions does not impede the usage of these assessments in vaccinated persons, neither of the presently approved tests have not been precisely sanctioned to measure resistance or safety of people who took COVID-19 vaccine [20].

INTEGRATED HEALTH INFORMATION PLATFORM (IHIP)

The IHIP is a near-real-time, web-enabled digital health information system to strengthen the country's disease surveillance through single operating platform by creating a decentralized state-based surveillance system for epidemic prone diseases to identify the early warning signs, therefore appropriate and efficient public health arrangements can be commenced in response to various health confronts in the country at the national, state and district level [21]. This IHIP has been synced with National Digital Health Mission and entirely congruent with the other electronic information practices presently being used in India [22].

India launched IHIP on 5th April, 2021 [23]. Earlier only 18 epidemic prone diseases were tracked through paper work mode but through IHIP 33 epidemic prone diseases will be tracked down digitally [23]. Key features are real time information on human health from across India (via mobile application); available at all points (central, state and community level), Geographic Information System (GIS) enabled graphical illustration of information into unified dashboard, role & hierarchy-based feedback & alert mechanisms, geo-tagging of reporting health services, data amalgamation with other health programs [22].

Also, IHIP has the ability to integrate data sources from public and private sector facilities, define and analyze topographical disparities in diseases under the framework of demographic, ecological, behavioral, socio-economic,hereditary and contagious risk factors, interpret geographic correlations of persons with their socioeconomic and demographics attributes [24].

The health worker or healthcare facilitators can login with their respective Login Id and password into "ihip.nhp.gov.in/idsp" portal and record the health events/outbreaks in the corresponding forms. Once the basic details of outbreak/events are recorded Patient Health ID and Patient Transaction ID will be generated automatically [25]. With the help of the generated ID the 'Action taken' by the RRT members assigned for the particular disease/ event can be followed-up [25]. All the outbreaks attended and ongoing outbreaks are represented with the help of geographic maps too [25].

LESSONS FROM OTHER COUNTRIES

The SARS outbreak posed a serious threat to Europe in 2003 which led to the idea of creating a European public health agency called European Centre for Disease Prevention and Control (ECDC) in 2005 to monitor and assess threats to public health in Europe from 56 communicable diseases and related health issues. One of the biggest achievements of ECDC was launching a web-based technical platform for data submission, data storage and dissemination by The European Surveillance System (TESSy) which replaced the 17 data collection systems into one system [26].

Similarly, to protect Americans from serious disease, the National Notifiable Diseases Surveillance System (NNDSS) a versatile program that comprises the surveillance system for public health monitoring, control, relevant data collection, analysis, and sharing of health data for prevention of about 120 diseases was initiated by

Centre for Disease Control and Prevention (CDC) [27]. Approximately 2.7 million disease cases are being informed through NNDSS per annum [28]. The CDC protects its people from health threats by proficiently using the data received from NNDSS. In order to offer more widespread, sensible, and better eminence of data than before the NNDSS Modernisation Initiative (NMI) was introduced under CDC Surveillance Strategy [29].

In 1959, electronic reporting structure for notifiable diseases has been launched in 30 provinces of China named the National Disease Reporting System (NDRS) [30]. Vital characteristics of this system were to provide apt feedback and conduct systematic assessment of data quality. Nearly 35 notifiable infectious diseases have been successfully reported under this system. A Nationwide Anti Epidemic Computer Telecommunication Network (NATCN) was established later in 1987 under NDRS [30]. With the improved technical services, usage of the NACTN has expanded into all facets of public health surveillance [30].

STRENGTH, WEAKNESS, OPPORTUNITY AND THREAT (SWOT) ANALYSIS

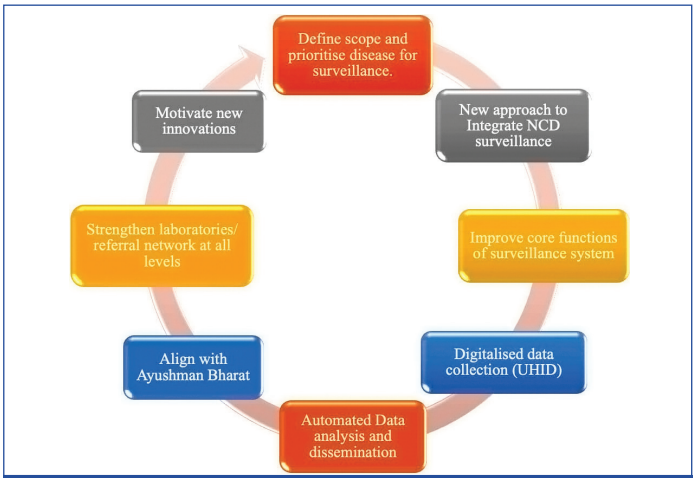
Employing evidence based public health plans, decoding research into public health program and practice, building public health workforce capacity and strengthening laboratory systems are the major strengths of CDC [30]. While, presence of functional surveillance units in each district of the country, progressively increased timely reporting, integration of influenza surveillance in national reporting system, availability of guidelines and Standard Operating Procedures (SOPs) for laboratories, entomologists and veterinary consultants' posts in state surveillance units and the domestic budget support are some of India's existing health surveillance system's strengths [31].

The ECDC, a developed country reporting system have adequate and good quality of professionals in all sectors to react to health crisis [30]. Whereas developing country like India has several weaknesses like lack of adequate human resources, limited private sector involvement, inadequate linkage of morbidity and mortality data, limited focus on non communicable disease surveillance and minimalistic approach in occupational health surveillance [32]. The NNDSS database has mentioned that lack of flexibility to implement changes rapidly to surveillance system as a weakness [29].

Opportunities in the field of surveillance can be created through the Ayushman Bharat scheme, IHIP, National Digital Health Blueprint, Clinical Establishment Act and through Point of Care (PoC) diagnostics and screening [32]. Threats to the existing surveillance are re-emerging and new communicable diseases and anti-microbial resistance which is cited by CDC as major threat too. Other threats being increasing rate of non communicable diseases/acute and chronic conditions [32].

Recommendations

[Table/Fig-1] As communities and economies struggle to improve their surveillance shortages, present moment is the time for developing countries and joint societies to have a glimpse at what went futile and to perform audaciously to employ the necessary improvements to disease surveillance. Courageous changes to execute fully interconnected disease surveillance is required to accomplish the hazards in future. In order to have a unified surveillance system, primarily it is necessary to have a Unique Health information IDentifier (UHID) for every individual. UHID enables the patient and healthcare worker to have comprehensive information on the health condition and ailment status of the individual with One Time Password (OTP) protection. UHID also serves as a linkage between mortality and morbidity data. Second, to align with the Health and Wellness centres under Ayushman Bharat scheme where the individuals can be screened for NCDs and it also initiates syndromic reporting of infectious diseases. Also, additional information on hospitalisation can be obtained through Pradhan Mantri Jan Arogya Yojana (PMJAY) assurance scheme. Third, importance should be given for occupational disease, injuries and pollution under the non communicable disease section apart from diabetes mellitus, cardiovascular disease and cancer which are given more attention. Lastly, encourage new innovations within the existing health surveillance system such as developing new case definitions, new diagnostic techniques such as Proof of Concept (PoC) diagnostic and screening devices and so on [32].



[Table/Fig-1]: Steps towards achieving better health surveillance.

CONCLUSION(S)

The advances made and lessons learnt from earlier experience in recognising and monitoring outbreaks, eliminating and eradicating diseases must be amalgamated to augment Public Health Surveillance in India. Impending enhancement of the organisation will be contingent with sustained support to notify disease along with the utilisation of the digital means to collect, organise and transfer data to different levels. Through IHIP collection of authentic data even from the last mile of the country is made easy. This refined digital surveillance stand will help in moving towards 'one health' approach in near future.

REFERENCES

[1] Wallace R, Kohatsu N. Wallace/Maxcy-Rosenau-Last public health & preventive medicine. 15th ed. The McGraw-Hill Companies, Inc.
[2] Snyder JD, Merson MH. The magnitude of the global problem of acute diarrhoeal disease: A review of active surveillance data. Bull World Health Organ. 1982;60(4):605-13.
[3] A nationwide framework for surveillance of cardiovascular and chronic lung diseases. Washington, D.C.: National Academies Press; 2011. https://www.ncbi.nlm.nih.gov/books/NBK83166/.
[4] Soto R, Ghee A, Nuñez C, Mayorga R, Tapia K, Astete S, et al. Sentinel Surveillance of Sexually Transmitted Infections/HIV and risk behaviours in vulnerable populations in 5 Central American Countries. JAIDS Journal of Acquired Immune Deficiency Syndromes. 2007;46(1):101-11.
[5] India M. Influenza Surveillance Lab Network: Integrated Disease Surveillance Programme (IDSP) [Internet]. Idsp.nic.in. 2021 [cited 10 May 2021]. Available from: https://idsp.nic.in/index1.php?lang=1&level=1&sublinkid=5789&lid=3722.
[6] May L, Chretien J, Pavlin J. Beyond traditional surveillance: Applying syndromic surveillance to developing settings–opportunities and challenges. BMC Public Health. 2009;9(1). Doi: 10.1186/1471-2458-9-242.
[7] Khanna KK, Dhanvijay A, Riley LW, Sehgal S, Kumari S. Cholera outbreak in Delhi-1988. J Commun Dis. 1990;22(1):35-38. PMID: 2230018.
[8] Ramalingaswami V. Psychosocial effects of the 1994 plague outbreak in Surat, India. Military Medicine. 2001;166(suppl_2):29-30. https://doi.org/10.1093/milmed/166.suppl_2.29.
[9] Thakur JS. Integrated Disease Surveillance-A key step to improve Public Health in India. Indian Journal of Community Medicine. 2006;31(4):215.
[10] Surveillance | National AIDS Control Organization | MoHFW | GoI. Naco.gov.in. 2021.
[11] Raut KD, Bhola KA. Integrated Disease Surveillance in India: Way Forward. Global Journal of Medicine and Public Health. 2014;3(4). https://healthmarketinnovations.org/sites/default/files/Integrated%20Disease%20Surveillance%20in%20India%20-%20Way%20Forward.pdf.
[12] India. Brief History: Integrated Disease Surveillance Programme (IDSP) [Internet]. Idsp.nic.in. 2021 [cited 28 April 2021]. Available from: https://idsp.nic.in/index1.php?lang=1&level=1&sublinkid=5768&lid=3697.

[13] India. IDSP Milestones: Integrated Disease Surveillance Programme (IDSP) [Internet]. Idsp.nic.in. 2021 [cited 28 April 2021]. Available from: https://idsp.nic.in/index1.php?lang=1&level=1&sublinkid=5770&lid=3699.
[14] Network e. Nikshay Online Tool for Monitoring TB Control Programme - eHealth Magazine [Internet]. Ehealth.eletsonline.com. 2021 [cited 28 April 2021].
[15] Mogan Ka, Periyasamy AG, Venkatesh U, Kishore J. A situation model of integrated health information platform in India: An anticipated review. International Journal of Community Medicine and Public Health. 2020;7(3):1197.
[16] Ministry of India. Organisation Structure: Integrated Disease Surveillance Programme (IDSP) [Internet]. Idsp.nic.in. 2021 [cited 16 September 2021]. Available from: https://idsp.nic.in/index1.php?lang=1&level=1&sublinkid=5771&lid=3700.
[17] Ministry of India. Data Management: Integrated Disease Surveillance Programme (IDSP) [Internet]. Idsp.nic.in. 2021 [cited 25 September 2021]. Available from: https://idsp.nic.in/index4.php?lang=1&level=0&linkid=412&lid=3695.
[18] Ministry of India. Roles and Responsibilities of RRTs in COVID-19 response: Ministry of Health and Family Welfare [Internet]. Ncdc.gov.in. 2021 [cited 16 September 2021]. Available from: https://ncdc.gov.in/showfile.php?lid=523.
[19] Coronavirus Disease 2019 Testing Basics [Internet]. US Food and Drug Administration. 2021 [cited 25 September 2021]. Available from: https://www.fda.gov/consumers/consumer-updates/coronavirus-disease-2019-testing-basics.
[20] Labs [Internet]. Centers for Disease Control and Prevention. 2021 [cited 25 September 2021]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antibody-tests-guidelines.html.
[21] India. IHIP: Integrated Disease Surveillance Programme (IDSP) [Internet]. Idsp.nic.in. 2021 [cited 16 September 2021]. Available from: https://idsp.nic.in/WriteReadData/IHIP/IHIP%20Manual-Final.pdf.
[22] India. IHIP: Integrated Disease Surveillance Programme (IDSP) [Internet]. Idsp.nic.in. 2021 [cited 16 September 2021]. Available from: https://idsp.nic.in/index4.php?lang=1&level=0&linkid=454&lid=3977.
[23] Dr Harsh Vardhan launches Integrated Health Information Platform (IHIP), the revised next generation Integrated Disease Surveillance Programme (IDSP) digital platform [Internet]. Pib.gov.in. 2021 [cited 29 April 2021]. Available from: https://pib.gov.in/PressReleasePage.aspx?PRID=1709676&s=08.
[24] IHIP-Integrated Health Information Platform [Internet]. Ihip.nhp.gov.in. 2021 [cited 16 September 2021]. Available from: https://ihip.nhp.gov.in/idsp/#!/.
[25] Ministry of India. IDSP-IHIP User manual for P Form users of Health Facilities (PHC, CHC etc) _v3_DJ: Ministry of Health and Family Welfare [Internet]. Idsp.nic.in. 2021 [cited 16 September 2021]. Available from: https://idsp.nic.in/showfile.php?lid=4778.
[26] ECDC activities on epidemic intelligence and outbreak response [Internet]. European Centre for Disease Prevention and Control. 2021 [cited 10 May 2021]. Available from: https://www.ecdc.europa.eu/en/about-us/what-we-do/ecdc-activities-epidemic-intelligence-and-outbreak-response.
[27] NNDSS | Centers for Disease Control and Prevention [Internet]. Wwwn.cdc.gov. 2021 [cited 29 April 2021]. Available from: https://wwwn.cdc.gov/nndss/.
[28] CDC. What is Case Surveillance? | CDC [Internet]. Cdc.gov. 2021 [cited 16 September 2021]. Available from: https://www.cdc.gov/nndss/about/index.html.
[29] Zeng G, Zhang JK, Rou KM, Xu C, Cheng YK, Qi GM. Infectious disease surveillance in China. Biomed Environ Sci. 1998;11(1):31-37. PMID: 9559100.
[30] CDC. Global Health Strategy overview [Internet]. Cdc.gov. 2021 [cited 16 September 2021]. Available from: https://www.cdc.gov/globalhealth/strategy/pdf/cgh_strategy_overview.pdf.
[31] IDSP. Integrated Disease Surveillance Programme [Internet]. Idsp.nic.in. 2021 [cited 16 September 2021]. Available from: http://idsp.nic.in/WriteReadData/l892s/JMM_part2.pdf.
[32] NITI Aayog. Vision 2035 Public Health Surveillance in India White Paper | NITI Aayog [Internet]. Niti.gov.in. 2021 [cited 16 September 2021]. Available from: http://www.niti.gov.in/node/1395.

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