HHS Public Access

Author manuscript

Indian J Public Health. Author manuscript; available in PMC 2023 June 15.

Published in final edited form as:

Indian J Public Health. 2021 January ; 65(Suppl 1): S1–S4. doi:10.4103/ijph.IJPH_1212_20.

Building Public Health Capacity through India Epidemic Intelligence Service and Field Epidemiology Training Programs in India

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India is a vast country with a population of 1.3 billion, 36 states and union territories, and 728 districts.[1,2] Although India has rapidly modernized with sustained economic growth, preventable communicable diseases persist, particularly among lower socioeconomic and marginalized populations. Despite recent successes such as polio eradication, tuberculosis control progress, and growing routine immunization coverage, the COVID-19 pandemic has highlighted gaps in India's public health system including severe shortages of trained human resources.[3–5] As the COVID-19 pandemic was emerging in early 2020, the Ministry of Health and Family Welfare (MOHFW) issued a request to fill over 200 vacancies for epidemiologists across the country.[6,7]

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Although a public health cadre exists at the central level, only a few states (e.g., Kerala, Maharashtra, Odisha, Tamil Nadu, and West Bengal) have a designated public health workforce. In addition, most postgraduate epidemiology training is provided through academic programs which do not include field-based training for outbreak investigations and public health responses. Field epidemiology training programs (FETPs) with an academic degree, such as the Master of Public Health (MPH) at the National Institute of Epidemiology (NIE), India Council of Medical Research (ICMR), or the historical MPH program at the National Centre for Disease Control (NCDC), were established to provide field-based training within the requirements of an academic model.

India Epidemic Intelligence Service program Development, Successes, and Challenges

The India Epidemic Intelligence Service (EIS) Programme was established in 2012 as a collaboration between NCDC and the United States Centers for Disease Control and Prevention. The India EIS Programme is a 2-year nondegree training program in field epidemiology with emphasis on public health surveillance, outbreak investigation, and applied research. Similar to a medical residency program, the EIS Programme employs a mentorship-based, "learning through service" approach to teach competencies and skills. The goal is to train a professional workforce of government epidemiologists to strengthen the public health system. Most trainees, referred to as EIS officers, are medical officers in government service, but the program also accepts nongovernment medical officers. EIS officers are assigned to public health institutions at the central, state, or municipality level. Officers conduct activities under the guidance of mentors, who are senior public health officers from assigned institutions, national health programs, or NCDC. EIS officers also provide public health response surge capacity for emergencies such as natural disasters or the COVID-19 pandemic. Following graduation, officers go on to serve public health careers and become mentors for future EIS officers.

As of July 2020, the India EIS Programme had graduated 46 officers (20% female) and 14 officers (21% female) were in training. Of the 46 graduates, 44 (96%) work in public health including 29 (63%) in government positions across 13 states and union territories. Since 2012, EIS officers have responded to over 140 public health emergencies and events such as outbreaks of acute diarrheal diseases ($n = 51$), vaccine preventable diseases ($n = 35$), vector-borne diseases ($n = 19$), zoonotic diseases ($n = 11$), acute encephalitis syndrome ($n = 6$), and COVID-19 ($n = 6$) as well as natural disasters ($n = 5$), chemical accidents ($n = 2$), and mass gatherings ($n = 2$). The India EIS Programme collaborated with *Indian Journal of Public Health* to produce this journal supplement to highlight outbreak investigations and public health response by EIS officers. Examples of groundbreaking investigations and responses published previously by the India EIS Programme have included the following:

Outbreak of hypoglycemic encephalopathy in Muzaffarpur, Bihar

In 2013 and 2014, EIS officers investigated outbreaks of acute encephalitis syndrome (AES) with high mortality among children (390 cases; 32% case fatality rate in 2014). Through systematic epidemiological, laboratory, and environmental investigation, officers identified

the illness as hypoglycemic encephalopathy from naturally occurring hypoglycemic toxins in litchi fruit.[8,9] Based on the findings, the MOHFW recommended minimizing litchi consumption, providing an evening meal for children, and implementing rapid glucose testing and treatment for suspected cases, which likely contributed to preventing subsequent outbreaks.[10]

Disease surveillance during Kumbh Mela in Ujjain, Madhya Pradesh and Prayagraj, Uttar Pradesh

In 2016 and 2019, EIS officers were deployed to set up and support daily disease surveillance during Simhastha Kumbh Mela in Ujjain, Madhya Pradesh, and Ardh Kumbh Mela in Prayagraj, Uttar Pradesh, respectively. Together these mass gathering events were attended by nearly 120 million people. Officers modified Integrated Disease Surveillance Programme (IDSP) reporting to collect real-time data. The surveillance system identified 56,600 events, 15 deaths, and two acute diarrheal disease outbreaks in Ujjain[11] and 156,000 events, eight deaths, and 11 early warning signals in Prayagraj.[12] The real-time use of the IDSP platform is now recognized as a best practice to identify, control, and prevent morbidity and mortality associated with mass gatherings in India.

Despite numerous successes, scaling the India EIS Programme training model has been challenging. Growth of a mentor-based training program is limited by the number of dedicated mentors, most often EIS graduates, willing and able to provide 2 years of intensive mentorship to officers. Although government medical officers are the primary audience for training, only 62% of EIS officers have been government employees. Despite robust advocacy by NCDC, many government candidates who are accepted into the program are denied training leave and support by their state governments to participate. In addition, because many states do not have a public health cadre, opportunities for career advancement upon completion of the EIS Programme are limited.

The India EIS Programme provides a minimum of 68 weeks of field-based epidemiology training aligned with global FETP accreditation standards.[13] The emphasis is to build practical applied epidemiology competencies and skills. In contrast, university-based academic programs, which grant an MPH degree, focus on classroom instruction rather than experiential learning. These competing requirements make harmonization and linkage with an academic degree challenging. Because the India EIS Programme does not offer recognized academic instruction, the program does not meet registration requirements for the Diplomate of the National Board – Field Epidemiology examination by the National Board of Examination.[14] The lack of an academic degree, professional recognition, and a defined public health career path with advancement opportunities has deterred many government officers from applying.

India Epidemic Intelligence Service and Field Epidemiology Training Programs Expansion

To help meet the country’s extensive training needs, the Ministry of Health and Family Welfare expanded the EIS Programme by adopting a multitiered field epidemiology

training approach to public health workforce development with additional collaborating institutions in 2016. Three dedicated levels of training – advanced (e.g., EIS Programme), intermediate, and frontline – were planned to build national, state, and district-level capacity to prevent, detect, and respond to public health threats and meet the target of one trained field epidemiologist per 200,000 population aligned with the World Health Organization's (WHO) revised 2005 International Health Regulations and Global Health Security Agenda core public health capacity goals.[15–17] The Frontline program focused on in-service training for district-level staff, using a 3-month basic field epidemiology standardized curriculum and field projects. From 2016 to 2020, three institutions (National Institute of Health and Family Welfare, NCDC, and NIE) implemented frontline in eight states and trained 273 district-level officers.

As part of the National Polio Surveillance Programme transition plan, an EIS training hub was established at the WHO Country Office in December 2016.[18] The training was planned as an advanced-level in-service program to allow surveillance medical officers to meet public health work responsibilities while concurrently fulfilling training requirements. The first cohort of 18 National Public Health Surveillance Project (NPSP) surveillance medical officers graduated in December 2019. In 2020, the WHO transitioned to an 18-month, intermediate-level in-service program and changed the name to the Applied Epidemiology Programme (AEP). In July 2020, 26 NPSP officers started in the first AEP training cohort.

In August 2018, an EIS training hub was established at NIE, ICMR, in Chennai. The NIE EIS Programme is a 2-year, advanced-level in-service training exclusively for state government officers. In 2020, the NIE EIS Programme had 21 officers in training across the first two cohorts including 11 officers in a noncommunicable disease epidemiology track.

As of July 2020, 86% of alumni and 98% of current officers across the three hubs have been engaged in COVID-19 pandemic response for municipality, state, and central governments. Current EIS officers have established and strengthened surveillance systems, investigated COVID-19 clusters in health care and community settings, and conducted screening, contact tracing, and other containment and mitigation activities. EIS alumni have managed resources and logistics in COVID-19 response leadership positions, built capacity through training and mentoring, strengthened surveillance and response systems, conducted hospital assessments, implemented infection prevention and control measures, and led serological surveys. In addition, frontline graduates are leading and implementing COVID-19 response activities in their respective districts across eight states.

The COVID-19 pandemic has highlighted the critical role of epidemiologists to rapidly identify, respond, and manage outbreaks and the severe shortage of trained field epidemiologists in India and globally. With increased advocacy, new partners, and critical funding for COVID-19 response, the MOHFW should vastly expand the three tiers of field epidemiology training – frontline, intermediate, and advanced – to build core epidemiology and public health capacity aligned with the National Health Policy 2017.[19] Operationally, this will require an MOHFW-led coordinating body; creating additional training hubs and strengthening existing public health institutions such as NCDC and NIE; increasing training

cohort size; recruiting and retaining EIS Programme graduates and mentors in government service by establishing professional recognition, career pathways, and incentives; creating a network of EIS and FETP alumni to strengthen mentorship and provide response surge capacity; enrolling more women and candidates from underrepresented states; and opening EIS and FETP training opportunities to nonmedical officers such as public health veterinarians. In addition, the MOHFW should partner with universities and academic institutions to develop more flexible approaches for officers to meet requirements for academic degrees. A professional workforce of field epidemiologists is crucial to effectively manage the COVID-19 pandemic and build a stronger public health system for India.

Acknowledgments

The following people and institutions have been instrumental to the success of the India Epidemic Intelligence Service and Field Epidemiology Training Programmes: L.S. Chauhan, Anil Kumar, C.S. Aggarwal, S. Venkatesh, A.C. Dhariwal, Jagdish Prasad, J.P. Narain, National Center for Disease Control; Rubesh Kumar, A. K. Savitha, and Manikanda Nesan, National Institute of Epidemiology, Indian Council of Medical Research; Maria Concepcion Quizon, Maria Concepcion Roces, Mohan Kumar, Kanica Kaushal, and Karishma Kurup, South Asia Field Epidemiology and Technology Network, Inc.; Sharon Daves, Richard Dicker, Kenneth C. Earhart, Rajeev Sharma, and Laura Shelby, Division of Global Health Protection, Center for Global Health, U.S. Centers for Disease Control and Prevention.

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