

# Public health preparedness, syndromic surveillance, and response during the largest religious gathering at the Catholic pilgrimage center of Velankanni in South India: 2016

Manickam Ponnaiah<sup>1</sup>, Viduthalai Virumbi<sup>1</sup>, Upasana Sharma<sup>1</sup>,  
Sendhilkumar Muthappan<sup>1</sup>, Ganeshkumar Parasuraman<sup>1</sup>,  
Premkumar Balasubramanian<sup>2</sup>, Vijayalakshmi Venkatachalam<sup>2</sup>,  
Kolandaswamy Karumanagoundar<sup>2</sup>

<sup>1</sup>Department of Online Courses, ICMR- National Institute of Epidemiology, Chennai, Tamil Nadu, India, <sup>2</sup>Directorate of Public Health and Preventive Medicine (DPHPM), Tamil Nadu, India

## ABSTRACT

**Background:** The dynamicity and mobility of the population in a mass gathering setting pose a challenge to traditional disease surveillance methods and strain the local health services. Velankanni is one of the most sacred Christian pilgrimage places located in Nagapattinam, Tamil Nadu, India. We participated in the Velankanni festival to describe the public health preparedness, surveillance, and response activities carried out during the festival. **Methods:** This was a cross-sectional study. We reviewed the national and international guidelines and published literature and discussed with the key stakeholders. We developed a checklist to observe public health preparedness activities. We facilitated the staff and monitored the activities by the implementers. We established the syndromic surveillance in the designated locations of the event and used tracker software to capture the data. Emergency medical teams were formed with trained health personnel to respond to medical emergencies. **Results:** The team monitored all the public health activities. There are 59 primary care public health facilities and nine ambulatory Mobile Medical Units, with 160 medical officers available at the site. Of the 16,169 persons who attended the medical camps, 9863 (61%) were males and 8408 (52%) were aged 15–44. Acute diarrheal disease was the most frequent of the reported syndromes, followed by injuries, acute febrile illness, and animal bites. **Conclusions:** There was no outbreak of any disease either identified or reported. Our findings suggest that risk assessments should be used, and establishing an Incident Command Center is vital for executing command and control mechanisms during mass gatherings.

**Keywords:** Mass gathering, public health preparedness, syndromic surveillance, Tamil Nadu, Velankanni

**Address for correspondence:** Dr. Manickam Ponnaiah, Scientist F (Epidemiology), Division of Online Courses, ICMR-National Institute of Epidemiology, R-127, Second Main Road, TNHB, Ayapakkam, Chennai - 600 077, Tamil Nadu, India. E-mail: manickam@nie.gov.in

Received: 11-11-2023

Revised: 23-12-2023

Accepted: 13-03-2024

Published: 26-07-2024

### Access this article online

#### Quick Response Code:



**Website:**  
<http://journals.lww.com/JFMPC>

**DOI:**  
10.4103/jfmpe.jfmpe\_1815\_23

## Introduction

According to the World Health Organization (WHO), “an organized or unplanned event can be classified as a mass gathering if the number of people attending is sufficient to strain

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**How to cite this article:** Ponnaiah M, Virumbi V, Sharma U, Muthappan S, Parasuraman G, Balasubramanian P, *et al.* Public health preparedness, syndromic surveillance, and response during the largest religious gathering at the Catholic pilgrimage center of Velankanni in South India: 2016. *J Family Med Prim Care* 2024;13:3135-42.

the planning and response resources of the community, state, or nation hosting the event".<sup>[1]</sup> High crowd density, international visitors, temporary catering, makeshift accommodation, and toilet facilities are the key factors that may contribute to increased risk of communicable diseases and consequent increased demand on local health services.<sup>[2]</sup> Thus, mass gatherings present a particular challenge for public health and burden the local health system. Participants of the mass gatherings potentially introduce disease within their communities soon after the gathering. This dynamicity and mobility of the population in a mass gathering setting pose a challenge to traditional disease surveillance methods. Therefore, public health preparedness is seen as a basic requirement to tackle communicable diseases and other health hazards in a mass gathering setting.<sup>[3]</sup> During the event of mass gathering, the extent of the public health response is determined by the risk assessment outcome, level of available resources, and integration of response by appropriate sectors.<sup>[3,4]</sup>

A thorough risk assessment coupled with enhanced epidemiologic surveillance and response in a mass gathering was emphasized as a minimum standard by the WHO.<sup>[5]</sup> Successful pre-event planning and emergency response where local, state, regional, and national authorities come together to support the individual security, public health, and logistical issues of special events are crucial.<sup>[6]</sup> During these large-scale events, local health departments play a significant role in public health preparedness, disease surveillance, and response. In addition, monitoring multiple potential risk factors, such as the time (weather and seasonal infectious diseases), type, duration, and characteristics of the participants of the mass gathering, is done by local health departments.<sup>[7,8]</sup>

India is a land of festivals and fairs. Thousands of special events and mass gatherings (e.g. conventions, sporting events, community-based festivals, and parades) occur throughout the year. Notified festivals at places of worship and annual religious prayers are widespread across the country. Large crowds participate in such festivals as practitioners of the rituals or merely spectators, where the duration varies from a few hours to months.<sup>[9]</sup> Velankanni is one of the most sacred Christian pilgrimage places located in the eastern coastal district, Nagapattinam, of Tamil Nadu, a southern state of India. It is home to a significant Roman Catholic Latin Rite shrine called the Basilica of Our Lady of Good Health. Velankanni's annual festival, starting in the last week of August and lasting for 10 days, attracts millions of pilgrims nationally and internationally.<sup>[10]</sup> Diversified traditional beliefs of this pilgrimage center have led to the cultural hybridity of Hinduism and Catholicism, attracting pilgrims from religions other than Christianity.<sup>[11]</sup> Factors such as the location of the pilgrim center, large crowd, practice of the "walking pilgrimages," where pilgrims reach the place by walk from distant places and events like Flag hoisting ceremony, religious mass prayer gathering, novenas, carrying a palanquin of Mary in a procession, head tonsuring and ear-piercing ceremonies, and so on demand significant public health preparedness, surveillance, and response activities for this

event.<sup>[12-15]</sup> We participated in the Velankanni festival to describe the public health preparedness, surveillance, and response activities carried out during the festival.

## Methods

To completely understand the public health preparedness, planning, and management activities in the Velankanni festival, the investigators made multiple pre-event field visits a month before the festival. This was followed by extensive field observation during the event from August 28 to September 09, 2016. The inquiry domains were focused on medical preparedness, safe water supply and sanitation preparations, hygiene, vector control, crowd management, Information Education and Communication (IEC) activities, and food hygiene. We adopted a cross-sectional study design in our observations to collect the relevant data related to this mass gathering. We conceived a framework to establish syndromic surveillance in the designated locations of the event. Based on the review and discussion with key stakeholders, we identified a list of diseases/syndromes to be captured and finalized the definitions of listed syndromes using international guidelines. A dedicated trained team was involved in emergency management at the festival site.

### Preparedness activities

During the pre-event (19/08/2016), we reviewed national and international guidelines and published literature on mass gatherings. We used an interview guide to survey key stakeholders involved in the festival's organization and its management. We discussed the past experience with key stakeholders, including the district health authority, the Deputy Director of Health Services (DDHS), medical officers of different grades, Health Inspectors, fire personnel, police personnel, community representatives, administrative authorities, and festival committee members in conducting the festival. We participated in orientation meetings of the Velankanni administration and that of the festival committee. Based on the above, we developed a checklist to observe public health preparedness during the festival. Based on the inputs received from the above exercise and in collaboration with the district team, we aided in formulating a plan of action for implementing public health surveillance. We facilitated the training of health staff and volunteers on water testing procedures, vector control measures (fly and mosquito), supervision of waste management, toilet maintenance, and food hygiene.

During the event, we reviewed records of health facilities, Integrated Disease Surveillance Programme (IDSP) reports, and water sample testing reports at various sites. We visited health facilities (including camps) of all types and water treatment plants to observe and record the level of preparedness in terms of human resources, equipment, consumables, drugs, disposables, disease surveillance strategy, public conveniences, awareness, and adherence to the procedures discussed in the pre-event orientation meetings by the implementers at various levels.

## Syndromic surveillance

We used the District Health Information System (DHIS) 2 tracker software to capture the syndromic surveillance data. We trained all the medical officers and field staff on identifying and capturing the details on diseases and syndromes reported by the pilgrims and participants of the event. They also underwent training in data entry using DHIS tracker capture, including saving and transmitting the data. An Incident Command Center (ICC) was established at the Velankanni primary health center to detect the signals, verify alerts, and initiate the response on time.

## Response activities

Government officials including health formed a team to manage the health and non-health emergencies. The team continuously followed the festival activities and relevant data to identify the outbreaks or any other incidents from the ICC.

## Results

We describe the observed preparedness, surveillance, and response activities. We observed vector control, sanitation, water and food hygiene, IEC, police and fire control, and crowd management activities. We established syndromic surveillance and response activities.

## Preparedness activities

### Vector control

The festival location is divided into 15 administrative wards, including the festival site. Under the local health authority and a senior entomologist's supervision, a zonal entomology team was formed to execute vector control activities during the festival. A two-member field staff team made the vector source reduction in the field apart from the dissemination of public health advisory on source reduction by the general public. A cadre of field staff called domestic breeding checkers (DBC) did door-to-door inter-personal communication to the households around the festival site. Under the National Vector-borne Disease Control Programme (NVBDCP), cadres called spraymen were involved to perform anti-adult measures using insecticides targeting the adult house flies and anti-maggot measures targeting the larval house flies.

The places where fly control was intensive included the compost yard of the city, fish market, temporary shelters, and other fruits, sweets, and eating establishments. Anti-adult mosquito measures such as indoor and shelter fogging were prioritized. Two cycles of thermal fogging were completed for each house in the area during the festival period. For *Aedes* control, fogging was done using Temephos during peak biting hours (late morning and early afternoon), and for other mosquitoes, it was done using Pyrethrum and diesel during dawn and dusk.

### Water hygiene

Considering the potential risk of waterborne disease in mass gatherings, the local health authority implemented a safe

water supply in the festival site and the neighborhood during pre-festival (August 21–28, 2016), during the festival (August 29–September 9, 2016), and post festival (September 10–15, 2016) period. The overhead tanks (OHTs) and water sumps were routinely chlorinated. A separate health field staff cadre was deployed to chlorinate and monitor the tank cleaning. The field health staff chlorinated the OHTs and water sumps with liquid chlorine. The field health staff monitored the chlorination using chloroscopes and chlorine measurement charts. The chlorination level was maintained between 1.5 and 2 ppm at pumping stations, ground-level reservoirs, and OHT and between 0.5 and 1.0 at distribution points. In addition, water samples were periodically sent to the district public health laboratory for analysis. We found the water had recommended microbiological and physical standards.

### Sanitation

#### Toilets

Separate temporary toilets for males and females were set up at crowded public places. Seventy-four temporary (37 male and 37 female) toilets with attached water tanks were established. Soakage pits were constructed for temporary toilets, and public usage of these toilets continued until the last day of the festival. There were a total of 642 functional units of toilets that were adequate for serving the festival requirements for which the source of water was bore wells and hand pumps. In addition to this, a mobile toilet was also provided during the festival period.

### Drainage system and solid waste management

Nine sanitary teams (20 persons per team) engaged for solid waste management. This included 175 workers resourced from the church administration and 85 sanitary workers from the local administration. We noted that personal protective equipment like gloves, masks, and shoes were provided to the workers.

### Food hygiene

According to the Food Safety and Standards Authority of India act, mobile vendors have to procure a license from the food safety department before the festival begins for this kind of mass gathering festival. They have to get a registered license from the municipality or village by approaching the designated local food safety officer (FSO). Before the festival, the public health authorities addressed the public and vendors through pamphlets, newspapers, and inter-personal communication to facilitate license delivery to vendors and information on food hygiene practices. A designated officer from Velankanni city was deputed to maintain food hygiene during the festival. Samples were collected from sacred food offerings (*annaprasadam*) for food analysis. We observed that many visitor pilgrims provided offerings without registration despite instructions and advice.

## Crowd management for public health preparedness

### Police and fire safety department

The police department was actively involved in festival arrangements. Their main functions included traffic management,

bomb detection, and video surveillance for crowd monitoring. Ten surveillance cameras were installed at various points in Velankanni (the police did not reveal places of surveillance for security reasons). The analysis of surveillance camera footage was recorded regularly. No concrete method was adopted for the walk-in strategy, that is, the headcount method. The calculation was based on the number of vehicles coming inside Velankanni and the number of people staying in one area or occupying a specific location.

The local authority of the fire safety department (FSD) inspected Velankanni before the festival started and was responsible for monitoring the fire safety arrangements. Parking places were chosen depending on the crowd and level of accessibility to that area. FSD had deputed ten fire engines, one emergency rescue team (ERT) vehicle, one first aid motorbike, and two ambulances during the festival. A temporary control room headed up by the District Superintendent was set up at a school in Velankanni. This comprised the departmental staff from health, police, coastal guard, and local bodies. Coastal security guards were in charge of surveillance at Velankanni Beach. A diversion route plan, ambulance path, and VIP route were also planned. Passes were issued for vehicle management. Many government departments worked closely for preparedness and surveillance activities [Figure 1].

**Volunteers**

Volunteers from the non-governmental organizations (NGOs) supported during the festival. Some of the activities performed by volunteers were the distribution of drugs, free ambulance service, distribution of free sacred food offerings (*annaprasadams*),

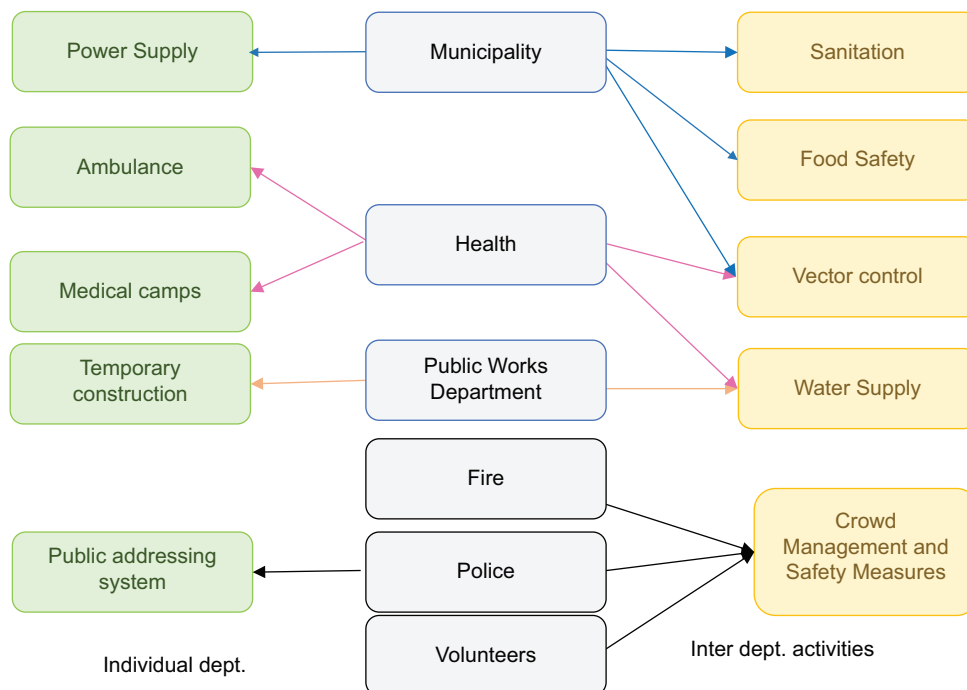
vehicle parking services, and sanitary support around the church area. The volunteers adopted a dress code to make identifying them easier for the public. In addition, flyers were distributed among visitors to raise awareness about the volunteer services available during the festival. Additionally, local fishermen volunteered to supervise the safety of people in the beach area as lifeguards.

**Information, education, and communication (IEC) activities**

During the festival, a campaign in which street bikes were used to share health information and raise awareness on good hygiene practices was held daily from 9 AM to 8 PM. IEC materials were utilized as prominent strategic locations such as hoardings, handbills, displays, and posters to distribute and display standard health messages that the public health department outlined on topics such as sanitation, HIV prevention, safe drinking water, food and nutrition, hand washing, and vector-borne disease control.

**Public health advisory on food safety**

Food handlers at the food processing facility were given health education on nail trimming techniques, hand washing techniques, and wearing a cap and not walking barefoot. We conducted training on the cleaning of cooking utensils and food serving vessels. Further instructions on solid waste management, water stagnation, and chlorination were given. Barbers were directed to use a single blade for tonsuring. Fish vendors were instructed on how to keep the fish safe in the commercial area. The Veterinary Department issued guidelines to slaughterhouses regarding the usage of registered livestock.



**Figure 1:** Inter-departmental coordination plan for implementing public health preparedness during Velankanni festival, South India, 2016

## Medical camps

We described the method of preparedness and response activities plan for the festival [Figure 1]. Eight special medical camps were set up in Velankanni and the surrounding areas during the Velankanni festival. Two of these camps were hospitals on wheels. Every medical camp had three work shifts (day and night), and each work shift had a medical officer, a staff nurse, a pharmacist, a hospital worker, and a driver. Each camp was supported with a vehicle for rapid and emergency transportation. Emergency medical kits were provided to medical camps for managing medical emergencies. In addition, dedicated corners for oral rehydration solutions were established at all the camps of the Velankanni festival area.

Patient flow was coordinated at the on-site medical camp by keeping designated corners, including registration, vital monitoring, medical consultation, drug dispensing, and medical dressing. The camps were functional on all the days of the festival. The local health officials organized drugs and equipment to the campsites. The state public health and preventive medicine department were responsible for drug allocation for the medical camps. The campsites were selected based on the pilgrims' footfalls and the clustering of temporary stays. Some of the campsites were established at the entry point of the festival site, passenger bus station, and railway station to cater to travelers' health needs. Similarly, one campsite was chosen in the beach area since many pilgrims, residents, and travelers visited during the festival period.

A 30-bedded primary health center located in this area served as a referral unit for patients along with treatment. An ambulance was stationed near each campsite to transport any high-risk patients identified in the medical camp immediately. Static camps were conducted in three shifts daily, and mobile medical units (MMUs) worked from 8 AM to 8 PM during the festival days. A private healthcare provider also established a medical camp in the festival site. Two health staff were posted in the district headquarters hospital to record in-patient admissions on the listed syndromes. Fifty-nine primary care public health facilities and nine ambulatory mobile medical units with 160 medical officers served in the site. Thus, the system was prepared enough to pool the resources to the festival site in case of any emergency.

## Syndromic surveillance

We successfully established a syndromic surveillance system on enlisted syndromes with standard definitions. This allowed public health data to be collected quickly and in a format that health department employees could quickly analyze. With the help of the DHIS-2 tracker capture system, we collected the information of these syndromes and shared it with an ICC for analysis and report generation. This syndromic surveillance system was continued from August 28, 2016 to September 8, 2016. During this period, the system captured the data on a daily basis and provided feedback for action. The collected

syndromic data were shared with an established ICC for analysis and report generation [Figure 2]. The syndromic surveillance identified 16,169 reportable conditions from August 28, 2016 to September 08, 2016 from the Velankanni festival area. The highest numbers of cases were reported on August 29 and September 06, 2016. On these days, a prime festival occurred, which brought a large number of people to congregate at the festival site. Among the collected, more than 60% (n = 9,863; 61%) were males, and more than 50% (n = 8,408; 52%) were aged 15–44 years and the majority were from Dindugal district (n = 2,102; 13%) [Table 1]. Acute diarrheal disease was the most frequent of the reported syndromes, followed by injuries, acute febrile illness, and animal bites [Figure 3]. We did not find any clustering of either acute febrile illness or diarrheal disease observed during the festival.

## Planning for rapid response in the situation of outbreak potential

Emergency medical teams were formed with trained health personnel (medical officers, health inspectors, staff nurses, and field staff) to respond to any medical emergency during the festival period. Despite large numbers of people who attended the festival, no outbreak of any disease was identified or reported.

## Discussion

We participated in the mass gathering at the pilgrimage site of Velankanni in South India and described public health preparedness, surveillance, and response activities. We documented several noteworthy practices that have the potential for replication in similar events. Inter-departmental coordination, one of the key components required for successfully managing a mass gathering event, was well demonstrated. We observed the festival

**Table 1: Demographic characteristics of participants who attended medical camps at Catholic pilgrimage center of Velankanni in South India: 2016 (n=16,169)**

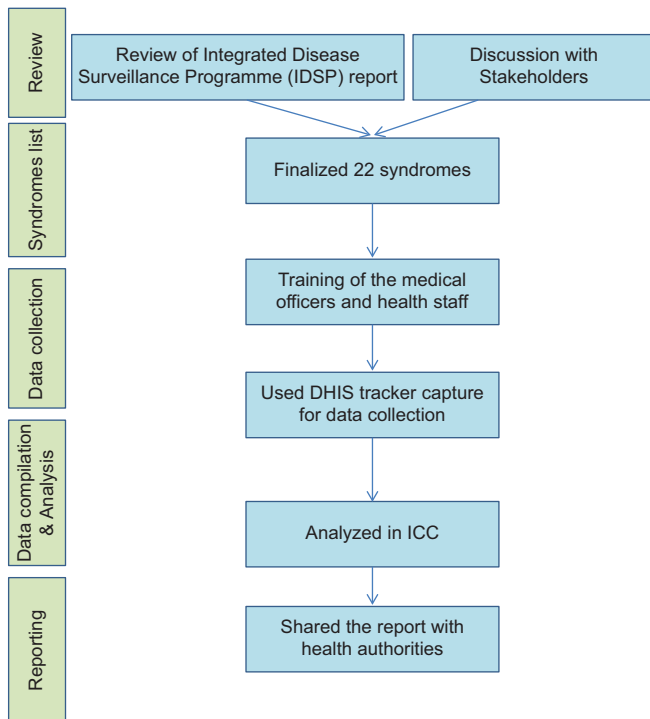
Characteristics		Number of cases (n)	%
Gender	Male	9,863	61
	Female	6,306	39
Age	0-4	1,455	9
	5-14	1,779	11
	15-29	4,527	28
	30-44	3,881	24
	45-59	3,234	20
	>60	1,294	8
Place of residence	Dindugal	2,102	13
	Chennai	1,940	12
	Tiruchirappalli	1,940	12
	Nagapattinam	1,617	10
	Other states	1,617	10
	Thanjavur	970	6
	Pudukottai	485	3
	Tiruvarur	485	3
Other districts	5,012	31	

preparedness arrangements were well planned and administered. Our team noted more focus on communicable diseases than non-communicable diseases and poor involvement of private health providers. The syndromic surveillance effectively captured illness during the festival time and used immediate actions.

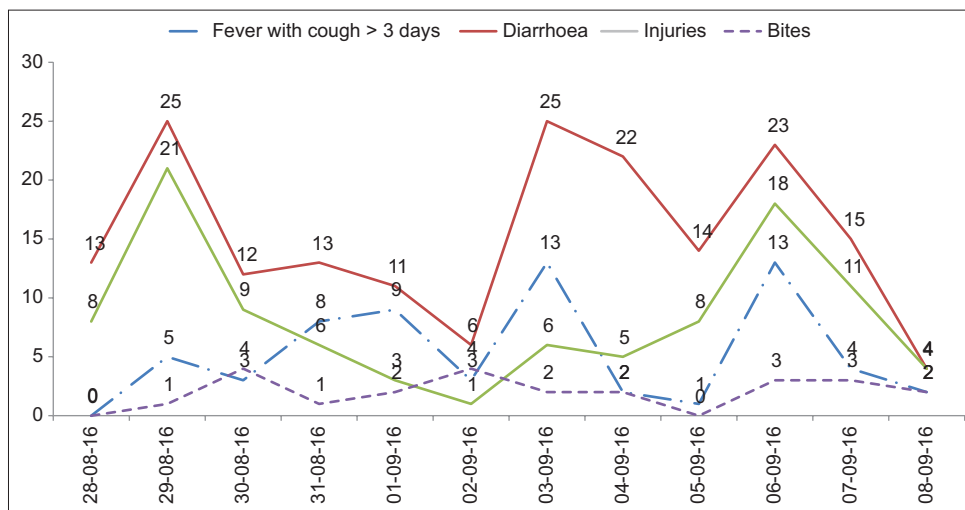
Research carried out in the past has highlighted that mass gathering medicine must be multi-disciplinary if it is to be successful.<sup>[7,16-18]</sup> The inter-departmental interaction model for ensuring integrated security during the World Cup and Confederations Cup matches in Kazan proved effective.<sup>[19]</sup> In a study conducted during the London Olympics in 2012, shared

micro-level leadership, linkages, and experiential learning enabled the development of collaboration.<sup>[20]</sup> Healthcare services were found to be satisfactory. Well-equipped medical camps on multiple sites significantly reduced the referral rates and the burden on existing health facilities. Similarly, earlier studies have concluded that the provision of on-site physician-level medical care for non-disaster injuries and medical complaints at mass gatherings significantly reduces the number of hospital referrals and patient presentation rates to the hospital.<sup>[21,22]</sup> Even effective healthcare planning and response to a mass gathering require collaborative planning.<sup>[23]</sup>

We observed the preparedness activities. Environmental hygiene was promptly monitored; safe drinking and water sanitation were provided throughout the festival. However, the availability of personal hygiene facilities was found to be inadequate. Consequently, the environment was not conducive to hand washing due to the absence of soaps at the hand washing stations. Contrary to this, the Kumbh Mela was an example of a large mass gathering in our country where soap companies used a heating stamp to print imprints of “wash your hands” onto *chapattis* (Indian bread) alongside meal orders and also by providing soaps in the washrooms of all the eateries to disseminate their message more widely.<sup>[24]</sup> At the time of routine monitoring for chlorination at the concerned outlets, water was found to be non-chlorinated. These incidents revealed the flaw in coordination between different authorities and the importance of written standard operating procedures for other circumstances.<sup>[25]</sup> Pilgrim-centered health promotion and health education campaigns on topics of public health importance, such as the importance of hand washing and the use of masks, can bridge the gap between knowledge and practice in pilgrims, empowering them and assisting them in coping with health hazards. Additionally, there is a considerable scope for researchers to develop and adapt modern methods and technologies to help crowd management and further improve water, sanitation, and hygiene in such events in the future.



**Figure 2:** Data collection flow of established syndromic surveillance at Catholic pilgrimage center of Velankanni in South India: 2016



**Figure 3:** Key syndromes reported in the medical camps at Catholic pilgrimage center of Velankanni in South India: 2016

Overall, the focus of health care services was heavily skewed toward communicable diseases, and the emphasis on managing non-communicable diseases (NCDs) and NCD-related emergencies was less. However, an Iraq-based study reported that the number of NCD emergencies quadrupled, and the average daily cases doubled during the MG event. This demonstrates an enormous load of NCD emergencies on hospitals during MG events and the need for effective service planning.<sup>[26-28]</sup> Because of the epidemiological transition and the nature of the event, the potential for NCD emergencies is high, so orienting the healthcare system toward managing NCD emergencies is vital to prevent such emergencies. Regarding the management and planning of the event, our study highlighted private health providers had little involvement. Several studies found insufficient health workers and that only limited public health services, infection control, and supplies were available at clinics.<sup>[10,11]</sup> Hence, in the future, it would be beneficial to engage them in public health preparedness as a strategy to overcome the shortage of healthcare workers.

Our findings suggest that establishing an ICC is vital for executing command and control mechanisms during the MG, as in other studies.<sup>[17,29,30]</sup> Similarly, in the past, enhanced epidemiologic surveillance during various other mass gatherings has strengthened public health response capacity and preparedness to make informed decisions and implement public health actions in a timely way and has served as a public health legacy in various other countries.<sup>[31-35]</sup> Experience of syndromic surveillance at mass gatherings indicates that injury-related outcomes, such as heat-related illness or motor vehicle accidents, can be more accurately measured than high-consequence infectious disease outbreaks.<sup>[5,36,37]</sup>

We collaboratively established the capture of syndromic surveillance data that enabled reporting and detection of public health threats during mass gatherings. Our findings suggest that risk assessments should be used to determine the level of public health response, available resources, and response integration by concerned departments. The development of modern technologies and methods can also aid in crowd management.<sup>[38]</sup> As part of planning a mass gathering event, we recommend local hospitals be involved in medical support for on-site support and disaster response. The results of our study emphasized the need for authorities to prepare for mass gatherings with adequate resources. Previous studies have shown that large crowds may particularly strain EMS, healthcare, and security resources, requiring planning.<sup>[20,38]</sup> Furthermore, our study demonstrated that public health preparedness for an MG ensures that the action plan is updated and authorities have sufficient knowledge of the risks to identify them. Preparedness and surveillance activities during MG may increase physicians' workloads in healthcare facilities. The outbreaks and management of huge crowds strain the healthcare systems and burden the healthcare physicians.<sup>[39]</sup> Hence, study results will be helpful for physicians at the facilities to work more efficiently during the mass gatherings. Ongoing surveillance in conjunction with event-based surveillance in MGs can improve the effectiveness of risk mitigation measures in response to public health problems.

## Limitations

We did not use the syndromic surveillance data for tracking or follow-up of the cases. The cross-notification was also not done during the festival. We did not get access and analyze the private facilities' data. This would have provided an exact scenario during the festival.

## Conclusion

Our findings suggest that risk assessments should be used to identify potential risks. The inter-departmental coordination and establishment of an ICC are vital for executing command and control mechanisms during mass gatherings.

## Recommendations

Based on the findings, we recommended (1) the development of a comprehensive action plan for the festival involving inter-departmental stakeholders, (2) the involvement of the private medical sector for on-site medical support and disaster response, and (3) the updation of the Tamil Nadu Public Health act that governs such mass gathering events, especially notification of fairs and festivals component.

## Ethical approval

We obtained approval to conduct the study from the Institutional Human Ethics committee of the Indian Council of Medical Research (ICMR) –National Institute of Epidemiology (NIE).

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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