



## **Digital and Non-Pharmaceutical Measures for Prevention of Biological Emergencies during Mass Gatherings in India**

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### **ABSTRACT**

*Mass gatherings (MG) are an effective breeding ground for various ills and pose diverse risks that include injuries, which may be occupational or otherwise and transmission of infectious and communicable disease. While pharmacological assistance may surely be the key to identification and subsequent remedies, certain non – pharmacological means offer simple and cost-effective preventive measures. In the COVID pandemic situations, it's important to revisit such measures for a multidirectional approach to combat any emerging scenarios. The methodology includes an in-depth review and discussion about the good practices followed and the lessons learned in dealing with the bio threats arising during the mass gatherings across the world. Any MG event may turn into a possible hotspot for the emergence, spreading, and scattering of emerging infectious disease. Prevention of biological incidents at MG is an important preparedness step. COVID pandemic has proved the efficiency of affordable and adaptable technology options on mobile, computer, wireless or bluetooth available in the world today, in managing the incidences of infectious diseases in MG. A careful analysis of digital and non-pharmaceutical interventions resulted in emergence of a multi directional approach. Cost-effective solutions utilizing digital innovations and non – pharmaceutical measures are valuable in recognizing and preventing biological emergencies and their spread. Following these modest ways is the best appreciation to secure the event against infectious and contagious diseases and/or food/vector borne illnesses.*

**KEYWORDS:** Bio- Threats, Mass Gathering, Non-Pharmaceutical Interventions, COVID-19, Public Health

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### **INTRODUCTION**

Mass gatherings, planned or unplanned, has the potential to strain the resources and responses of the community, wherever they may take place.<sup>1</sup> For a country like India which is an old civilization and a host to at least four popular religions, there are many opportunities to socialize, often with negative outcomes. In India, relaxation of the forced lockdown due to COVID – 19 conditions, introduced a new concept of revenge travel where the people went on a vacation after an extended period of lockdown. This revenge travel, which was also welcomed by the tourist places for obvious economic reasons, has led to most well-known touristy sites being crammed with visitors. although major festivals of Ganesh Chaturthi, Navratras and KanwarYatra has been shelved by the state governments for the second year in row, the revenge tourism continues to be a breeding ground for spread of Corona Virus. The Kerala government's order allowing a three-day relaxation in Covid-19 restrictions ahead of Bakrid (Eid-ul-Azha) festival lead to the State registering a massive surge in coronavirus infections for the past many weeks even as the overall numbers across India have been falling rapidly since the second wave peak. Any Mass gathering (MG) event may turn into a possible hotspot for the emergence, spreading, and scattering of emerging infectious disease. Ailments like respiratory tract infections (like SARS and ILI) are the most common, easily communicated and destined to be spread broadly past the gathering site by participants returning to their native places. Variables that adds to the spread of these diseases during MG, includes the place/area of such gatherings, extent of crowding, climatic conditions, age, hygiene conditions and the health status of the participants. In recent decades, the public health specialists have concentrated on the transmission of infections and their effect on the participants at the MGs and the general health system. The appearance and reemergence of new deadly microbes with epidemic potential infecting people have uplifted the consciousness of the capability of rapid spread at mass social occasions and gatherings and calls for more noteworthy worldwide consideration and examination.

## **MAJOR INDIAN FESTIVALS INVOLVING MASS GATHERINGS**

Festivities and celebrations in India are essential due to its social, cultural and religious diversity. India being the second most populated country with diverse religious heritage and legacy has many festivals that become the basis of MG<sup>2</sup> and pull in enormous hordes of divergent physical and behavioral qualities. Celebrations breathe life into public activity and join individuals by uniting them in blissful festival of significant occasions and in shared recognition of euphoric past.

As a part of its rich and diverse heritage, Indians celebrate many festivals around the year for different reasons – to appease the god, celebrate child-birth, weddings, success in examination, etc. Some of the major religious festivals celebrated during autumn and winter months are listed in Table 1.<sup>2</sup> With the society culture deeply rooted amongst Indians, it's impossible to let go of any event not involving the relatives, friends and members of extended family. There is an expanding acknowledgment that our prosperity is formed by social factors, for example, our social connections and participation in these various social and festive gatherings. Different processes have been placed to clarify this relationship. A portion of these worry the convictions and practices of specific gatherings.

### **MASS GATHERINGS AND PUBLIC HEALTH EMERGENCIES**

MG events pose a unique set of public health challenges requiring appropriate preventive measures, preparedness and capacity development. Prevention of epidemic outbreaks should be an overriding priority. Mass gathering also give rise to challenges like major sickness/illnesses including meningitis outbreaks, respiratory tract and gastrointestinal infections, burns caused due to fires, exposure to extreme weather, and challenges like stampede, crush injuries, structural damage etc. Increased noise, air and sound pollution due to extensive use of loud speakers and crackers/pyrotechnics in festivals resulted in about nearly 78% of individuals reporting sleep disturbances and approximately 76% complained about difficulty in concentration.<sup>3</sup>

### **PREVENTION OF BIOLOGICAL INCIDENTS AT MASS GATHERINGS**

Management of infectious disease outbreak at mass gatherings needs awareness, overall preparedness and risk reduction at all levels, including contingency planning and capacity development. With the increase in the likelihood of spread of COVID-19 and other diseases involving microbial pathogens, the need to raise medical preparedness is much more today. Some of the non – pharmacological measures for prevention of biological emergencies during mass gatherings are enumerated below.

#### **Managing the Points of Entry**

In the case of any infectious disease outbreak originating from off shores, the best approach at the early stage is to put strict control measures at the point of entry, to avoid any human movements and physical transactions with that country with trained Customs and Immigration staffs equipped with proper technology to manage the port of entry. Complete lockdown of such international movement was found to be effective in containing the spread during the COVID – 19 situations.<sup>4</sup> As has been found to be relevant in the present situation, the organizers of any planned event may also commit to screen the visitors at the entrance. Monitoring their temperature, checking for vaccination against the prevailing epidemical scenario, proof of any digital record of health condition, pulse measuring device etc. may be installed at the entrance to the gathering, since physical distancing might not be practicable, always

#### **Disease Surveillance and Outbreak Investigation**

A legitimate and deliberate general wellbeing surveillance at the area of Mass Gathering will help in distinguishing a general wellbeing crisis or a pandemic spread. The syndromic observation and sentinel site surveillance will assist better with seeing any change observed during such surveillance that warrants an immediate response.<sup>5</sup>

#### **Mass Dispensing**

Mass gathering has the ability to overwhelm any framework. Recognizing approaching episode, characterizing the uncovered populace, data identified with the capacity to perceive flare-up, recognizable proof of reason causing this general wellbeing emergency, preparing the provisions expected to react to the affected populace successfully and giving clinical consideration to the affected individual just can help assume powerful responsibility for the circumstance and react to it.<sup>6</sup> For example, in case of the Athens 2004 Olympics, the national health authorities had decided to order mass prophylaxis if the cases exceed 300, as recommended for the creation of a mass prophylaxis plan in Greece during the Athens 2004 Olympic Games, suspecting a CBRN Attack.<sup>7</sup>

#### **Effective Media Management**

Conceivable spread of untruths, gossipy tidbits and improper or erroneous information does raises safety concerns for the family members of those attending such gathering. This may lead to the utter chaos among the overall population. A prepared group of PR personnel can help spread correct and timely

information to the mass. Their task comprises of passing the general wellbeing related data to teaching them about the dos or the don'ts in the social event, eliminating any disarray, tending to public concerns or giving a direly required data.<sup>8</sup>

### **Food Safety**

Proper planning regarding moves to be made against any coincidental tainting of food in food readiness and food handling areas is key to reduce vulnerability. The preparation of food at site seriously increases the threat of transmission of food borne diseases. Aside from the territory needed to set up the food, there is a different zone needed for eating, washing and arranging the left overs. If required, firms that have gone through the Food Safety Trainings or have affirmations like the Hazard Analysis and Critical Control Point (HACCP) based frameworks and structures are prepared assets to be considered for including in such a Mass Gathering.<sup>9,10</sup>

### **Public Health Laboratory**

Anticipating Public and Environmental Health, Food Control Laboratory would be an extraordinary assistance in controlling of a Public Health Crisis in the following manner:<sup>11</sup>

- Taking environment samples around the food planning and conveyance surface regions and testing it for expected Health Hazard
- Taking and keeping up tests of the food being appropriated for at least 24 hours, and testing it against the conceivable bacterial, poison, microbial, synthetic or actual perils.<sup>12</sup>  
SOPs should be composed covering various perspectives related with the foundation of such research facilities and in this way, the manner in which the samplings ought to be done:
- Defining a goal, method, number of examining and its technique.
- Carrying out observation, including taking examples of the residue inside the rooms, floors, and office hardware, air channels ought to be taken to audit and stop any Public Health Issue
- Period for which the samples should be stored and maintained for agreed period.

### **Hand – Hygiene Facilities**

Emergence of COVID – 19 has fortified the act of hand washing as a significant activity to keep health issues cornered. Both the time and speed of consistence and the speed of adherence to the suggested act of hand washing, is important for ensuring full affectivity. Pasting posters and making regular audiovisual announcements on hand washing strategy/technique, alongside making arrangement for hand washing utilizing soap-based cleanser or alcohol based hand sanitizers, hand dryers and paper towels made accessible at normal spots<sup>13</sup>, can significantly decrease the common sicknesses. An investigation carried out in 2009 expressed that the explorers to Hajj, showing up at the King Abdul-Aziz worldwide air terminal in Jeddah demonstrated that 48.1% of travelers knew that regular hand washing and 28.5% of pioneers knew that utilization of hand sanitizer, individually, could forestall H1N1 contamination.<sup>14</sup>

### **Water Safety**

Water sampling from a source ought to be picked and tried on regular schedule dependent on standards like pH, conductivity, turbidity, shading, chlorine levels and E. coli. Water source should be clearly demarcated for drinking purpose or otherwise, in pictorial mode for simple comprehension.<sup>15</sup> Additionally, setting up of packaged drinking water at ostensible cost which would be halfway or completely repaid on depositing the empty bottles to the assortment place to keep away from littering around at the site, can be planned.

### **Public Information and Health Promotion**

Public information and wellbeing promotion counters can be utilized for advancement of public information issues like climate related sicknesses. Event related issues can be disseminated through such counter prompting the attending people to take care while they are a part of this gathering. The messages may also be dispersed through bulletins and regular announcements. Signs posted at in highly visible locations (for example, at entrances, in restrooms) that promote everyday protective measures and describe how to stop the spread. In case the gathering is specific to a targeted group or the attendees from diverse part of society are expected, due consideration related to display of messages in multiple languages and formats should be considered. Sign language, symbols, video and audio messages are good examples for consideration.

### **Sanitation and Toilet Facilities**

MG poses a big challenge for proper sanitation and toilet facilities since they need to be made accessible at advantageous and promptly available locales. For meeting these challenges, expertise of specialized organizations like Sulabh Global Social Assistance Association can help in providing or for making courses of action for temporary toilet facilities catering to specific sexual orientation based air pit restrooms, street side urinals and bio – digesters at a safe distance from the water body is best suited for these occasions.<sup>16</sup>The substance of human open defecation conveys contagious microbes and infections like

norovirus, rotavirus and hepatitis A and E like Campylobacter, Enterococcus, Escherichia coli, Salmonella, Shigella, Staphylococcus, Streptococcus and Yersinia microorganisms.<sup>17</sup> The users need to be taught about using public toilet properly as the door handles, tap handles, water mugs/bucket, toilet paper dispenser and buttons are the most contaminated part of the toilet. Using elbow or a tissue paper to open/closing the tap and the door is the way. Wash basin may be placed outside to wash off the hand.<sup>18</sup>

### **Sewage Facilities and Disposal**

Positioning of toilet should consider factors like their position vis-à-vis the gathering, accessibility to the overhauling vehicles. Reasonable arrangement for disposal of sanitary material from such latrines in a public or network sewerage framework, according to local directives should be followed ensuring the sewer framework is maintained away from the drinking water office, to treat the progression of wastewater, prior to being released to the outside of the ground or into any conduit. The solid waste should be gathered and put away in sealed, nonabsorbent holders and eliminated day by day or more than once every day, contingent upon the get-together to a strong garbage removal office, or in a clean landfill built by the nearby local civic authority.<sup>18</sup>

### **Use of Masks**

Infections easily spread through droplets respiratory aerosols that continue to remain suspended in air for a longer period, as seen recently for COVID-19. The spread of respiratory viral pollutions happens fundamentally through contacts and droplets courses, which continue remaining evident for a long time. In such a case, a mask is an effective physical barrier restricting the spread of these droplets. An inexpensive cotton and custom made mask of 300 TPI(thread per Inches) is acceptable to retain the aerosols and droplets away and stop any entrance of Virions.<sup>19</sup>

### **Ventilation**

Regular and proper ventilation ensures proper air circulation in an enclosed area. If possible, windows and doors must be kept open unless the same poses health risk to the attendees or the staff (for example, risk of falling or triggering asthma symptoms). In case of portable ventilation equipment like fans, any possibility of air blowing from one person directly at another person should be reduced to prevent potential spread of any airborne or aerosolized viruses.

### **Travel Restrictions**

The human body has its own inbuilt mechanisms that helps it fight to an amazing degree against the unfamiliar invasions. Protection against a transferable infection assault includes an assortment of measures in potential objective populaces. In any case, if challenging measures are in place, regardless of whether by method of isolation, confinement, inoculation or any other, the infectivity lessens undeniably and populace is made sure about against common sicknesses.<sup>20</sup> A modest nation like Taiwan safeguarded itself against COVID - 19 Pandemic by suitably shutting its outskirts to any departure from and to its effected neighbor - China.<sup>21</sup>

### **Standard practices and Operating Procedures**

Based on the inputs of previous incidents, past experiences and learnings from the table top exercises, a general SOP should be prepared to prevent any mismanagement and overwhelming of limited resources. Some of the challenges related to response to outbreaks (like Ebola, Influenza, Zika virus, and the COVID-19 pandemic) include aid workforce issues, personal protective equipment, data challenges, trust, logistics, lack of planning, ethical challenges, logistics, lack of coordination, legal challenges, mental health and psychosocial support.

### **Lockdown:<sup>22</sup>**

Lockdown (encompassing stay-at-home orders, curfews, quarantines, *cordons sanitaires* and similar societal restrictions) is a state of isolation or restricted access instituted as a safety measure. Since, it's difficult for the government to control the entry and spread of pandemic, a lockdown has proved to be an effective step to keep people indoors, forcibly, and ensure that the link of the spread of pandemic is weakened and broken, as has been witnessed in case of the present pandemic, COVID - 19. The governments ordered lockdown in their own country after assessing the prevalent pandemic situation there and have successfully brought a substantial decrease in the daily increasing cases and deaths, worldwide. By April 2020, about half of the world's population was under some form of lockdown, with more than 3.9 billion people in more than 90 countries or territories having been asked or ordered to stay at home by their governments.<sup>23</sup> Countries like Argentina had the longest lockdown of 234 days (in Greater Buenos Aires) while some parts of Turkey had lockdown of only 04 days.<sup>24</sup> India had the longest lockdown of 74 days during the first wave of SARS CoV - 2.<sup>25</sup>

### **Call Center:<sup>26</sup>**

The concept of call center has been in existence since the early 21<sup>st</sup> century. In India, a centralized number 1075 has made it easy for the people to seek information about SARS-CoV - 2. This number is also being used to inform about any suspected health conditions in their neighbourhood. The government

with its specialized agencies, institutes and hospitals including those in private sectors provides guidelines on various topics related to the pandemic ranging from recognizing the symptoms to treatments, diagnostics, use of social distancing, mask, and hygiene and sanitisation to taking precautions to evade the pandemic. This proved to be extremely helpful during the earlier stages of COVID – 19, when government sponsored call center helped the people seek information related to COVID – 19 and dispel the prevailing myths.

### Digital Technologies

The ongoing pandemic has proved the efficiency of affordable and adaptable technology options on mobile, computer, wireless or Bluetooth available in the world today, in managing the incidences of infectious diseases in mass gatherings.<sup>27</sup> Various emerging diagnostic and analytic instruments, like Foldscope,<sup>28</sup> an economical but portable and versatile microscope created joining origami and standards of optical design, could be handily brought into areas with restricted resources. Fast point-of-care diagnostic tests for both bacterial and viral diseases can be valuable during MGs. Few of these innovations with varying sensitivity and speedy analysis, are either in the advanced stages of development or already available in the market.<sup>29</sup> Availability of these tests to clinicians can help in quick determination of existing and emerging infectious illnesses. Various digital technologies empowering the documentation of health events, risks and wellbeing in a way that can direct illness occasion reactions are useful in managing biological incidences in mass gatherings are presented in Table 2. Such technologies are practical, affordable, explicit, prescient worth and openly available. While customary methodologies, for example, contact tracing, can be very taxing during episodes of MG events, frameworks dependent on these digital technologies can help in early identification and help encourage a prompt response. Use of thermal sensors and biosensor machines at the entrance gate of events to detect, if the visitor has temperature or any other abnormalities or has worn the mask properly.

**Table 1. Common India festivals during autumn and winter months<sup>(2)</sup>**

Sr. No.	Festival	Celebrated by	Celebrated on dates as per Religious Calendar	Vulnerabilities
01	Shardiya Navratras/Durgapuja (Shardiya Navratraarambh)	Hindus	Sep - Oct (beginning from 1 <sup>st</sup> of Ashwin Month)*	Allergies and breathing problems, Headache and Acoustic Trauma, Respiratory difficulties, Gastroenteritis
02	Milad - ul - nabi and Eid - e - milad	Muslims	Rabi' al-awwal, the third month (As per Islamic Calender)	Viral Infections
03	Diwali	Hindus	Oct - Nov (Amavasya of Kartik Month)*	Throat, eye and skin irritation, Smoke and noise problems leading to breathing problems, Carcinogen materials in air make people vulnerable to different types of cancer.
04	Chhath Pooja	Hindus	November (Kartika month, Shukla shasthi)	Water related diseases, due to pollution and fecal matter in the water bodies, Vector Borne and parasitic infection, sanitation issues
05	Devutthan Ekadashi	Hindus	November (Kartika month, Shukla ekadashi)	Water related diseases, due to pollution and fecal matter in the water bodies, Vector Borne and parasitic infection, sanitation issues
06	Guruvayur Ekadashi	Hindus	Nov (Based on Solar Calendar)	Water related diseases, due to pollution and fecal matter in the water bodies, Vector Borne and parasitic infection, sanitation issues
07	Guru Nanak Jayanti	Sikh	Nov (Kartik Month, Shukla Purnima)	Viral infection
08	Christmas	Christians	25 Dec (Fixed Day in Gregorian Calendar)	Noise pollution, viral infection, skin and nasal allergies, Vector Borne and parasitic infection, sanitation issues
09	New Year Celebrations	All Indians	01 Jan (First Day of Gregorian Calendar)	Noise pollution, viral infection, drug and alcohol related issues, accidents
10	Lohri/Pongal/Sankranti/Bihu	Hindus	13 Jan (Day before Makar Sankranti)	Smoke and noise pollution, viral infection
12	Republic Day	All Indians	26 Jan (Fixed Day in Gregorian Calendar)	Viral infection, respiratory tract infections, cough
13	Goa Carnival	All Indians	February or March before the onset of Lent.	Viral infection, Vector Borne and parasitic infection, sanitation issues, respiratory tract infections, cough,
14	Maha Shiv Ratri	Hindus	Feb - Mar (Magha)	Viral infection

			Month, Krishna Chaturdashi)	
15	KumbhMela	Hindus	Dates are decided as per astrological predictions and religious considerations (Based on Lunar Calendar)	Cholera, diarrhea, tuberculosis, meningococcal outbreaks, influenza, measles, chicken pox, pertussis and mumps, sanitation issues, respiratory tract infections, cough, transmission of Blood Borne, Vector Borne and parasitic infection, concentration and sleep difficulties
16	Holi	Hindus	March (Phalgun Month, Shukla Purnima)	Dermatological problem, Eczematous, Xerosis and scaling, Erythema, Urticaria, Exacerbation of preexisting dermatoses, Abrasion, conjunctivitis, corneal abrasions

\*according to Hindu Lunisolar Calendar

**Table 2: Digital Technologies found useful in managing Biological Incidences during MassGatherings**

Occasion	Technology	Details
KumbhMela, 2001	Tele-medicine	Averted a possible cholera epidemic <sup>(30)</sup>
Olympic games in 2002	Digital technology's automated system	Aggregated data from urgent care center and emergency departments, providing visual plots and maps and was set to trigger an alert in case of any unusual disease activity <sup>(31)</sup>
Annual Hajj	Wireless Sensors Network (WSN) & Body Sensors Network (BSN)	Helps identify the person who may be sick and call for ambulance by sending the coordinates to the medical services <sup>(32)</sup>
Annual Hajj	RFID based technology	Used in conjunction with the smartphones and the medical data collected can alert the Ambulance Services <sup>(33)</sup>
Annual Hajj	Hajj Mobile Disease Surveillance System	Collects the data related to infectious disease and enable informed decision making for disease control and prevention <sup>(34)</sup>
Annual Hajj	Healthcare Electronic Surveillance Network (HESN)	Enables monitoring of cardiovascular, Gastrointestinal, respiratory, skin and Eye/Ear diagnosis <sup>(35)</sup>
Olympic games 2008	GeoSentinal Surveillance Network	Maintains the largest database of travel related illnesses with geographical information and was used to assess the disease that were common to the travelers to China <sup>(36)</sup>
2010 Winter Olympics	Healthmap	Development of integrated system which combined the knowledge of worldwide air traffic patterns with Web Based global surveillance of infectious diseases to anticipate the threat of disease outbreaks during the Olympics <sup>(37)</sup>
2012 London Olympics,	Monitoring through Technology	Olympics officials responded by publically conveying reassurance and communicating accurate information <sup>(38)</sup>
COVID - 19 Pandemic	AarogyaSetu,	Works on Contact Tracing on Global Positioning System (GPS) and Bluetooth Technology <sup>(39)</sup>

## CONCLUSION

Cost-effective solutions utilizing digital innovations and non - pharmaceutical measures are valuable in recognizing and preventing biological emergencies and their spread. Healthcare providers need an ideal opportunity to spot a situation involving a viral epidemic or pandemic. Owing to biological lag times involved between infection and appearance of disease symptoms and also the time involved in testing and confirmation of the disease, the initiation of remedial actions against pandemics is delayed. Following these modest ways is the best appreciation to secure the event against infectious and contagious diseases and/or food/vector borne illnesses. Non-compliance with cleanliness rules and lacking sterilization are at risk for fecal-oral transmission of gastrointestinal diseases. General wellbeing measures focusing on arrangement of safe water and food supplies with thorough inside control are likely the best options available to restrict the event of gastrointestinal episodes at MGs. Masks offer the most straightforward insurance against disease spread. A simple and affordable home - made cover is extraordinarily efficient in securing the user against the flu like sicknesses. Besides, these methods form part of the hygiene that each person is exposed and trained on, as a child, these are the most effective possible and economic means to stop spread of infections.

## CONFLICT OF INTEREST

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