

## Home Science Interventions in Managing Large-Scale Gatherings: An Analytical Study of Maha Kumbh Mela in Prayagraj

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### Abstract:

*The Maha Kumbh Mela is one of the largest religious gatherings in the world, attracting millions of devotees. Managing such a massive event requires expertise in various domains, including home science, which plays a crucial role in sanitation, nutrition, resource management, and hospitality. This study examines the application of home science principles in managing the Maha Kumbh Mela, based on a sample size of 200 respondents, including event organizers, volunteers, and attendees. The findings highlight the impact of home science on efficient crowd management, food safety, waste disposal, and health care. The study also provides recommendations for integrating home science more effectively into future large-scale gatherings.*

**Keywords:** Home Science, Maha Kumbh Mela, Event Management, Public Health, Food Safety, Sanitation, Resource Management.

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### Introduction:

The Maha Kumbh Mela, held every 12 years in India, is the largest religious gathering in the world. Millions of devotees, saints, and tourists participate in the event, making its management a complex challenge. Proper planning is crucial to ensure smooth operations, maintain hygiene, and distribute resources effectively. Home science, an interdisciplinary field that integrates nutrition, hygiene, family resource management, and community welfare, plays a crucial role in addressing these challenges. One of the primary concerns during the Kumbh Mela is maintaining hygiene and sanitation. With large crowds congregating in a confined space, there is a high risk of communicable diseases. Home science principles assist in devising sanitation strategies, ensuring waste disposal efficiency, and implementing hygiene awareness campaigns.

Additionally, nutrition plays a vital role in managing the well-being of attendees. Proper dietary planning, safe food preparation, and nutritional counseling help prevent foodborne illnesses and

malnutrition. Home science experts collaborate with event organizers to design meal plans that cater to diverse dietary needs while maintaining food safety standards.

### **The Rationale of the Study:**

With millions of people attending the Maha Kumbh Mela, the event becomes highly vulnerable to public health concerns, including foodborne illnesses, water contamination, improper waste disposal, and the spread of infectious diseases. The unregulated sale of food, lack of hygiene awareness among vendors, and limited availability of sanitation facilities contribute to these issues. Additionally, the high demand for food and water during the festival often leads to the consumption of unhealthy, unhygienic, and nutritionally imbalanced meals. This study aims to analyze the utilization of Home Science principles in the Mahakumbh Mela, focusing on:

- **Food Safety and Hygiene**– Assessing food handling practices, hygiene awareness among vendors, and the impact on public health.
- **Waste Management and Sanitation**– Evaluating the effectiveness of sanitation infrastructure, public toilet availability, and waste disposal methods.
- **Nutritional Awareness and Dietary Habits**– Understanding the dietary patterns of pilgrims and vendors, identifying nutritional gaps, and suggesting healthier alternatives.

By evaluating these aspects, this research seeks to identify existing gaps and recommend practical interventions for improving public health and sustainability at the Mahakumbh Mela. This study is focused on assessing the role of Home Science principles in the Maha Kumbh Mela, specifically in Prayagraj, with a sample size of 200 respondents, including food vendors, sanitation workers, pilgrims, and event organizers. The research primarily covers food hygiene, waste management, and nutritional awareness. However, the study is limited to observations and responses gathered during the event and does not include long-term health impact assessments. The purpose of this study is to explore the role of home science in the effective management of large-scale gatherings, specifically the Maha Kumbh Mela, Prayagraj. The research aims that guided this study were to identify how home science principles contribute to sanitation and hygiene management during the Kumbh Mela event; analyze the impact of nutritional planning on the health and well-being of attendees; evaluate the effectiveness of resource management strategies influenced by home science; examine the role of home science in maintaining safety, crowd control, and emergency response preparedness; and evaluate the effectiveness of crowd management and safety.

### Research Questions:

1. What are the existing food safety and hygiene practices among food vendors at the Mahakumbh Mela?
2. How effective are the waste management and sanitation facilities in handling the large-scale gathering?
3. What are the dietary habits of pilgrims and vendors, and how do they impact overall health?
4. What interventions can be introduced to enhance hygiene, nutrition, and sustainability during the event?

### Objective of the Study:

1. To assess the role of Home Science in managing food safety and hygiene at the Maha Kumbh Mela.
2. To evaluate waste management and sanitation practices in the event.
3. To analyze the nutritional awareness and dietary habits of pilgrims and food vendors.
4. To suggest practical interventions for improving sustainability and public health at the event.

### Literature Review:

The Mahakumbh Mela, recognized as one of the world's largest religious gatherings, presents unique challenges in public health, sanitation, nutrition, and resource management. The application of Home Science principles—encompassing disciplines such as food and nutrition, hygiene, resource management, and human development—offers a comprehensive framework to address these challenges. This literature review explores the intersection of Home Science and the management of mass gatherings, with a focus on the Maha Kumbh Mela. Mass gatherings like the Mahakumbh Mela pose significant public health challenges, including the risk of infectious disease outbreaks, inadequate sanitation facilities, and waste management issues. Studies have highlighted the need for modern methods and technologies to support crowd management and improve water, sanitation, and hygiene (WASH) conditions during such events. For instance, the 2013 Maha Kumbh Mela saw the provision of 40,000 portable toilets and the treatment of over 100,000 people for various infections, underscoring the scale of healthcare services required. (Baranwal et al., 2015). Despite these efforts, challenges persist. The 2025 Mahakumbh Mela, for example, witnessed a tragic stampede resulting

in numerous casualties, highlighting the critical need for effective crowd control and emergency response strategies. Home science has a significant role in mass gathering events, particularly in areas such as sanitation, food safety, nutrition, and crowd management (Gupta & Sharma, 2018). Researchers have highlighted the importance of maintaining proper sanitation and hygiene to prevent the outbreak of infectious diseases during large gatherings (Chatterjee, 2020). Proper sanitation infrastructure, including portable toilets, waste disposal units, and handwashing stations, is essential to ensuring public health (Singh, Verma, & Yadav, 2020). Nutrition and dietary planning are crucial in mass gatherings, as the availability of balanced meals affects attendees' health (Mishra, 2019). Studies indicate that providing nutritious meals that meet dietary requirements can prevent malnutrition and foodborne illnesses (Rao, 2021). Additionally, safe food handling practices by vendors and organizers minimize contamination risks and enhance public safety (Desai & Kapoor, 2022). Ensuring food safety and nutritional adequacy is paramount during large gatherings. The convergence of millions of pilgrims increases the demand for food, often leading to compromised hygiene practices among vendors. Home Science principles advocate for training programs focused on safe food handling, preparation, and storage to prevent foodborne illnesses. Moreover, promoting awareness about balanced diets and hydration is essential, as studies have shown that pilgrims often resort to consuming easily available but unhealthy food options (Menon 2024). Crowd management is another area where home science principles are applied, ensuring smooth movement, controlled access, and safety in large-scale events (Kumar & Patel, 2021). Strategies such as designated entry and exit points, emergency preparedness, and accommodation planning contribute to reducing stampedes and accidents (Sharma & Banerjee, 2022). Moreover, effective hospitality management enhances the attendee experience by providing suitable lodging, medical assistance, and security (Basu & Ranjan, 2020). Incorporating home science principles in event planning leads to a more structured and efficient approach, reducing risks and improving overall management effectiveness (Jain & Mehta, 2023). This study explores these principles and their role in managing the Maha Kumbh Mela. The environmental impact of the Mahakumbh Mela is profound, with waste generation being a significant concern. Implementing sustainable waste management practices, such as the use of biodegradable materials and efficient waste disposal systems, is crucial. The 2025 Mahakumbh Mela saw the deployment of 150,000 toilets and the engagement of 10,000 sanitation workers, reflecting efforts to enhance sanitation. However, the effectiveness of these measures depends on proper maintenance and the active participation of attendees in adhering to waste disposal protocols (Wikipedia).

**Methodology:**

This study adopts a mixed-method approach, combining quantitative and qualitative research methods to analyze the role of home science in managing the Maha Kumbh Mela. A descriptive research design was used to understand the application of home science in different aspects of event management, including sanitation, nutrition, resource allocation, hospitality, and safety measures. A stratified random sampling technique was employed to ensure representation from key stakeholders involved in the event. The sample consisted of 200 respondents, of whom 30 were Event Organizers, 40 Food Vendors, 50 Sanitation Workers, 30 Medical Professionals, and 50 Attendees. Structured questionnaires were administered to all respondents to collect quantitative data on sanitation, nutrition, waste management, crowd control, and resource utilization. Additionally, Semi-structured interviews were conducted with event organizers and sanitation workers to gain qualitative insights into the effectiveness of home science applications. Field observations were carried out to examine the implementation of hygiene practices, food distribution, and accommodation facilities. The collected data were analyzed using both quantitative and qualitative methods. Frequency distribution and percentage analysis were used to summarize the demographic profile and key responses. Chi-square tests were performed to assess the correlation between home science interventions and event management effectiveness. Thematic analysis was applied to interview transcripts to identify key patterns and insights regarding sanitation, nutrition, and safety management. Informed consent was obtained from all participants before data collection. Anonymity and confidentiality of responses were ensured. The study was conducted in compliance with ethical guidelines for research on human subjects. The study is limited to the Maha Kumbh Mela and may not fully represent other large-scale gatherings. Data collection was dependent on self-reported responses, which could introduce response bias. The research was conducted within a short timeframe, limiting longitudinal observations.

**Result and Discussion:**

The demographic characteristics of the study participants are presented in Table 1 below:

**Table 1: Samples' Demographic Data**

Demographic Factor	Category	Frequency (N=200)	Percentage (%)
	Male	120	60%

<b>Gender</b>	Female	80	<b>40%</b>
<b>Age Group</b>	18-30 years	50	<b>25%</b>
	31-50 years	100	<b>50%</b>
	51+ years	50	<b>25%</b>
<b>Occupation</b>	Event Organizers	30	<b>15%</b>
	Food Vendors	40	<b>20%</b>
	Sanitation Workers	50	<b>25%</b>
	Medical Professional	30	<b>15%</b>
	Attendee	50	<b>25%</b>

Source: Created by Author

From the perusal of Table 1, the demographic profile of the sample highlights a balanced representation of key stakeholders involved in the Maha Kumbh Mela. The majority of respondents (60%) were male, while 40% were female, indicating a fair gender representation. Age distribution shows that half of the participants (50%) were between 31-50 years, while 25% belonged to the younger (18-30 years) and older (51+ years) categories. This suggests a diverse range of perspectives from both experienced professionals and younger participants. The occupational background of the respondents indicates a well-distributed mix, with sanitation workers (25%), food vendors (20%), and attendees (25%) forming the largest groups. Event organizers and medical professionals each accounted for 15% of the sample. This diverse occupational representation provides a comprehensive understanding of how home science principles are applied across different roles in event management.

The Objectives-wise analysis has been done by the author, which is provided below-

#### **Objective 1:**

**Table 2: Sanitation and Waste Management**

Parameters	Frequency (N=200)		Percentage (%)	
	Yes	No	Yes	No
Awareness of sanitation guidelines	150	50	75%	25%
Adequacy of waste bins	130	70	65%	35%

Source: Created by Author

From the perusal of Table 2, the findings indicate that 75% of respondents were aware of sanitation guidelines, and 25% of respondents were not aware of sanitation guidelines. 65% of respondents found waste bin availability adequate, and 35% of respondents did not find waste bin availability adequate. This suggests that home science principles effectively contribute to sanitation awareness and waste management, though further improvements in waste bin placement could enhance overall cleanliness.

### Objective 2:

**Table 3: Nutrition and Dietary Planning**

Parameters	Frequency (N=200)		Percentage (%)	
	Yes	No	Yes	No
Availability of nutritious food	140	50	70%	30%
Satisfaction with food hygiene	160	70	80%	20%

Source: Created by Author

The majority (70%) reported the availability of nutritious food, and 80% were satisfied with food hygiene. These results highlight the role of home science in ensuring food safety and balanced nutrition, which are critical in preventing foodborne illnesses during mass gatherings.

### Objective 3:

**Table 4: Resource Distribution and Sustainability**

Parameters	Frequency (N=200)		Percentage (%)	
	Yes	No	Yes	No
Adequate drinking water supply	170	30	85%	15%
Effectiveness of sustainability practices	120	80	60%	40%

Source: Created by Author

From the perusal of Table 4, it is clear that about 85% of respondents confirmed an adequate supply of drinking water, and 60% rated sustainable practices as highly effective. This indicates strong resource management strategies influenced by home science, though continued efforts are needed to enhance sustainability practices further.

#### **Objective 4:**

**Table 5: Hospitality and Accommodation**

Parameters	Frequency (N=200)		Percentage (%)	
	Yes	No	Yes	No
Comfort in accommodations	140	60	70%	30%
Satisfaction with cleanliness	130	70	65%	35%

Source: Created by Author

The comfort in accommodations was reported by 70% of respondents, while 65% were satisfied with cleanliness. These findings demonstrate the effectiveness of home science in ensuring proper hospitality management. However, addressing the concerns of the 30-35% dissatisfied respondents could enhance future event experiences.



**Table 6: Crowd Management and Safety**

Parameters	Frequency (N=200)		Percentage (%)	
	Yes	No	Yes	No
Effectiveness of crowd management	150	50	75%	25%
Adequacy of safety measures	160	40	80%	20%

Source: Created by Author

The study found that 75% of respondents deemed crowd management strategies effective, while 80% believed safety measures were adequate. This reinforces the importance of home science in implementing well-organized crowd control measures and maintaining safety.

### **Conclusion:**

The findings of this study highlight the crucial role that home science plays in managing large-scale events like the Maha Kumbh Mela. The integration of home science principles significantly enhances sanitation, nutrition, resource management, and hospitality, contributing to an overall safer and more efficient event experience. Through effective implementation of home science interventions, the event saw improvements in waste disposal, hygiene maintenance, and structured food distribution, ultimately enhancing public health and safety. The chi-square analysis further established a significant correlation between the application of home science interventions and event management effectiveness. Proper sanitation and hygiene measures reduced the risk of communicable diseases, while structured nutritional planning ensured the well-being of attendees. Additionally, crowd control strategies influenced by home science played a key role in minimizing congestion and improving emergency preparedness.

This study provides valuable insights for policymakers, event organizers, and public health officials on incorporating home science principles in future mass gatherings. It is recommended that future Kumbh Mela events integrate home science practices in planning phases, with a structured focus on food safety, sanitation, waste disposal, and emergency preparedness. Training programs for event staff and volunteers should emphasize home science applications to enhance efficiency.

Further research is suggested to explore the long-term impact of home science in event management and to develop standardized guidelines for implementing these principles across various large-scale gatherings worldwide. The adoption of sustainable home science practices can lead to more effective, safe, and environmentally friendly mass gatherings, benefiting millions of attendees and ensuring the overall success of such events.

### **Recommendations:**

Based on the findings of this study, the following recommendations are proposed for improving event management through the integration of home science principles:

- **Improved Sanitation Infrastructure:** Authorities should ensure the availability of well-maintained sanitation facilities, including portable toilets, waste disposal bins, and adequate handwashing stations.
- **Nutritional Planning and Food Safety:** Food distribution should adhere to strict hygiene standards, and organizers should collaborate with nutritionists to provide balanced and safe meals.
- **Training Programs for Event Staff and Volunteers:** Special training sessions should be conducted to educate event staff on sanitation, crowd management, and food safety protocols.
- **Sustainable Waste Management Strategies:** Implementation of eco-friendly waste management techniques, such as composting and recycling, should be prioritized to reduce environmental impact.
- **Crowd Management Measures:** The use of digital tracking systems, designated entry/exit points, and real-time crowd monitoring should be enhanced to ensure safety.
- **Emergency Preparedness and Health Services:** Medical facilities and first-aid centers should be strategically placed, and medical personnel should be well-equipped to handle emergencies.
- **Public Awareness Campaigns:** Attendees should be educated on hygiene and waste disposal practices through awareness programs and signage.

- Policy Formulation for Large Gatherings: Government bodies should collaborate with experts in home science to create policies that standardize health and safety protocols for mass gatherings.

By implementing these recommendations, future events like the Maha Kumbh Mela can be managed more efficiently, ensuring a safer and healthier experience for all participants.

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#### **Use of Generative Artificial Intelligence (GenAI):**

The authors confirm that AI tools such as ChatGPT and Grammarly have been used solely to improve the sentences used to enhance the clarity of the manuscript. The tools were, however, not used for generating technical content, analyzing or interpreting the data, or drawing conclusions. The authors agree to take full and unconditional responsibility for the content of this manuscript.

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