ความชุกของโรคไม่ติดต่อในผู้เดินทางที่เข้าร่วมการรวมตัวของคนจำนวนมาก: การทบทวนวรรณกรรมอย่างเป็นระบบ

Prevalence of non-communicable diseases among travelers attending mass gathering: a systematic literature review

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บทคัดย่อ

โดยปกติการดำเนินการด้านสาธารณสุขมักเน้นการป้องกันโรคติดต่อขณะมีการรวมตัวของคนจำนวนมาก อย่างไรก็ตามอุบัติการณ์โรคไม่ติดต่อที่อาจเป็นสาเหตุให้เจ็บป่วยและการเสียชีวิตก็เกิดขึ้นได้ โดยเฉพาะในผู้เดินทางระหว่างประเทศ การศึกษานี้มีวัตถุประสงค์เพื่อประเมินความชุกของโรคไม่ติดต่อในผู้เดินทางที่เข้าร่วมการรวมตัวของคนจำนวนมาก โดยเป็นการทบทวนวรรณกรรมอย่างเป็นระบบตามแนวทาง PRISMA โดยสืบค้นข้อมูลจาก PubMed, Scopus และ Google Scholar และคัดเลือกงานวิจัยเชิงสังเกตที่รายงานภาวะเฉียบพลันของโรคไม่ติดต่อซึ่งเกิดขึ้นระหว่างหรือมีความสัมพันธ์กับการรวมตัวของคนจำนวนมาก และสกัดข้อมูลเกี่ยวกับลักษณะเหตุการณ์ รูปแบบการศึกษาและความชุกของโรค จากการศึกษางานวิจัยทั้งหมด 2,439 เรื่อง พบว่ามี 27 เรื่อง ซึ่งเป็นการศึกษาวิจัยเชิงสังเกตในผู้เดินทางระหว่างประเทศที่รายงานภาวะเฉียบพลันของโรคไม่ติดต่อระหว่างหรือสัมพันธ์กับการรวมตัวของคนจำนวนมาก เข้าเกณฑ์การคัดเลือก ส่วนใหญ่เป็นการรวมตัวทางศาสนา โดยเฉพาะพิธีฮัจญ์ โรคหัวใจและหลอดเลือดเป็นสาเหตุหลักของการเจ็บป่วยรุนแรงและการเสียชีวิต คิดเป็นร้อยละ 19.4-37.5 ของการเข้ารักษาในโรงพยาบาล และร้อยละ 31.0-65.5 ของการเสียชีวิต ภาวะอื่นที่พบบ่อย ได้แก่ โรคที่เกี่ยวข้องกับความร้อน (ร้อยละ 2.0-10.5) ภาวะฉุกเฉินทางเมตาบอลิกและต่อมไร้ท่อ (ร้อยละ 7.3-9.5) ภาวะไตวายเฉียบพลัน (ร้อยละ 10.2) และการกำเริบของโรคระบบทางเดินหายใจเรื้อรัง (ร้อยละ 15.0-18.0) อัตราการเสียชีวิตโดยรวมอยู่ในระดับต่ำ (ร้อยละ 0.0-0.1) แต่ส่วนใหญ่เกิดจากโรคไม่ติดต่อ ผลการศึกษาชี้ให้เห็นว่าโรคไม่ติดต่อเป็นภาระสุขภาพที่สำคัญในผู้เดินทางที่เข้าร่วมการรวมตัวของคนจำนวนมาก จึงควรให้ความสำคัญกับการประเมินความเสี่ยง การดูแลโรคเรื้อรัง และการเตรียมความพร้อมก่อนการเดินทางเพื่อลดผลลัพธ์ที่รุนแรง

คำสำคัญ: การรวมตัวของคนจำนวนมาก, โรคไม่ติดต่อ, การทบทวนวรรณกรรมอย่างเป็นระบบ

Abstract

Public health efforts typically focus on preventing infectious diseases during large gatherings of people. However, the incidence of non-communicable diseases (NCDs) that can cause illness and death is possible, particularly among international travelers. This study aimed to describe the prevalence of NCDs among travelers participating in mass gatherings. This was a systematic literature review conducted using the PRISMA guidelines, by searching data from PubMed, Scopus, and Google Scholar. Observational studies reporting acute outbreaks of NCDs occurring during or associated with mass gatherings were selected, and data on event characteristics, study designs, and NCD prevalence were extracted. From a review of 2,439 research papers, 27 observational studies involving international travelers and reporting acute non-communicable conditions occurring during or associated with mass gatherings met the inclusion criteria. Most were religious, particularly the Hajj pilgrimage. Cardiovascular diseases were a leading cause of severe morbidity and mortality, accounting for 19.4-37.5% of hospitalizations and 31.0-65.5% of deaths. Other common conditions included heat-related illness (2.0-10.5%), metabolic and endocrine emergencies (7.3-9.5%), acute kidney (10.2%), and exacerbations of chronic respiratory diseases (15.0-18.0%). Overall mortality rates were low (0.0-0.1%) but were predominantly attributable to NCDs. The study indicated that NCDs represented a significant burden among travelers participating in mass gatherings and highlighting the importance of risk assessment, management of chronic illnesses, and pre-travel preparation to mitigated serious outcomes.

Keywords: Mass gatherings, Non-communicable diseases, systematic literature review

Introduction

Mass gathering events are defined as organized or spontaneous events that attract a large number of people and have the potential to strain the planning and response capacities of the host community[1]. Such events include religious pilgrimages, international sporting competitions, cultural festivals, and political assemblies. In recent decades, mass gathering medicine has emerged as a distinct field, primarily driven by concerns related to communicable disease transmission and outbreak preparedness[2].

Alongside the traditional focus on communicable diseases, non-communicable diseases (NCDs) have increasingly been recognized as major contributors to morbidity and mortality during mass gatherings[3]. Globally, NCDs account for most deaths and healthcare utilization, and this burden is mirrored in mass gathering settings, where cardiovascular diseases, chronic respiratory conditions, heat-related illness, and other acute exacerbations of chronic disease are consistently described as the predominant causes of morbidity and mortality, although precise prevalence estimates vary across events and settings[3]. Environmental stressors such as extreme temperatures, dehydration, and crowd density further increase the risk of acute NCD-related events[4].

Evidence from large-scale religious mass gatherings, particularly the Hajj pilgrimage, consistently demonstrates that NCDs are responsible for a substantial proportion of emergency department visits, hospital admissions, and deaths, with cardiovascular disease repeatedly identified as a leading cause of hospitalization and mortality, often exceeding communicable diseases[5-7]. Correspondingly, hospital admission patterns during mass gatherings show a predominance of medical conditions related to underlying chronic illness rather than acute infections[7].

Travelers attending mass gathering events represent a distinct subgroup within these populations. Compared with local participants, travelers may be older, have a higher prevalence of pre-existing medical conditions, and face additional challenges such as long-distance travel, unfamiliar healthcare systems, language barriers, and limited access to medical records or regular medications. Despite these vulnerabilities, pre-travel health preparation for mass gatherings has traditionally emphasized vaccination and infectious disease prevention, with less systematic attention to NCDs risk assessment and mitigation[2-3].

Although individual studies have described NCDs-related outcomes at specific mass gatherings, the existing literature remains fragmented, and no comprehensive synthesis has focused specifically on the epidemiology of NCDs among travelers attending mass gathering events. A clearer understanding of the burden, spectrum, and outcomes of NCDs in this population is essential to inform pre-travel counseling, on-site medical preparedness, and public health planning for future mass gatherings. This systematic review therefore aims to synthesize available evidence on the type and prevalence of NCDs occurred as well as the severity and health-care utilization among travelers attending specific mass gathering events.

Objectives

1. To assess the prevalence and patterns of non-communicable diseases among international travelers attending mass gathering events.

2. To summarize the types, severity, and clinical outcomes of non-communicable diseases reported in the context of mass gatherings.

3. To evaluate healthcare utilization and mortality associated with non-communicable diseases among travelers attending mass gathering events.

Methodology

Study Design and Protocol

This systematic review was conducted to synthesize evidence on NCDs-related occurred among international travelers attending mass gathering events. The review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines[8]. The protocol was prospectively registered in PROSPERO (registration number CRD420251271847).

Eligibility Criteria

Studies involving international travelers attending mass gathering events were included. Studies reporting the prevalence of non-communicable diseases among international travelers attending mass gathering events, were eligible for inclusion. Studies focusing exclusively on event staff, volunteers, healthcare workers, security personnel,

or organizers who were local residents and not traveling to attend or work at the mass gathering event were excluded. Population-based studies conducted during festivals or holiday periods without explicit linkage to event attendance or participation were also excluded, as were studies in which international traveler participation could not be identified or reasonably inferred

Operational Definition

Mass gatherings were defined as organized events involving more than 1,000 participants[9]. International travelers were defined as individuals who travel across national borders to attend the event, and participants could include international spectators, attendees, athletes, or pilgrims. NCDs were defined as conditions occurring during, or temporally associated with, mass gathering events and included musculoskeletal injuries, non-infectious dermatological and respiratory conditions, exacerbations of underlying medical conditions, and environmental exposures such as heat-related illnesses.

Information Sources and Search Strategy

A comprehensive literature search was conducted in PubMed, Scopus, and Google Scholar from inception to 24 December 2025. Search terms combined concepts related to mass gatherings, international travel, and non-communicable medical outcomes. Reference lists of included studies were also screened to identify additional relevant publications.

Study Selection

All records identified through database searching were imported into reference management software and duplicates were removed. Two reviewers independently screened titles and abstracts for eligibility. Full texts of potentially relevant articles were then assessed. Discrepancies were resolved through discussion between the two reviewers until consensus was reached.

Data Extraction

Two reviewers independently extracted the data. Data were extracted using a standardized and pilot-tested data extraction form. Extracted variables included study characteristics (author, year, event type and year, country or region), study design, participating travelers characteristics, study setting (e.g., hospital-based, on-site medical services, airport-based), timing of outcome assessment (pre-travel, during travel, or post-travel), and outcome ascertainment methods.

Only acute NCDs occurred during or in close temporal relation to the mass gathering were extracted. The prevalence of each type of NCDs were extracted as percentage. Baseline NCDs prevalence was not extracted, unless the NCDs became exacerbated during the mass gathering events. Discrepancies were resolved between the two reviewers until consensus was reached.

Risk of Bias Assessment

Two reviewers independently assessed the risk of bias. Risk of bias for included studies was assessed using the Hoy et al.[10] tool for prevalence studies, adapted as appropriate for different observational designs. The tool consisted of 10 questions with answer yes, no, and unclear. Disagreements between two reviewers were resolved through discussion until achieving the consensus.

Data Synthesis

Given substantial heterogeneity in study design, event characteristics, populations, and outcome definitions, a narrative synthesis was performed. Outcomes were grouped into major NCD categories to facilitate comparison across studies.

Results

Study selection

The study selection process is summarized in the PRISMA flow diagram (Figure 1). Of 2,274 records identified through database searching, 188 articles underwent full-text review. Excluded studies included 62 studies on communicable diseases, 47 studies with wrong study design, 13 studies not involving international travelers, 11 studies that did not show temporal association of NCDs with mass gathering events, 10 studies without relevant health outcome, 9 studies not met criteria for mass gathering event, 5 studies that could not confirm whether they involved international travelers or not, 2 were retracted articles, and 2 were in foreign languages. Ultimately, 27 studies were included [6-7, 11-35].

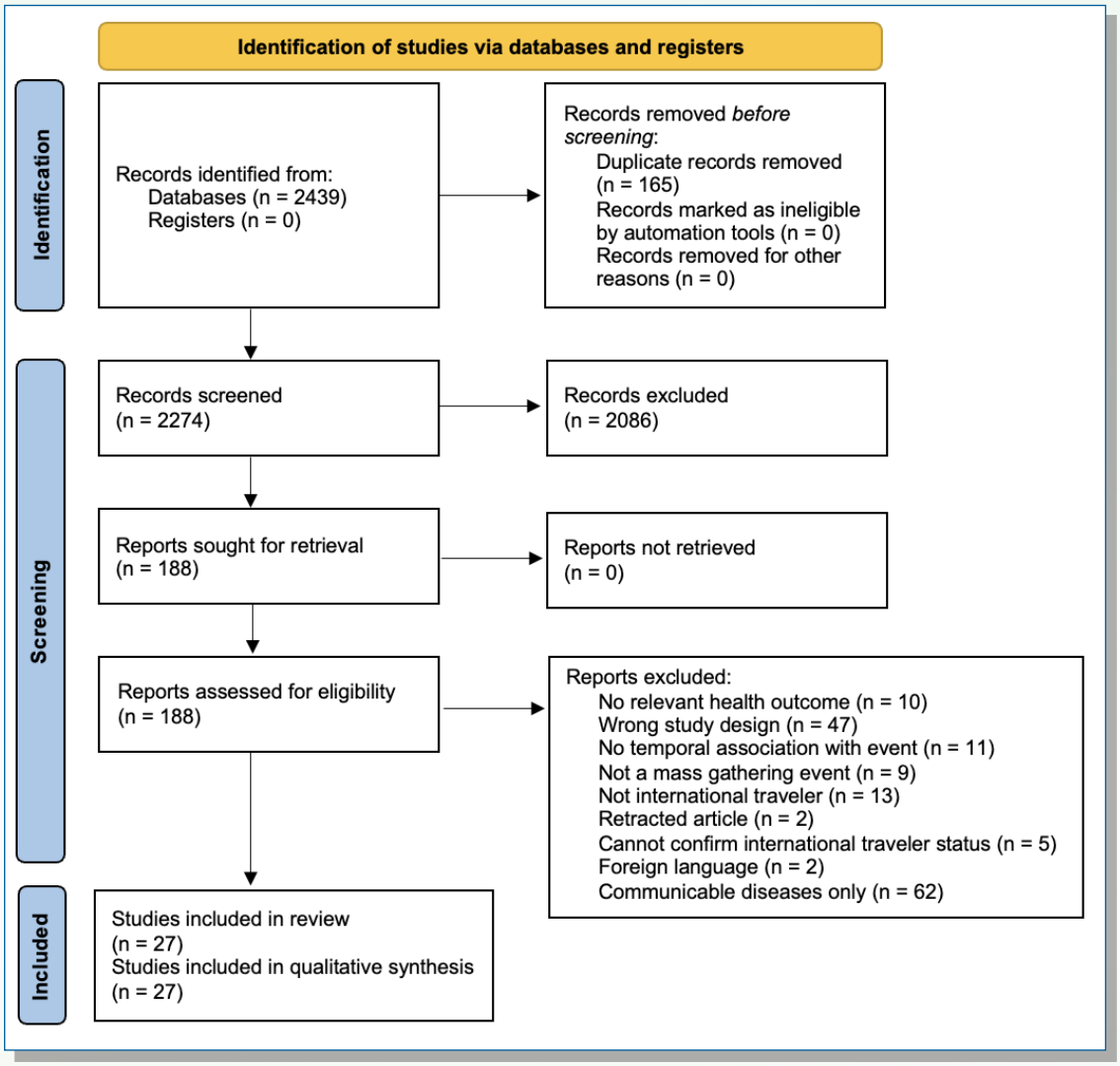


Figure 1 PRISMA flow diagram

Characteristics of included studies

The 27 included studies were published between 2000 and 2025. Most were conducted during religious mass gatherings, particularly the Hajj pilgrimage in Saudi Arabia[6-7,13-14,16-19,21-35]. Additional studies examined the Grand Magal pilgrimage in Senegal[11], the FIFA World Cup in Brazil[12] and the Arbaeen pilgrimage in Iraq[15, 20].

Study designs included 12 cross-sectional studies[11,13,15,18-20,23,27-28,30,34-35], 13 prospective and retrospective cohorts[6-7,14,16,21-22,24-26,29,31-33], and 2 case-control analyses[12,17]. Study populations ranged from small clinical cohorts (n = 87)[25] to large national surveillance datasets (n = 476,506)[35]. Data sources included hospital medical records, emergency department registries, on-site medical services, national surveillance systems, and self-administered questionnaires. Figure 2 presents the locations of mass gathering events included in the review and the range of reported NCDs outcomes among travelers by country. Detailed study characteristics are available upon request.

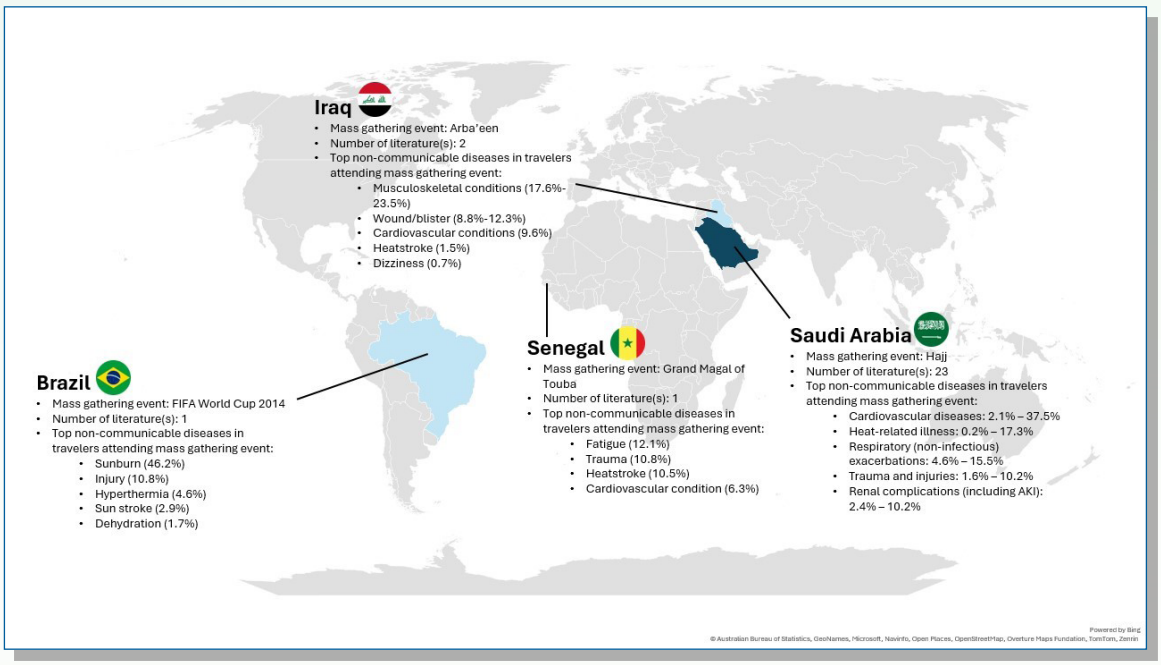


Figure 2 Geographic distribution of mass gathering events and non-communicable disease outcomes among international travelers. Map created by the authors using data extracted from included studies.

Across hospital-based and cohort studies, participants were predominantly middle-aged to older adults. Mean or median ages ranged from approximately 43 to 69 years in most Hajj cohorts[7,18,24-25,27,29], with several studies reporting peak age groups between 41 and 70 years[6,13,17]. Male predominance was observed in many hospital-based studies, with proportions ranging from 57.7% to 78.6%[7,18,24,33],

although some community-based cohorts reported more balanced distributions or female predominance[6,16,35]. Pre-existing non-communicable diseases were common among participants, particularly hypertension (14-70.1%)[7,25,29-30], diabetes mellitus (13.2-60.9%)[18,25,29], and chronic respiratory diseases including COPD and asthma (6.1-33.3%)[7,24-25]. Several studies reported that a substantial proportion of severe cases or deaths occurred in individuals with underlying cardiovascular disease or metabolic comorbidities[17,25,29].

Prevalence and patterns of non-communicable diseases

1. Cardiovascular diseases

Cardiovascular conditions were consistently reported as a major cause of severe morbidity during mass gatherings. In hospital-based studies, cardiovascular diseases accounted for approximately 19.4-37.5% of admissions, including ischemic heart disease (8.8-23.6%), heart failure (0.3-6.3%), arrhythmias (1.1-4.7%), hypertensive emergencies (1.3-1.8%), and stroke (2.5-3.4%)[7,18-19,25,29]. Mortality-focused analyses identified cardiovascular disease as the leading cause of death outside of crowd-related disasters. In large inpatient and mortality datasets, cardiovascular causes accounted for 31-66% of reported deaths, most commonly due to cardiac arrest (22.0-48.9%) and myocardial infarction (4.7-6.5%)[6,17,35].

2. Metabolic and endocrine conditions

Metabolic complications, particularly diabetes-related emergencies, were reported across multiple studies (7-10%). Hospital-based cohorts documented hypoglycemia (3.4-4.2%), hyperglycemia (3.7%), diabetic ketoacidosis (2.4-4.6%), and electrolyte disturbances (8.2-11.8%)[18-19,21,29]. While baseline diabetes prevalence was frequently reported, acute metabolic complications during mass gatherings were less common but often required hospitalization[19,21,25].

3. Renal diseases

Renal complications were primarily described in hospitalized populations. In one retrospective cohort, acute kidney injury occurred in approximately 10.2% of hospitalized pilgrims, with 24.1% requiring renal replacement therapy and 29.9% experiencing in-hospital mortality[25]. Renal disease was frequently reported in association with cardiovascular and metabolic comorbidities[18,25,29].

4. Chronic respiratory diseases

Chronic respiratory conditions, including asthma (4.6-17.9%) and chronic obstructive pulmonary disease (7.3-14.4%) exacerbations, contributed substantially to morbidity. Hospital-based studies reported respiratory conditions accounting for approximately 15.0-18.0% of admissions[7,18-19 29]. Pulmonary embolism was infrequently reported (0.9-1.4%) but documented in emergency and critical care settings[19,29].

5. Heat-related illness and other non-communicable conditions

Heat-related illness was reported across diverse events and settings, ranging from heat exhaustion (17.3-39.8%) to confirmed

heat stroke (5.7-6.1%), with other reported manifestations including heat syncope or hyperpyrexia (31.2-54.5% in heat-illness-specific cohorts), heat cramps (16.0%), and heat-related peripheral edema (6.9%)[11,13-15,18,23,29,31]. During the Grand Magal pilgrimage in Senegal, heat-related conditions accounted for approximately 10.5% of healthcare encounters[11]. Among hospitalized pilgrims during the Hajj, heat-related illness represented 1.9-4.0% of admissions[7,18].

Musculoskeletal, and dermatologic (15.0-40.4%), conditions were common in on-site and ambulatory care settings. Musculoskeletal complaints accounted for approximately 17.6-18.0% of primary care encounters[15, 30], while foot-related conditions were reported by 58.9% of pilgrims in one prospective cohort[26].

Severity spectrum, healthcare utilization, and clinical outcomes

The clinical spectrum of non-communicable conditions ranged from mild ambulatory presentations to life-threatening emergencies. Mild to moderate conditions were predominantly managed in on-site or outpatient settings and included musculoskeletal complaints (17.6%)[15,30] and dermatologic disorders (15.0-40.4%)[30,34]. In contrast, hospital admission was more frequently associated with cardiovascular diseases, which represented a substantial proportion of inpatient admissions during the Hajj[7,19,29]. Hospitalization rates were considerably lower in the Grand Magal (3.4%) and FIFA World Cup (0.6%)[11-12].

Among hospitalized patients, intensive care unit (ICU) admission was reported in up to 8.3%[18]. Cardiac arrest cohorts demonstrated an overall survival-to-discharge rate of 15.5%[24]. Although overall mortality across mass gatherings was low (0.0-0.1%)[11,35], deaths were predominantly attributable to cardiovascular causes[6,17].

Severe presentations were frequently described in individuals with pre-existing chronic conditions, including hypertension, diabetes mellitus, cardiovascular disease, and chronic respiratory disorders[7,17,25,29]. However, the proportion of these comorbidities specifically among severe or fatal cases was not quantified across studies. Environmental heat exposure, prolonged walking, dehydration, and crowd density were also described as contributing factors to clinical deterioration[13,23,31].

Event-specific variation in non-communicable disease patterns

Religious mass gatherings, particularly the Hajj pilgrimage, were associated with a higher burden of severe cardiovascular and metabolic complications requiring hospitalization and intensive care[7,18,29]. In contrast, sporting and community-based events predominantly involved mild, self-limited conditions managed in ambulatory settings[11-12,15,20]. Differences in environmental conditions, participant demographics, and healthcare infrastructure likely contributed to these variations. Table 1 summarizes the event-specific patterns and severity of non-communicable diseases among international travelers.

Table 1 Event-specific patterns and severity of non-communicable diseases among international travelers

Event	Predominant NCD Patterns	Typical Severity Profile	Mortality Pattern
Hajj (Saudi Arabia)	Cardiovascular (19.4-37.5%) [7,19,29], metabolic (7.3-9.5%) [18,21], AK I (10.2%)[25], respiratory exacerbations	Frequent hospital admissions; ICU up to 8.3%[18]; cardiac arrest cases reported	Cardiovascular causes 31.0-65.5% [6,17] of deaths
Grand Magal (Senegal)	Trauma (10.8%)[11], fatigue (12.1%)[11], heat-related illness (10.5%)[11]	Mostly ambulatory; hospitalization 3.4%[11]	Low mortality (0.03%)[11], mainly trauma-related
Arbaeen (Iraq)	Musculoskeletal (17.6%)[15], cardiac complaints (9.6%)[20], heat-related illness (1.5%)[15]	Predominantly outpatient management	Mortality not reported
FIFA World Cup (Brazil)	Sunburn (46.2%)[12], hyperthermia (4.6%)[12], dehydration (1.7%)[12]	Rare hospitalization (0.6%)[12]	Mortality not reported

Risk of bias

Using the Hoy et al. tool, five studies were assessed as having low risk of bias, eighteen as moderate risk, and four as high risk. The most common sources of bias were limited representativeness and healthcare-based sampling, which likely over-represented moderate to severe NCD presentations.

Discussion

This systematic review synthesizes available evidence on NCDs-related medical outcomes among international travelers attending mass gathering events. Across 27 studies, cardiovascular diseases, heat-related illness, metabolic and renal complications, chronic respiratory disease exacerbations, and trauma were consistently reported as leading causes of hospital admission and death. These findings highlight that, beyond communicable disease threats, NCDs represent a dominant and often underappreciated health burden in mass gathering medicine.

A key finding of this review is the disproportionate contribution of cardiovascular disease to severe outcomes and mortality. Several hospital-based and mortality-focused studies identified cardiovascular causes (particularly acute coronary syndromes, arrhythmias, heart failure, and sudden cardiac death) as the leading causes of death among pilgrims and mass

gathering attendees, accounting for up to two-thirds of reported fatalities in some cohorts[17,29,35]. Heat-related illness also emerged as a recurrent trigger for severe illness, either as a primary diagnosis or as a precipitating factor for cardiovascular and renal decompensation[13,18,23,29]. Together, these findings underscore the interaction between environmental stressors, physical exertion, and underlying chronic disease in shaping health outcomes during mass gatherings.

Environmental conditions appear to play an important role in shaping the pattern of non-communicable diseases during mass gatherings. Studies conducted during hotter pilgrimage seasons consistently reported higher frequencies of heat-related illness and secondary cardiovascular or renal complications[13,23,31]. Extended walking, physical exertion, dehydration, and crowd density may further increase physiological stress, particularly in individuals with underlying disease[15,22]. Differences in climate, event duration, and infrastructure likely contributed to the variation observed across settings.

Most participants in hospital-based cohorts were middle-aged or older adults with established chronic conditions, including hypertension, diabetes mellitus, cardiovascular disease, and chronic respiratory disorders[7,18,25,29]. These comorbidities were frequently present among hospitalized and critically ill patients and were associated with increased mortality in several cohorts[17,25]. In many cases, severe presentations reflected exacerbation of pre-existing disease rather than new-onset conditions.

Reported severity also varied according to the healthcare setting. Hospital-based studies naturally captured more serious presentations[18,29], whereas on-site clinics predominantly managed mild or self-limited conditions[15,30]. Differences in referral pathways, access to intensive care, and local surveillance systems should therefore be considered when comparing outcomes between events.

When compared with data from general international travelers, the NCDs profile observed in mass gathering attendees differs markedly in both severity and clinical impact. Large surveillance studies of ill returned travelers, particularly from the GeoSentinel network, consistently demonstrate that most travel-related illnesses are mild and self-limited, with gastrointestinal, febrile, and dermatologic conditions predominating, and relatively low rates of hospitalization and death[36-37]. In the one analysis of GeoSentinel data, cardiovascular disorders accounted for fewer than 10 cases per 1,000 ill travelers, and overall mortality was rare[36]. Similarly, summaries of GeoSentinel surveillance highlight that the majority of travelers are managed in outpatient settings, with inpatient care required in only a minority of cases[37]. This pattern is broadly consistent with reports from international sporting mass gatherings, such as the FIFA World Cup[12], where acute NCD events among spectators are relatively uncommon and underlying cardiovascular disease is more often documented as a background comorbidity than as the primary reason for medical consultation.

In contrast, the studies included in the present review largely captured moderate to severe presentations requiring medical evaluation or hospitalization, which explains the higher observed burden of cardiovascular, renal, and metabolic complications. Unlike typical leisure or business travelers, mass gathering attendees are often exposed to prolonged physical exertion, high crowd density, heat stress, sleep deprivation, and limited access to routine medical care, all of which increase the risk of acute decompensation of underlying chronic disease[3-4]. In addition, participants attending mass gatherings (particularly religious pilgrimages such as the Hajj) tend to be older and have a higher prevalence of pre-existing non-communicable diseases, including cardiovascular disease, diabetes mellitus, and chronic respiratory conditions, compared with general travel populations[3,5,-6]. These contextual factors likely explain why NCDs-related mortality appears disproportionately higher in mass gathering settings compared with general travel populations[36].

Comparisons with local or domestic mass gathering populations reveal both similarities and important contrasts. Surveillance studies conducted during large religious gatherings in Pakistan, Iraq, and Jordan demonstrate that communicable diseases and minor injuries often account for the majority of healthcare encounters, NCDs typically represent a smaller proportion of total consultations[38-41]. For example, public health surveillance during the Baba Farid Urs in Pakistan reported that non-communicable diseases accounted for approximately 11% of healthcare visits, while minor injuries and trauma, such as cuts, falls, and soft-tissue injuries, predominated alongside communicable diseases, most commonly acute respiratory tract infections and diarrheal illness[41]. Similarly, studies from Ashura gatherings in Karbala, Iraq identified trauma (primarily minor injuries related to crowd movement and processions) as well as communicable diseases, including upper respiratory tract infections and gastroenteritis as major contributors to hospital workload, although cardiovascular disease remained a leading cause of in-hospital mortality[39].

Evidence from Hajj surveillance suggests that international pilgrims experience a disproportionately higher burden of severe non-communicable disease outcomes, whereas domestic pilgrims more commonly present with minor trauma and communicable illnesses. Studies focusing on domestic Saudi pilgrims report predominance of respiratory, gastrointestinal, and musculoskeletal complaints, while analyses of international pilgrim cohorts consistently demonstrate higher rates of cardiovascular morbidity and mortality, likely reflecting differences in age distribution, baseline comorbidities, and healthcare-seeking behavior[40,42].

This review has several limitations. First, the predominance of healthcare-based studies likely overestimates the severity of NCDs burden and underrepresents mild or self-limited conditions. Second, heterogeneity in study design, outcome definitions, and reporting practices limited

direct quantitative comparison and precluded meta-analysis. Third, most included studies focused on religious mass gatherings (particularly the Hajj) potentially limiting generalizability to other event types. Finally, information on pre-travel risk assessment, medication adherence, and preventive interventions was inconsistently reported.

Future research should prioritize standardized surveillance systems that integrate both communicable and NCDs monitoring across the full spectrum of care, including on-site, outpatient, and hospital-based services. Prospective studies incorporating pre-travel health assessment and post-event follow-up would improve understanding of modifiable risk factors and preventive strategies for NCDs-related outcomes.

From a public health perspective, these findings highlight the need to reframe mass gathering preparedness to explicitly include non-communicable diseases alongside infectious disease threats. Pre-travel health advice should emphasize cardiovascular risk assessment, optimization of chronic disease management, heat-related illnesses prevention, and medication continuity, particularly for older travelers and those with known comorbidities. On-site medical planning should ensure adequate capacity to manage acute cardiovascular events, heat-related illnesses, renal complications, and trauma including timely referral pathways to higher-level care.

As global participation in mass gatherings continues to increase and traveler populations age, the burden of NCDs is likely to rise further. Integrating NCDs-focused risk assessment and preparedness into mass gathering health systems will be essential to reduce preventable morbidity and mortality and to strengthen overall public health resilience at large-scale events.

Conclusion

NCDs were a common cause of serious illness among international travelers attending mass gathering events. Cardiovascular disease, heat-related illnesses, metabolic and renal complications, and trauma accounted for most hospitalizations and deaths. These findings suggest that health planning for mass gatherings should not focus solely on communicable diseases. Greater attention to non-communicable disease risk, prevention, and clinical preparedness is needed to reduce avoidable adverse outcomes.

แนะนำการอ้างอิงสำหรับบทความนี้

ภีมเดช กฤติยานนท์, พัฒน์ ฉันทภิญญา, สกานต์ เจริญสกุลไชย, รณิดา เตชะสุวรรณา. ความชุกของโรคไม่ติดต่อในผู้เดินทางที่เข้าร่วมการรวมตัวของคนจำนวนมาก: การทบทวนวรรณกรรมอย่างเป็นระบบ. วารสารสถาบันป้องกันควบคุมโรคเขตเมือง. 2569;11(2):69-84.

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