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Review Article

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Health and environmental impacts of Gaza conflict (2023−2024): A review

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ABSTRACT

The war in Gaza, which erupted on October 7, 2023, unleashed unprecedented assaults from the air, sea, and land, affecting the densely populated area of 360 square kilometers housing 2.3 million people. The conflict claimed over 36 000 Palestinian lives, with women and children making up 70% of the casualties, and resulted in more than 80 000 injuries. The devastation was extensive, with over 70% of homes destroyed, along with six universities, numerous hospitals, communication networks, sewage systems, water desalination plants, roads, wells, and other essential infrastructure. Over a million people were displaced from the northern regions to the southern coastal area of Al-Mawasi, which constitutes less than 3% of Gaza's total area, facing dire shortages of water, healthcare, food, and medicine. The collapse of sewage networks and garbage accumulation led to an increase in flies, mosquitoes, insects, and rodents, contributing to the spread of infectious and non-communicable diseases among the displaced population. This research aimed to study the health and environmental impacts of the war in Gaza through data collection, field visits, and photographic documentation. The findings revealed catastrophic conditions, with the destruction of all infrastructure, including buildings, hospitals, universities, mosques, churches, sanitation, water networks, and communications, and the spread of diseases such as intestinal, respiratory infections, and skin infections due to the complete lack of basic life necessities.

KEYWORDS: Gaza; War; AL-Mawasi; Displacement; Health; Environment; Infections

1. Introduction

As history has shown, wars bring about widespread disasters that touch every facet of human life, including health, psychological well-being, social dynamics, and the environment. For instance, the psychological and social impacts are profound: war inflicts severe trauma, including post-traumatic stress disorder (PTSD), anxiety, and depression. These effects can persist long after the conflict concludes, impacting not just the individuals directly affected but also their families and surrounding communities. Additionally, wars often disrupt family and social relationships, exacerbating psychological and social stress[1]. Moreover, wars typically have a severe impact on health situation in affected areas, significantly increasing death and injury rates and placing a tremendous strain on local resources. The destruction of healthcare infrastructure further exacerbates the situation, leading to the spread of diseases and compromising public health. The obliteration of hospitals and medical facilities results in a critical shortage of essential healthcare services, severely undermining the overall quality of public health in conflict zones[2]. An often overlooked but critical consequence of war is its environmental impact. Warfare causes substantial environmental damage by polluting water, soil, and air,

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and depleting natural resources. The use of chemical weapons and explosive ordnance results in the destruction of natural habitats and contributes to severe environmental contamination, which poses significant risks to both human and animal health[3]. Additionally, the economic impact of war is profound: it devastates economic infrastructure, disrupts businesses and industries, and leads to elevated rates of unemployment and poverty. Economic stability is severely undermined, with widespread destruction of property and infrastructure resulting in substantial financial losses and long-term economic challenges[4].

The Gaza Strip, a slim coastal strip along the Mediterranean in southern Palestine, spans approximately 360 square kilometers. Despite its limited size, it is one of the world's most densely populated regions, housing around 2.23 million residents, as reported by the Palestinian Central Bureau of Statistics in 2023. With a density of roughly 6300 people per square kilometer, Gaza stands out as one of the most crowded places on Earth[5–7]. Before the recent conflict, this tiny region was already struggling with severe economic difficulties, relying almost entirely on external support, aid, and foreign transfers. It had also experienced numerous conflicts over the past two decades, including a major one in 2014, which impacted all sectors, most notably the water sector. That war destroyed more than 33000 meters of water and sewage networks, some of which remain unrepaired, leaving thousands of families without reliable access to water. The conflict also intensified existing issues with electricity, fuel, energy, and infrastructure—challenges that Gaza was facing even before the 2023 conflict[6]. The water crisis was one of the severe issues Gaza faced prior to the current war. According to international reports and data from the Palestinian Water Authority, 97% of the water in the Gaza Strip was deemed undrinkable. Before the conflict, the average water consumption per person was merely 22.4 liters per day, which is approximately 20% of the World Health Organization's recommended amount for safe drinking water[8]. Furthermore, Gaza was grappling with a complex array of pressing economic, health, and social issues. The region faced a sharp rise in unemployment and poverty, with the poverty rate soaring to 61% in 2020, underscoring the severity of a deepening economic crisis. These harsh conditions had a profound impact on daily life, creating significant barriers to accessing essential services and job opportunities, and further intensifying the existing social and health challenges the community was already enduring[7].

Undoubtedly, the Israeli blockade has significantly impacted the availability of essential needs like food, fuel, and sanitation, profoundly affecting every aspect of life in Gaza. The health system, already grappling with substantial challenges, has been particularly hard hit. The blockade and the destruction of previous conflicts have severely disrupted health services, leading to critical shortages of medicines, fuel, and other vital health resources[9,10]. In addition, before the onset of this war, conditions were already grim, marked by a troubling rise in malnutrition among children. In 2021, more than 10.3% of kids under five were affected by stunting, revealing the critical challenges in their nutritional well-being[9]. These are some of the significant economic, health, and social challenges that were deeply impacting the population in Gaza before the onset of the current war, creating a particularly difficult and challenging situation. Despite Gaza's history of enduring various conflicts over the years, the war that ignited on October 7, 2023, is considered the most catastrophic and damaging. This conflict has led to the deaths of at least 40000 people, representing 1.7% of the total population, including more than 16000 children and 11000 women. In addition, over 90000 individuals have been injured, many with severe wounds that require medical care, which is critically lacking in Gaza[11–13]. Shockingly, this conflict in Gaza has resulted in the partial destruction of 297000 housing units and the complete destruction of 8700 units. Additionally, 34 hospitals in the region have been destroyed, along with thousands of homes, mosques, churches, and public facilities, all as a direct consequence of the conflict[14]. The crisis intensified as Israeli forces instructed over 2 million residents of the Gaza Strip to evacuate their homes and relocate to so-called "humanitarian zones" within severely overcrowded displacement camps, where they encountered desperate conditions and a critical shortage of basic necessities[15,16].

It's crucial to recognize that this review is dedicated to unveiling the severe health and environmental repercussions of the ongoing conflict in Gaza. The focus will be on the critical risk factors impacting the population and their devastating effects on both health and the environment. The study will delve into major infectious diseases reported among the displaced, employing a range of methods: evaluating statistics and data from trusted local and international sources, scrutinizing pertinent studies from around the world, and integrating on-the-ground photographic evidence. Remarkably, some of the researchers are themselves displaced residents within the conflict zone, offering invaluable firsthand perspectives on the crisis.

In conclusion, as highlighted earlier, words alone cannot fully convey the extent of the immediate effects of the war on health and the environment in Gaza. The subsequent section of this research will provide a detailed examination of the impact on each of these critical areas.

2. Study area and data sources

2.1. The study area

The study was conducted in the southern region of Wadi Gaza, an

area where individuals displaced by conflict were forced to migrate from northern to southern regions, specifically relocating to the central and southern governorates. Subsequently, this displaced population was further concentrated into a restricted coastal zone known as Al-Mawasi, situated along the western Mediterranean shoreline of the Gaza Strip. This coastal strip extends from Khan Younis in the south to Deir al-Balah in the north[17,18]. This tiny area constitutes merely 3% of the Gaza Strip's total land area, which encompasses approximately 360 square kilometers. Consequently, this narrow zone measures just 10.8 square kilometers in size[18]. On the other hand, Figure 1 illustrates a map of the Gaza Strip, highlighting the Al-Mawasi region.

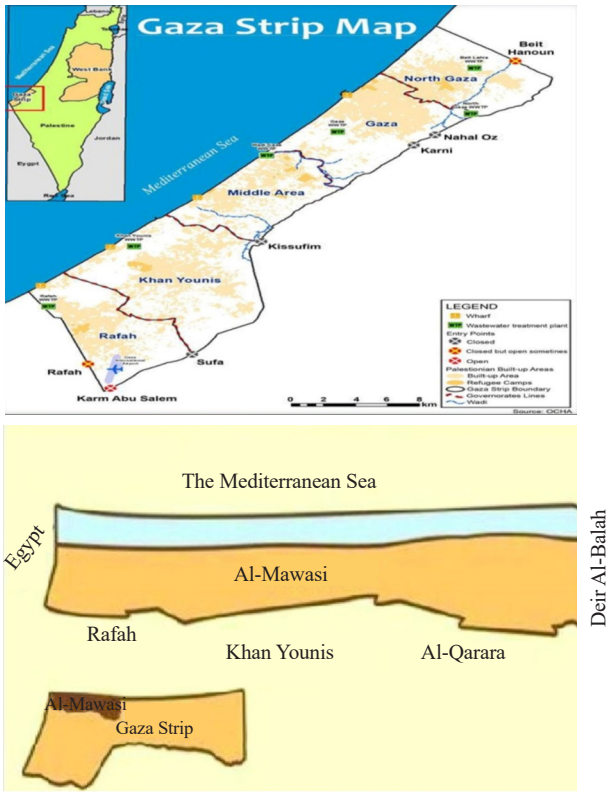

Figure 1. The map of Gaza Strip and the Al-Mawasi region[19].

2.2. Sources of information

Due to the insufficiency of published data and the limited presence of Palestinian authorities in Gaza, researchers relied on updates from credible international news agencies, sporadic Palestinian government websites, the United Nations and its affiliated organizations, the World Health Organization, and relief organizations, as well as reports from international non-governmental organizations and local authorities and municipalities. These sources were utilized to gather the essential data, statistics, and information needed to complete this research.

2.3. Observations and findings

As some researchers in the study were themselves displaced individuals, they visited nearby displacement camps to assess the environmental impact of the conflict. Their observations included sewage overflow, garbage accumulation, damaged buildings, and the use of plastic and nylon for cooking due to shortages of fuel and electricity. They also noted contamination of wells and drinking water. Additionally, the war's repercussions on health were evident in the rise of certain diseases, such as hepatitis A, and adverse effects on individuals with chronic conditions.

2.4. Photographic documentation

In the current research, the researchers employed photography as the primary method for documenting the issues previously outlined. They captured images to record these conditions, including photographs of accumulated garbage, overflowing sewage, deceased animals, the presence of insects, and other relevant observations for comprehensive documentation.

3. Impact of conflict in Gaza

This study reveals the immense scale of suffering experienced by the hundreds of thousands of displaced individuals in the Gaza Strip due to the war, especially those in refugee camps. The situation has been exacerbated by the widespread devastation of vital infrastructure.

3.1. Population displacement

The displacement story began with directives from the Israeli side instructing local residents in the northern Gaza Strip and Gaza City to move to humanitarian areas in the southern part of the Gaza Valley, specifically the Central Governorate, Khan Younis, and Rafah. Consequently, groups of displaced individuals began to leave their homes and head southward towards these designated areas[20]. In a further dramatic development, the Israeli side issued a series of staged evacuation orders for residents of Khan Younis and Rafah, directing them to move towards what it designates as humanitarian zones in Al-Mawasi—a very small area along the Mediterranean coast[21,22]. Displacement continued under dire and tragic conditions, with some statistics indicating that around 83% of Gaza's population has been displaced. Over 1.9 million people have been forced to flee

due to the military operations conducted by Israeli forces since the conflict began in October 2023[23]. Displaced individuals are facing severe hardships, living in overcrowded conditions where each shelter managed by the United Nations Relief and Works Agency for Palestine Refugees hosts approximately 12 400 people—four times its intended capacity. The situation is further exacerbated by a critical shortage of health facilities and essential services, including water and sanitation, making daily life exceptionally challenging for those seeking refuge[10].

3.2. Enviornmental risks

As previously highlighted, the war has wreaked havoc on every essential aspect of daily life in Gaza, severely hampering the ability of municipalities and local organizations to manage and dispose of waste properly. It's significant to recognize that waste management was already a critical issue before the conflict erupted. Gaza generates about 1 700 tons of waste each day, which is primarily processed in just two landfills throughout the region. For instance, the Juhr al-Dik landfill, which has handled 3.9 million tons of waste, has seen waste piles soar to heights of 20-35 meters. Over time, this landfill has surpassed its capacity, causing waste to overflow and frequently catch fire due to inadequate resources, raising significant concerns about its impact on the environment, public health, and the community[24]. The conflict in Gaza, worsened by a severe fuel shortage, brought garbage truck operations and landfill activities to a complete stop, causing major disruptions in waste collection services. Before the conflict, waste collection was nearly perfect at 98%, with garbage regularly transported to designated landfills. However, during the conflict, the collection rate plummeted to below 20%, leading to waste piling up on streets, around shelters and schools, and at makeshift dumping sites where various types of refuse were haphazardly mixed. The mingling of medical waste with other refuse has raised serious concerns for both health and the environment[25]. During a field visit to the displacement camps, researchers observed extensive trash heaps totaling tens of tons, scattered throughout the camps, near universities, and along the roads. As illustrated in Figure 2, there is a notable accumulation of garbage in the Al-Mawasi area, where thousands of displaced individuals are residing in overcrowded conditions.

In addition, researchers documented and photographed the proximity of trash heaps to the tents of displaced people in the Al-Mawasi displacement area, highlighting the associated hazards. This situation not only poses a clear health risk but also creates ideal conditions for attracting rodents and insects. Figure 3 illustrates the close proximity of garbage piles to the tents in the displacement camps.

It is essential to highlight that, as a catastrophic outcome of the war, the accumulation of garbage had far-reaching consequences not only for the environment and public health but also for local practices. Specifically, the piles of waste became unintended pastures for domestic animals such as sheep. At the onset of the conflict, these animals emerged as the primary source of meat for displaced populations, leading to their grazing amid the refuse. This practice has been meticulously documented by researchers, who captured numerous photographs of the sheep foraging through the garbage, as depicted in Figure 4.

Moreover, the acute food shortages in Gaza during the conflict, particularly within overcrowded displacement camps, have driven some displaced individuals to salvage food scraps from garbage heaps. This dire situation highlights the critical food insecurity faced by these populations, which exacerbates the health and environmental risks stemming from the war. Figure 5 depicts children gathering food scraps from refuse piles in the Mawasi area, a zone heavily populated by displaced people, underscoring the severe conditions they endure.

Compounding the issue, researchers observed during field visits to displacement camps that the accumulation of waste had led to significant heaps of baby diapers and sanitary pads, along with their contents, within the garbage piles. As previously discussed, these heaps are often scavenged by sheep and children searching for food scraps. Figure 6 shows a scene of neglect, depicting the occurrence of discarded baby diapers and sanitary pads amidst the waste surrounding the displaced individuals' tents.



Figure 2. The buildup of waste in the Al-Mawasi area.



Figure 3. Heaps of trash located close to the tents of displaced individuals in the Al-Mawasi region.



Figure 4. Animals raised on garbage in Al-Mawasi region.



Figure 5. Children are scavenging for food in a rubbish dump in Al-Mawasi Region.



Figure 6. A pile of trash containing a baby's diaper, with house flies swarming around it.

3.3. Spread of insect vector

In displaced regions, insects, particularly mosquitoes and house flies, have notably increased. Researchers, during their surveys, observed an unusually high number of flies, which is both striking and uncommon. Figure 7 illustrates the occurrence of flies around trash bins located near displacement camps.

3.4. Water and sanitation infrastructure breakdown

Before the current conflict, Gaza's water supply was severely inadequate compared to global standards. Residents had to make do with just 21 liters of safe drinking water per day—less than a quarter of the 100 liters deemed necessary by the World Health Organization (WHO). This disparity is even more pronounced when compared to Israeli citizens, who enjoyed about 280 liters daily, making Gaza's water availability less than 10% of their neighbor's[26]. Furthermore, the Gaza Strip's water reserves have been critically depleted due to the ongoing war and continuous attacks, exacerbated by Israel's extraction from Gaza's underground aquifer. This has forced the local population to further strain and deplete the already limited reservoir. The coastal aquifer has experienced a dangerous rise in water salinity. Despite these severe challenges, the occupying authority has displayed indifference and inflicted significant damage on Gaza's water infrastructure, with no apparent solutions on the horizon. Political, social, and economic obstacles have hindered the development of new water sources[26]. Despite the situation, the UN Office for the Coordination of Humanitarian Affairs reports that municipal wells in the Gaza Strip are currently operating at only 10% of their pre-war capacity. The daily output has plummeted to around 21 thousand cubic meters, down from 255 thousand cubic meters before October 7, 2023. Additionally, the office emphasized that the water from these wells is no longer safe for consumption due to its high salt content[27]. Before the war, the ongoing siege and the recent violent military invasion of Gaza by Israel had already strained the area's fragile sewage infrastructure. As a result, large amounts of raw and partially treated sewage are now being released into the environment, notably into Wadi Gaza, the Storm Water Reservoir in Khanyounis, and various points along the Mediterranean coast, totaling approximately 80 000 cubic meters daily. This pollution has raised significant concerns about potential cholera outbreaks, as warm, contaminated seawater is a known risk factor. Microbiologically contaminated seawater has been detected along the Gaza coast, leading to sanitation-related infections. Although cholera has not been reported in Gaza since 1992, the WHO cautions that the risk of waterborne and foodborne diseases remains high and could increase if water, sanitation, and food control services are not quickly restored and improved[28]. The current conflict has

severely damaged the sewage network, leading to significant sewage overflow in streets and public spaces. Researchers have confirmed this issue through numerous photographs showing sewage in public areas and buildings. Additionally, the reliance of camp residents on makeshift sewage wells presents both environmental and health hazards, as well as negatively impacts groundwater. Figure 8 shows sewage spilling into the streets near the tents of displaced individuals in the Al-Mawasi region.

The war has resulted in significant damage or destruction of wastewater treatment plants, creating a crisis where over 100 million liters of untreated wastewater are dumped into the Mediterranean Sea each day. This has led to severe pollution of the sea and beaches, adversely affecting hundreds of thousands of displaced individuals. The destruction of desalination plants has further exacerbated water scarcity, leaving millions without access to safe drinking water. Even prior to the conflict, Gaza's water sources were heavily polluted, with 97% of the groundwater deemed unsafe for consumption due to high salinity and nitrate contamination. The quality of available water has deteriorated further, making it even less safe for drinking[29]. Additionally, sewer overflow involves the discharge of untreated sewage and pathogens from fecal matter into various environments, including land, bodies of water (such as seas, rivers, and pools), as well as underground or into the air. This phenomenon poses a significant threat to the global environment, as it contaminates the air, groundwater, and surface water[30].

3.5. Debris accumulation and explosure hazard

Additionally, the attacks on Gaza during 2023 and 2024 have caused severe damage to both public and private infrastructure and residential buildings, resulting in a significant accumulation of debris throughout the region. As of March 15, 2024, it is estimated that approximately 23 million tons of rubble have accumulated [31–33]. It is important to highlight that more than 10 000 bodies are thought to be entombed under the rubble of destroyed buildings in Gaza. This situation severely hampers recovery efforts due to constraints such as limited resources, insufficient personnel, and the difficult conditions imposed by the occupying forces[33]. Entire groups of houses were destroyed as a result of heavy bombing during the war. The United Nations estimates that this has resulted in 37 million tons of rubble in Gaza. As previously mentioned, about 800 000 tons of this debris consist of asbestos and other harmful materials[33]. Nonetheless, a new concern is emerging regarding non-explosive weapons left over from the war in Gaza. UN specialists estimate that around 7 500 tons of these weapons may be scattered across the region, necessitating a 14-year cleanup effort due to the potential danger they pose to the population's safety and well-being[34]. The problem extended beyond just human casualties to encompass the effects of war and mistreatment on animals. Researchers noted a rise in animal carcasses in various places, especially near trash containers and areas affected by displacement. Figure 9 illustrates animal carcasses found near garbage bins in the Al-Mawasi region.

3.6. Epidemiological risks in post–conflict Gaza

A report from the World Health Organization, issued on December 21, 2023, revealed that Gaza is facing a surge in infectious diseases. Since mid-October, more than 100 000 cases of diarrhea have been reported, with half of these affecting toddlers under five—an increase 25 times greater than pre-war levels. Similarly, a UNICEF report has noted a dramatic rise in diarrhea cases among young children. Projections indicate a 2% rise in such cases among children under five by the end of 2023, underscoring the worsening health crisis and severe lack of access to clean water[35]. Additionally, more than 150 000 cases of upper respiratory tract infections have been recorded, alongside a range of other health issues including scabies, lice, varicella, skin rashes, chickenpox, hepatitis A, and various other diseases affecting the displaced population[35,36]. The decline in Gaza's health conditions during the war was largely driven by shortages of food and clean water, contamination of existing supplies, and challenges in maintaining their safety. This crisis has resulted in widespread food poisoning and intestinal diseases, characterized by severe diarrhea and vomiting, especially among children. Recent reports from the World Health Organization indicate that the total number of documented diarrhea cases has reached 213 085, with 104 213 of these affecting children under five years old[37,38]. Moreover, the systematic destruction of hospitals by the Israeli army and outdated information have rendered accurate statistics on the spread of hepatitis A unavailable. Nonetheless, a significant number of displaced individuals are suffering from hepatitis A, with the situation worsened by the severe lack of clean water and the absence of medical care[36,38]. In a recent and uncommon study conducted during the war to evaluate the prevalence of hepatitis A and the level of awareness among the displaced population, it was found that over 32% of the 384 respondents reported having contracted the virus during the conflict[39]. Moreover, the violence has led to severe health consequences, including wound infections caused by antibiotic-resistant bacteria. These infections are worsened by overcrowded hospitals, insufficient infection control measures, contaminated hospital water, and a lack of essential antibiotics. The prevalence of antibiotic-resistant germs results in patients either dying or losing limbs due to infections in their wounds[38]. The lack of healthcare services, vaccinations, and reliable statistics has facilitated the widespread transmission of these illnesses. Recently, a new concern emerged when the polio virus was found in sewage water samples. This finding underscores the rapid spread of yet another infectious disease among the displaced populations, emphasizing the critical need for enhanced healthcare and preventive measures[39,40].



Figure 7. House flies clustered in mounds of trash close to temporary shelters of displaced individuals.



Figure 8. Sewage overflowing into the streets near displacement camps in the Al-Mawasi area.



Figure 9. Dead animals discarded near garbage cans in the Al-Mawasi area.

4. Discussion

The journey of displacement persisted as people were forced to move from various locations to the so-called humanitarian zone in Al-Mawasi. According to United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the population density in this area has surged to between 33 000 and 34 000 people per square kilometer, compared to approximately 200 people per square kilometer before October of the previous year[41]. This enormous population increase is exacerbated by insufficient capacity and public services. Many displaced individuals are residing in overcrowded shelters with inadequate sanitation facilities. Reports show that in some areas, there is only one toilet for every 600 people, making it nearly impossible to uphold the hygiene standards needed to prevent the spread of infections[42]. This overcrowding significantly affects public health by heightening the risk of spreading infectious diseases like colds, flu, and meningitis. Research shows that overcrowded conditions exacerbate the risk of diseases such as meningitis and tuberculosis, particularly among children[43]. Additionally, overcrowding adversely affects mental health, leading to heightened stress, anxiety, and depression. The lack of privacy and increased physical contact contribute to social and behavioral issues, particularly among children[44]. Besides, overcrowding is associated with an increased risk of physical diseases, such as heart and lung diseases and arthritis. It also heightens the likelihood of skin infections, such as impetigo, and gastrointestinal issues like dysentery[10]. Lastly, Overcrowding deteriorates overall quality of life by intensifying psychological and social stress on residents. It disrupts social interactions, hampers children's development, and affects the formation of personal identity[44]. Furthermore, Gaza, which was already one of the most densely populated regions in the world before the conflict, now has the majority of its population concentrated in Al-Mawasi. This coastal strip, extending from Deir al-Balah to Rafah, spans less than 16 square kilometers[45]. Additionally, the mounting piles of garbage and the challenge of managing waste present a critical and severe issue for both the environment and public health. For instance, the United Nations Relief and Works Agency for Palestine Refugees reported that its teams were able to dispose of 10 000 tons of garbage in January and February 2024. However, the agency estimates that Gaza still contains over 270 000 tons of solid and organic waste[46]. The pressing issue at hand is how the massive buildup of waste impacts both our environment and public health. This growing problem poses a serious health threat around the world, particularly in developing countries where infrastructure falls short of managing the ever-increasing piles of garbage on their streets. This accumulation not only becomes a breeding ground for dangerous pests and rodents but also emits foul odors. Inefficient waste disposal

practices can also exacerbate the spread of diseases like cholera, typhoid, malaria, and dengue fever[47,48,49]. Waste generally falls into two categories: solid waste and organic waste. Solid waste encompasses non-liquid materials such as dust, food scraps, paper, metal cans, plastics, glass, textiles, garden clippings, and medical waste. Organic waste, on the other hand, originates from living organisms—plants, animals, and microorganisms—and includes materials in various stages of decomposition. Organic matter plays a crucial role in soil health and ecosystem balance by enhancing soil fertility, retaining moisture, and supporting the carbon cycle. However, the failure of waste management systems in Gaza during the conflict has led to a surge in kitchen waste and food scraps. This situation creates optimal conditions for harmful microorganisms to flourish, posing a significant threat to public health. Direct contact with solid waste can result in infections and chronic diseases, while the decomposition of organic waste releases gases that contribute to air pollution, further jeopardizing human health[49,50]. Moreover, inadequate waste management infrastructure—characterized by ineffective collection, transportation, and disposal systems—intensifies the public health hazards related to waste accumulation. As a result, garbage can accumulate in public areas, fostering ideal conditions for pests that transmit diseases and presenting a serious threat to public health[48,49,50]. Another serious consequence of waste accumulation in displacement areas is the presence of scavenging animals, which can spread diseases among themselves and pose a health risk to humans. During the intense conflict siege, the scarcity of meat led to its consumption without proper regulation or oversight. The lack of adequate cooking facilities forced displaced individuals to use firewood, nylon, and plastic bags for cooking, which compromised food quality and increased the risk of harmful pathogens. Research by Dardona *et al*. highlights those animals, such as sheep, can contract diseases like toxoplasmosis from consuming food scraps found in garbage. These diseases can then be transmitted to humans through the consumption of raw or undercooked meat from infected animals[51]. A significant concern arising from the accumulation of waste is the direct interaction individuals have with it, especially under severe conditions where some people scavenge for uneaten food, escalating their risk of health issues. Such direct contact with refuse has been linked to a spectrum of health problems, including fatigue, drowsiness, and headaches, particularly among those living near hazardous waste sites. Research corroborates that proximity to landfill sites presents a tangible health threat[52]. Additionally, landfills emit bioaerosols composed of bacteria and fungi, which can disseminate through leachates, vectors, and aerosols, posing further respiratory risks. These sites are teeming with microorganisms, such as *Escherichia* (*E.*) *coli*, *Proteus mirabilis*, *Staphylococcus sciuri*, and *Staphylococcus xylosus*, alongside fungi like *Aspergillus fumigatus* and *Aspergillus flavus*, all integral to waste decomposition[52,53]. Furthermore, the handling of trash, particularly by street garbage collectors, exacerbates the spread of intestinal parasites. Studies reveal that 65% of these workers are infected with multiple parasites, including *Entamoeba histolytica/dispar*, *Giardia lamblia*, *Hymenolepis diminuta*, and *Hymenolepis nana*[54]. Furthermore, sanitary pads and disposable diapers present considerable environmental risks if not correctly managed in landfills or natural settings. With up to 90% of their composition being plastic and other non-biodegradable substances, these products can remain intact for centuries before breaking down[55,56]. In landfill environments, the plastics and chemicals in these items can seep into the soil and water sources, resulting in pollution[55]. Moreover, the buildup of waste creates a perfect breeding ground for insects, especially during the summer when high temperatures, overcrowding, and poor hygiene and sanitation in displacement camps exacerbate the situation. Insects, which have adapted to nearly every environment, play essential roles in terrestrial ecosystems. They are vital for nutrient recycling, seed dispersal, soil health maintenance, population regulation of various organisms such as predators, parasites, and disease vectors, and serve as a primary food source for amphibians, reptiles, birds, fish, other insects, and some mammals[57]. The Gaza City Municipality has clarified that the surge in skin diseases is linked to a rise in insect populations, which has been exacerbated by the ongoing conflict and efforts to eradicate pests in the Gaza Strip. The situation has been aggravated by the accumulation of approximately 90 000 tons of waste and sewage overflow into rainwater reservoirs. Officials have reported extensive damage to the city's infrastructure, particularly sewage pipes, leading to malfunctions at sewage treatment facilities. This has resulted in wastewater leaking onto the streets, creating a breeding ground for harmful mosquitoes. Additionally, a shortage of crucial insecticides and elevated temperatures have further intensified the proliferation of insects, which has in turn led to skin ailments among both children and adults, as well as disturbances in sleep patterns[58]. House flies for example, are widely recognized as mechanical vectors for a multitude of pathogens, underscoring their significant role in transferring harmful microorganisms from waste, excrement, and decomposing organic matter to human and animal food and various surfaces. These flies are linked to an array of pathogens, including bacteria, parasites, viruses, and fungi, which can result in diverse diseases in humans. These diseases range from gastrointestinal infections like *salmonella*, *E. coli*, and *Shigella*, to more severe conditions such as typhoid fever, cholera, dysentery, and conjunctivitis[59]. Moreover, house flies are infamous for transmitting pathogens that can cause serious and potentially life-threatening diseases in both humans and animals, with over 100 different pathogen types—including bacteria, viruses, fungi, and parasites like protozoans and metazoans—associated with these insects[60,61]. In

contrast, mosquitoes transmit diseases primarily through bites, carrying pathogens such as Zika virus, West Nile virus, Chikungunya virus, dengue fever, and malaria to humans[62,63]. One of the devastating consequences of war on public health and the environment is the contamination of streets with sewage, resulting from the destruction of water and sewage infrastructure as well as sewage treatment facilities. Sewage is a breeding ground for numerous harmful pathogens, including bacteria such as *E. coli*, *Salmonella*, *Shigella*, and *Vibrio cholerae* (which causes cholera), as well as viruses like hepatitis A and norovirus. Other significant pathogens present in sewage include enteroviruses and adenoviruses, protozoa such as *Giardia*, *Cryptosporidium*, and *Entamoeba histolytica*, and parasitic worms like *Ascaris* (roundworm), *Trichuris* (whipworm), and hookworms[31,64]. Due to limited awareness and the dire conditions of war, affected populations are regrettably exposed to raw sewage flowing through streets, roads, and even the shelters of displaced individuals. These pathogens can lead to a spectrum of health issues, ranging from mild gastrointestinal infections to severe and potentially fatal diseases such as dysentery, hepatitis, and polio. Exposure occurs through contaminated drinking water, direct contact with sewage, or consumption of shellfish from polluted waters[51]. Moreover, the war has led to the accumulation of millions of tons of debris from destroyed buildings, which may contain hazardous materials such as asbestos, heavy metals, and chemicals. These substances can pose severe health risks, including respiratory problems and cancer, if inhaled. The mixing of household waste with industrial and medical waste exacerbates these health risks. Contact with contaminated debris can lead to infections and diminish the effectiveness of antimicrobial treatments. Additionally, the decomposition of bodies trapped under the rubble can attract insects and rodents, further increasing the risk of disease outbreaks due to inadequate waste management and debris removal[65,66,67]. Moreover, estimates suggest that there are over ten thousand bodies trapped under the rubble in Gaza. The prolonged entrapment of bodies under debris, particularly following natural disasters or conflicts, poses significant health and environmental risks. For instance, the improper burial of bodies can increase the risk of disease outbreaks and environmental contamination, potentially affecting water sources. Decomposing bodies have the potential to spread bacteria, viruses, and other pathogens that can lead to severe diseases such as cholera and malaria[68,69]. However, the WHO notes that, contrary to common belief, there is no evidence that bodies can spread infectious diseases during a disaster. Many pathogens have a short lifespan in the human body after death. Generally, there are no major health concerns associated with human remains, except in specific cases such as deaths from cholera or hemorrhagic fever. Nonetheless, personnel who regularly handle deceased individuals may face risks from tuberculosis, bloodborne viruses (such as hepatitis B and C, and HIV), and gastrointestinal infections (including cholera, *E. coli*, hepatitis A, rotavirus diarrhea, *salmonella*, *Shigella*, and typhoid/paratyphoid fever)[68]. In addition, the intersection of a stringent blockade, deteriorated infrastructure, inoperative sewage and water systems, inadequate waste management, and acute shortages in electricity, fuel, food, and medicine has inevitably exacerbated the proliferation of various diseases amidst the ongoing conflict. In Gaza, the 2023-2024 conflict has precipitated a sharp escalation in acute watery diarrhea and respiratory infections, precipitating a severe health crisis. The scarcity of clean water, overcrowded living conditions, and deficient sanitation have significantly aggravated the spread of infectious diseases, disproportionately impacting young children, pregnant women, and breastfeeding mothers. This grave scenario has further intensified malnutrition, thereby amplifying the adverse effects of disease and elevating morbidity and mortality rates among Gaza's most vulnerable populations[68,36]. Several of the previously identified risk factors play a pivotal role in the transmission of hepatitis A, notably the contamination of drinking water, overcrowded conditions in refugee camps, improper waste management, insect infestations, and the overflow of sewage into public spaces. Additionally, poor sanitation practices and inadequate personal hygiene have been recognized as major drivers of the outbreak[40]. These challenges have facilitated the spread of infectious diseases, particularly among displaced populations in the AL Mawasi region, where this study was conducted.

5. Recommendations and conclusions

The level of destruction in Gaza is almost unimaginable, with 70% of buildings, including universities, hospitals, mosques, and churches, destroyed. Damaged sewage and water networks, along with accumulating garbage, contribute to a dire environmental and health situation. Additionally, overcrowded displacement camps lacking essential facilities such as hygiene and sanitation, combined with waste and sewage buildup and insect infestations, have led to the spread of various infectious and non-communicable diseases among the displaced, exacerbated by the absence of healthcare facilities. The study concluded that the war's ultimate aim is to render Gaza uninhabitable. It is estimated that Gaza will need numerous years to recover, necessitating collective global efforts to salvage what can still be saved.

The current study strongly recommends that both Gaza's responsible authorities and humanitarian non-governmental organizations intensify their relief efforts by promptly removing the garbage accumulating around displaced persons' tents. In addition, it is crucial for water providers to exercise extreme caution in

sterilizing drinking water and water for household use to prevent the spread of infectious diseases. The study also calls on international organizations, particularly the WHO, to urgently provide vaccines—especially for polio—as well as essential medicines, health supplies, and personal hygiene items such as sterilization tools and soap, which are currently restricted from entry. Isolating displaced individuals from those who are infected and prioritizing personal and public hygiene to help curb the spread of disease. To address overcrowding, it suggested increasing the number of toilets in displacement camps. Furthermore, the study emphasized the need for improved food distribution in areas where displaced people reside to ensure adequate nutrition and strengthen immune defenses. The study also highlighted the importance of enhancing cultural awareness and education among displaced populations regarding the causes and prevention of infectious diseases, as well as the critical role of maintaining proper hygiene practices.

Conflict of interest statement

The authors declare that there is no conflict of interest.

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Data availability statement

The data supporting the findings of this study are available from the corresponding author upon request.

Authors' contributions

Dardona Z played the key role in data collection, composing the article, identifying relevant sources, writing, providing photographic documentation, and revising the text through linguistic and editorial editing. Amane M contributed to the research review and offered support in the writing process, while Dardona A assisted in both writing and reviewing tasks. Boussaa S supervised the entire project, performed a comprehensive review, managed communication with the journal, and provided significant assistance in writing, data collection, and editing.

References

[1] Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *N Engl J Med*; 2004; **351**(1): 13-22.

[2] Levy BS, Sidel VW (Eds.). *War and public health*. Oxford: Oxford University Press; **2008**, p.518.

[3] Westing AH. *Environmental hazards of war: Releasing dangerous forces in an industrialized world*. London: Sage; **1990**.

[4] Collier P. On the economic consequences of civil war. *Oxford Econ Pap* 1999; **51**(1): 168-183.

[5] Palestinian Central Bureau of Statistics. *Palestinian Central Bureau of Statistics presents the conditions of the Palestinian population on the occasion of the World Population Day*. [Online] Available form: https://www.pcbs.gov.ps/portals/_pcbs/PressRelease/Press_En_IntPopulationDy2023E.pdf. [Accessed on 23 August 2024].

[6] World Bank. *Gaza factsheet*. [Online] Available form: https://www.worldbank.org/content/dam/Worldbank/document/MNA/Factsheet_Gaza_ARA.pdf. [Accessed on 23 August 2024].

[7] United Nations Development Programme. *Gaza war policy brief*. [Online] Available form: https://www.undp.org/sites/g/files/zskgke326/files/2023-11/2301926e-policybrief-gazawar-escwa-undp-english-4pm_1.pdf. [Accessed on 23 August 2024].

[8] Palestine Studies. *Initial effects of the war on Gaza: The water sector as an example*. [Online] Available form: https://www.palestine-studies.org/en/node/1654847. [Accessed on 23 August 2024].

[9] Beiraghdar F, Momeni J, Hosseini E, Panahi Y, Negah SS. Health crisis in Gaza: The urgent need for international action. *Iran J Public Health* 2023; **52**(12): 2478-2483.

[10]Juzoor for Health and Social Development. *A war on health: Gaza*. [Online] Available form: https://www.juzoor.org/cached_uploads/download/2024/03/12/03-2024-a-war-on-health-gaza-juzoor-report-1710245501.pdf. [Accessed on 23 August 2024].

[11]BBC News. *More than 40,000 killed in Gaza, Hamas–run health ministry says*. [Online] Available form: https://www.bbc.com/news/articles/cn49v0nzv3ko. Accessed August 23, 2024.

[12]Cable News Network. *Gaza death toll reaches 40,000 amid ongoing Israel war*. [Online] Available form: https://edition.cnn.com/2024/08/15/middleeast/gaza-death-toll-40000-israel-war-intl/index.html. [Accessed on 23 August 2024].

[13]Palestinian Central Bureau of Statistics. *Martyrs*. [Online] Available from: from https://pcbs.gov.ps/site/lang__en/1405/Default.aspx. [Accessed on 23 August 2024].

[14]Palestinian Central Bureau of Statistics. *Destroyed Buildings*. [Online] Available from: https://pcbs.gov.ps/site/lang__en/1408/Default.aspx. [Accessed on 23 August 2024].

[15]Palestinian Central Bureau of Statistics. *Israeli occupation aggression on Palestine since Oct.7th 2023, latest update 12:00, 22/08/2024*. [Online] Available from: https://pcbs.gov.ps/site/lang__en/1408/Default.aspx. [Accessed on 23 August 2024].

[16]Reuters. *UN says Israeli military warns 1.1 million Gazans to relocate south*. [Online] Available from:https://www.reuters.com/world/un-says-israeli-military-warns-11-mln-gazans-relocate-south-2023-10-13/. [Accessed on 23 August 2024].

[17]United Nations Office for the Coordination of Humanitarian Affairs. *Gaza humanitarian response update (13–19 May 2024)*. [Online] Available from: https://www.unocha.org/publications/report/occupied-palestinian-territory/gaza-humanitarian-response-update-13-19-may-2024. [Accessed on 20 July 2024].

[18]The New Humanitarian. *Inside Gaza's supposed safe zone: Displaced Palestinians struggle in Al–Mawasi*. [Online] Available from: https://www.thenewhumanitarian.org/news-feature/2024/01/11/inside-gaza-supposed-safe-zone-displaced-palestinians-struggle-al-mawasi. [Accessed on 13 September 2024].

[19]Abd Rabou AN. The mammalian, reptilian and amphibian fauna of Al-Mawasi ecosystem, south-western Gaza Strip-Palestine. *Agric Technol* 2019; **23**(1): 00301-00314.

[20]CBS News. *Israel military tells United Nations over one million Palestinians should evacuate southern Gaza within 24 hours*. [Online] Available from: https://www.cbsnews.com/news/israel-military-tells-united-nations-over-one-million-palestinians-should-evacuate-southern-gaza-within-24-hours/. [Accessed on 23 August 2024].

[21]United Nations. *Journey into the unknown: Thousands of Gazan families flee Rafah without the bare necessities of life*. [Online] Available from: https://news.un.org/ar/story/2024/05/1130731. [Accessed on 23 August 2024].

[22]United Nations. *Gaza: 250,000 people forced to flee again after new Israeli evacuation orders*. [Online] Available from: https://news.un.org/ar/story/2024/07/1132221. [Accessed on 23 August 2024].

[23]Internal Displacement Monitoring Centre. *Palestine: Conflict in Gaza leaves 83% of the population internally displaced in less than three months*. [Online] Available from: https://www.internal-displacement.org/spotlights/Palestine-Conflict-in-Gaza-leaves-83-per-cent-of-the-population-internally-displaced-in-less-than-three-months/. [Accessed on 23 August 2024].

[24]United Nations Developing Program. *A silent threat: Gaza's struggle with solid waste management*. [Online] Available from https://stories.undp.org/a-silent-threat-gazas-struggle-with-solid-waste-management. [Accessed on 24 August 2024].

[25]Modak PR, Nangare PB. Quantitative and qualitative assessment of municipal solid waste for Nagpur City. *J Environ Res Sci* 2011; **2**(2): 55-61.

[26]Middle East Institute. *The devastating impact of Gaza's acute and prolonged water crisis*. [Online] Available from: https://www.mei.edu/publications/devastating-impact-gazas-acute-and-prolonged-water-crisis. [Accessed on 23 August 2024].

[27]United Nations News. *Diminishing drinking water sources in Gaza, and fears of disease outbreaks*. [Online] Availabel from: https://news.un.org/ar/story/2024/01/1127872. [Accessed on 24 August 2024].

[28]Ashour F, Ashour B, Komarzynski M, Nassar Y, Kudla M, Shawa N, et al. *A brief outline of the sewage infrastructure and public health risks in the Gaza Strip for the World Health Organization*. [Online] Available from: https://www.un.org/unispal/document/auto-insert-198691/. [Accessed on 24 August 2024].

[29]WATTAN news agency. *Gaza, Environmental massacre*. [Online] Available from: https://www.wattan.net/ar/news/433898.html. [Accessed on 22 August 2024].

[30]Sojobi AO, Zayed T. Impact of sewer overflow on public health: A comprehensive scientometric analysis and systematic review. *Environ Res* 2022; **203**: 111609.

[31]Tondera K, Klaer K, Koch C, Hamza IA, Pinnekamp J. Reducing pathogens in combined sewer overflows using performic acid. *Int J Hyg Environ Health* 2016; **219**(7): 700-708.

[32]United Nations. *Gaza: 23 million tonnes of debris 'will take years to clear'; acute malnutrition doubles in a month*. UN News. [Online] Available from: https://news.un.org/en/story/2024/03/1147616. [Accessed on 23 August 2024].

[33]United Nations. *10 000 people feared buried under the rubble in Gaza*. [Online] Available from: https://news.un.org/en/story/2024/05/1149256. [Accessed on 23 August 2024].

[34]United Nations. *New threat emerges from unexploded ordnance in Gaza*. [Online] Availbale from: https://news.un.org/en/story/2024/05/1149256. [Accessed on 27 May 2024].

[35]World Health Organization. *Risk of disease spread soars in Gaza as health facilities, water and sanitation systems disrupted*. [Online] Available from: https://www.emro.who.int/media/news/risk-of-disease-spread-soars-in-gaza-as-health-facilities-water-and-sanitation-systems-disrupted.html. [Accessed on 23 August 2024].

[36]Doctors Without Borders. *Gaza: Lack of clean water brings disease and suffering*. [Online] Available from: https://www.doctorswithoutborders.ca/gaza-lack-of-clean-water-brings-disease-and-suffering. [Accessed on 24 August 2024].

[37]International Middle East Media Center. *WHO: Infectious diseases spreading in Gaza*. [Online] Available from: https://imemc.org/article/who-infectious-diseases-spreading-in-gaza/. [Accessed on 24 August 2024].

[38]Institute for Palestine Studies. *Infectious diseases and the war on Gaza: The deadly silent killer*. [Online] Available from: https://www.palestine-studies.org/en/node/1655349. [Accessed on 23 August 2024].

[39]Dardona Z, Amane M, Boussaa S. Assessing the epidemiological status and awareness level of hepatitis A virus among displaced populations in southern Gaza during the 2023-2024 conflict. *Microbes Infec Dis* **2024**. doi: 10.21608/mid.2024.305028.2087.

[40]AL Jazeera. *Ticking time bomb: Poliovirus found in Gaza sewage*. [Online] Available from: https://www.aljazeera.com/news/2024/7/19/ticking-time-bomb-poliovirus-found-in-gaza-sewage. [Accessed 0n 20 July 2024].

[41]Wafa. *OCHA warns of 'catastrophic situation in Gaza' due to displacement, overcrowding*. [Online] Available from: https://english.wafa.ps/Pages/Details/148264. [Accessed on 23 August 2024].

[42]BBC. *WHO 'extremely worried' about possible Gaza polio outbreak*. [Online] Available from: https://www.bbc.com/news/articles/crgrxjn9rkpo. [Accessed on 5 August 2024].

[43]McNicholas A, Lennon D, Crampton P, Howden-Chapman P. Overcrowding and infectious diseases-when will we learn the lessons of our past? *N Z Med J* 2000; **113**(1121): 453.

[44]Solari CD, Mare RD. Housing crowding effects on children's wellbeing. *Soc Sci Res* 2012; **41**(2): 464-476.

[45]United Nations Office for the Coordination of Humanitarian Affairs. *Al–Mawasi: Facts finding mission*. [Online] Available from: https://www.unocha.org/publications/report/occupied-palestinian-territory/al-mawasi-fact-finding-mission.[Accessed on 24 August 2024].

[46]United Nations Relief and Works Agency for Palestine Refugees in the Near East. *UNRWA situation report #103 on the situation in the Gaza Strip and the West Bank, including East Jerusalem*. [Online] Available from https://www.unrwa.org/resources/reports/unrwa-situation-report-103-situation-gaza-strip-and-west-bank-including-east-Jerusalem. [Accessed on 22 August 2024].

[47]Ogundele, OM, Rapheal OM, Abiodun AM. Effects of municipal waste disposal methods on community health in Ibadan-Nigeria. *Polytechnica* 2018; **1**(1): 61-72.

[48]Kwun Omang DI, John GE, Inah SA, Bisong JO. Public health implication of solid waste generated by households in Bekwarra Local Government area. *Afr Health Sci* 2021; **21**(3): 1467-1473.

[49]Organic biotech.*Negative effects of improper solid waste disposal on human health*. [Online] Available from: https://organicabiotech.com/negative-effects-of-improper-solid-waste-disposal-on-human-health/. [Accessed on 23 August 2024].

[50]Alam P, Ahmade K. Impact of solid waste on health and the environment. *Intern J Sustainable Dev Green Econ* 2013; **2**(1): 165-168.

[51]Dardona Z, Hindi AA, Hafidi M, Boumezzough A, Boussaa S. Seroprevalence of Anti-Toxoplasma gondii antibodies in the most consumed livestock and poultry in Gaza–Palestine. *IUG J Nat Stud* 2022; **30**: 37-50.

[52]Vrijheid M. Health effects of residence near hazardous waste landfill sites: A review of epidemiologic literature. *Environ Health Perspect* 2000; **108**(suppl 1): 101-112.

[53]Boer R. Zwijnenburg W. *Exploring environmental harm from explosive weapons in populated areas*. PAX. [Online] Available from: https://humanitariandisarmament.org/2020/05/29/exploring-environmental-harm-from-explosive-weapons-in-populated-areas/. [Accessed on 24 August 2024].

[54]Pereira IGS, Rodrigues CS, Gurgel-Gonçalves R, Machado ER. Frequency of intestinal parsites and commensals in street waste pickers from two cooperatives in the Brazilian Federal district. *Rev Patol Trop* 2015; **44**: 432-440.

[55]Vyas H.*The hidden costs: Harm to the environment caused by sanitary pads and diapers. LinkedIn*. [Online] Available from: https://www.linkedin.com/pulse/hidden-costs-harm-environment-caused-sanitary-pads-vyas-he-him-. [Accessed on 23 August 2024].

[56]Science Daily. *Is food waste the key to sustainable, plastic–free diapers and sanitary pads*? [Online] Available from: https://www.sciencedaily.com/releases/2024/03/240319123119.htm. [Accessed on 24 August 2024].

[57]Van Huis A. Potential of insects as food and feed in assuring food security. *Annu Rev Entomol* 2013; **58**: 563-583.

[58]Gaza City Municipality. *Gaza Municipality warns of the danger of the spread of diseases due to the increase in harmful insects*. [Online] Available from: https://gaza-city.org/news/bldy-ghz-ththr-mn-khtor-ntsh-r-lamr-d-ntyg-tz-yd-lhshr-t-ld-r/14995. [Accessed on 22 August 2024].

[59]Greenberg B. *Flies and Disease. Ecology, Classification and Biotic Associations*. New Jersey: Princeton University Press; **1971**, p.856.

[60]Tsagaan A, Okado K. Study of pathogenic bacteria detected in fly samples using universal primer-multiplex PCR. *Mong J Agric Sci* 2015; **15**(2): 27-32.

[61]Kassiri H, Zarrin M, Veys-Behbahani R, Faramarzi S, Kasiri A. Isolation and identification of pathogenic filamentous fungi and yeasts from adult house fly (Diptera: Muscidae) captured from the hospital environments in Ahvaz City, southwestern Iran. *J Med Entomol* 2015; **52**(6): 1351-1356.

[62]United States Environmental Protection Agency. *General information about mosquitoes*. [Online] Available from: https://www.epa.gov/mosquitocontrol/general-information-about-mosquitoes#:~:text=But%20a%20more%20serious%20consequence,encephalitis%2C%20meningitis%20and%20microcephaly. [Accessed on 23 August 2024].

[63]Centers for Disease Control and Prevention. *Mosquito–borne diseases*. [Online] Available from: https://www.cdc.gov/niosh/topics/outdoor/mosquito-borne/default.html.[Accessed on 22 August 2024].

[64]United States Environmental Protection Agency. *Sewer system evaluation and rehabilitation: Description of sewer systems*. [Online] Available from: https://www3.epa.gov/npdes/pubs/ssodesc.pdf. [Accessed on 24 August 2024].

[65]Morgan O. Infectious disease risks from dead bodies following natural disasters. *Rev Panam Salud Publica* 2004; **15**: 307-312.

[66]Morgan O, Tidball-Binz M, Van Alphen D (Eds). *Management of dead bodies after disasters: A field manual for first responders*. Washington D.C. : Pan American Health Organization (PAHO); **2006**.

[67]World Health Organization. *Risks posed by dead bodies after disasters*. [Online] Availabe from: https://www.who.int/publications/m/item/risks-posed-by-dead-bodies-after-disasters#:~:text=Download%20(1.5%20MB)-,Overview,the%20human%20body%20after%20death. [Accessed on 24 August 2024].

[68]Nutrition Cluster. *Nutrition vulnerability and situation analysis / Gaza (Version 7)*. [Online] Available from: https://www.nutritioncluster.net/sites/nutritioncluster.com/files/2024-02/GAZA-Nutrition-vulnerability-and-SitAn-v7.pdf. [Accessed on 23 August 2024].

[69]Al-Quds University. *Gastrointestinal diseases in the context of the war in Gaza*. [Online] Available from: https://www.alquds.edu/en/news/staff-news/43421/gastrointestinal-diseases-in-the-context-of-the-war-in-gaza/. [Accessed on 20 July 2024].

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