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# Imam Reza General Hospital Newsletter

Tabriz University of Medical Sciences

## Special issue on the 12-day war against Iran and related medical articles during war and crisis

Volume 6 / issue 3 / September 2025

Tabriz University of Medical Sciences, Tabriz, Iran

Imam Reza General Hospital, Tabriz University of Medical Sciences, Tabriz, Iran

In this issue we read:

**Medical articles during war and crisis**

**Appreciation to medical staff and professors of Imam Reza General Hospital, Tabriz for their outstanding performance during the 12-day war against Iran**

• **Mojtaba Mohammadzadeh**
Assistant Professor of Anesthesiology and Intensive Care Medicine
The head of Imam Reza General Hospital, Tabriz, Iran and the Scientific Editor of the congress

Dear respected Professors and Colleagues,

Greetings and respect to all of you, the honorable scholars and colleagues at Imam Reza General Hospital in Tabriz.

We truly appreciate your strong presence during the recent attacks by the Zionist regime, which showed examples of sacrifice and dedication while continuing your services.

You with the experience of the eight-year defense and the time of the COVID19- pandemic, showed real sacrifice through your successful and admirable performance, and you recorded a lasting and valuable role in the history of this center.

As a member of the great health system family, I feel it is my duty to thank all the professors, physicians, students, nurses, nurse assistants, service staff, security staff, support staff, unit managers, and the administrative leaders — in short, all colleagues — who stood by the injured and wounded not only with your unique skills and knowledge, but also with a spirit of sacrifice and responsibility, and became a healing presence for the physical and emotional pain of your fellow citizens.

Your cooperation and responsible actions during the special time of war at Imam Reza General Hospital, Tabriz are admirable and worthy of praise.

I sincerely wish health and happiness for all of you, dear friends and respected colleagues, from God.

I would also like to express my sincere gratitude for the voluntary commitment of over 200 professors and physicians from Imam Reza General Hospital in Tabriz, who offered their medical support to the injured during times of crisis and war.



**More than 200 professors and physicians from Imam Reza General Hospital in Tabriz volunteered to give medical help to injured people during emergencies and war**

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Professor of Anesthesiology and Critical Care, Subspecialty in Intensive Care Medicine (ICM), Clinical Fellowship in EBM, Fellowship in Trauma Critical Care and CPR
Deputy Dean for Education and Research, Imam Reza General Hospital, Tabriz, Iran

## Promote diplomacy over war with Iran

It is clear that war and its threats have widespread negative impacts on the physical and mental health of individuals and communities. These impacts include increased anxiety, stress, depression, and living in war-torn and threatened conditions can lead to chronic stress and reduced psychological resilience. War also leads to physical injuries from military conflicts. Conflicts and the destruction of infrastructure reduce access to health services. War can lead to the spread of infectious diseases and increased malnutrition. Efforts to peacefully resolve disputes and promote dialogue can prevent the outbreak of war and its resulting damage. The Zionist regime's repeated attacks on residential areas and infrastructure in the country, especially health and medical infrastructure in Iran, in addition to threatening the lives and property of thousands of innocent civilians, have had devastating and irreparable effects on the general mental and social health of the people. On the other hand, women and children, as the most vulnerable population groups, have suffered the most from these attacks. Many children have suffered from psychological shock and chronic anxiety due to the sound of explosions and the destruction of their homes. Beyond the geography of their residence and the skin color of children caught in war and conflict zones, behind the death of each child lies a huge human tragedy. Children do not play a role in the emergence and continuation of wars, but they pay the highest costs for wars and conflicts. Children all over the world deserve a happy and peaceful life in peace, and this is an issue that should be emphasized in all human rights criteria and standards. On the other hand, military attacks on Iran have led to the destruction or serious damage to infrastructure such as drinking water and environmental sanitation networks, power plants, and communication systems, roads, and relief routes, which directly and indirectly threaten the lives of ordinary people, especially residents of rural and underprivileged areas. Also, attacks on nuclear facilities not only directly threaten the lives of Iranian civilians, but also pose a risk of a radiation disaster in the region. Iran's peaceful nuclear facilities have been continuously verified by the International Atomic Energy Agency (IAEA), and numerous reports by this organization emphasize the full compliance of Iran's nuclear activities with safeguards obligations. The Zionist regime's aggressive action against Iran's peaceful nuclear facilities, in gross violation of the fundamental rules of international law, was a clear attack on the common aspiration of humanity for scientific progress in the shadow of peace. In these critical circumstances, the World Health Organization is expected, given its serious responsibility in the field of global health, to take urgent action to condemn these attacks and use its diplomatic tools to pressure the Zionist regime to prevent the escalation of the humanitarian and health crises in the Islamic Republic of Iran, and to ensure that the authorities are held accountable for their criminal actions against the Iranian people. It is essential that the Zionist regime continuously adheres to its international obligations, including those contained in international humanitarian and human rights law. **It is recalled that at this critical moment, silence and inaction in the face of widespread violations of human rights, health, and human dignity not only violates the mission of your institutions, but will also undermine the trust of the people of the world in justice and humanity.**

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## Introduction to the measures of medical centers against radiation incidents

•Farzad Rahmani
Associate Professor of Emergency Medicine, Imam Reza General Hospital
Tabriz University of Medical Sciences, Tabriz, Iran
Email: farzadrhn88@gmail.com

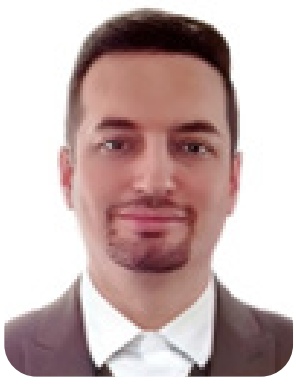
Response to radiation incidents in medical centers should begin after the initial warning by the Emergency Operations Center (EOC) or the referral of several suspicious patients with common symptoms. The hospital should immediately establish a Radiation Emergency Area (REA) based on preparedness, existing instructions, and previously held exercises and drills. The REA is for triage, physician visit, and initial diagnostic-therapeutic measures for contaminated patients. Contaminated and clean patients should be separated in this area. Special bands should be used to create zoning to identify the area and limit access. The floor of the area should be covered with plastic using strong adhesives to prevent contaminated materials from entering the ground.

Decontamination personnel must have appropriate personal protective equipment. To prevent contamination of skin and clothing, employees should use water-resistant gowns, cover, and shoe covers. Employees should use two layers of gloves and change the outer gloves if they come into contact with contaminated items or patients. A simple mask is sufficient for staff, but an N95 mask is recommended if available. If a dosimeter is available, it should be worn under protective clothing at the collar. When a patient or hospital staff member leaves the contaminated area, remove contaminated outer clothing and check their body with a survey meter before leaving the area.

Patient contamination in radiation incidents is divided into three types of external contamination, internal contamination, and radiation exposure. In a crisis with a large number of casualties, triage will be based on the clinical condition of the patients, not the amount of radiation exposure. Internal and external (body) nuclear contamination is not life-threatening in any way, and decontamination measures for these patients should not replace life-saving interventions. The priority for treating patients is based on life-threatening injuries, patients with external contamination (to prevent the spread of contamination), patients with internal contamination, and finally, patients with exposure to nuclear materials.

A patient exposed to radiation will have different signs/symptoms over time based on the dose of radiation received. Doses greater than 2 Gy are associated with a hematopoietic syndrome (pancytopenia, infection, and hemorrhage), and a rapid decrease in lymphocyte count is the hallmark of hematopoietic syndrome and is the best indicator of the extent of radiation damage. Doses greater than 6 Gy are associated with gastrointestinal syndrome, with dehydration, electrolyte disturbances, gastrointestinal bleeding, and fulminant enterocolitis, and the possibility of death. Doses greater than 10 Gy (usually 20 Gy) are associated with a neurovascular or cardiovascular/CNS syndrome, characterized by refractory hypotension, cardiovascular collapse, and death within 24 to 72 hours.

## When Every Second Counts: Artificial Intelligence in War Medicine



•Ataollah Jodeiri
Assistant Professor of Biomedical Engineering
Tabriz University of Medical Sciences
Email: ata.jodeiri@gmail.com

In the chaos of conflict, where split-second decisions determine who lives and who dies, artificial intelligence has emerged as an unexpected ally in the fight to save lives. While the intersection of AI and warfare often conjures images of autonomous weapons and military strategy, perhaps its most profound impact lies in an entirely different realm: the preservation of human life through revolutionary medical applications.

The battlefield has always been a crucible of medical innovation. From the development of triage systems during the Napoleonic Wars to the advancement of trauma surgery in Vietnam, conflict zones have consistently driven breakthroughs that eventually transform civilian healthcare. Today, artificial intelligence represents the next frontier in this evolution, offering unprecedented capabilities to military medical personnel operating under the most challenging conditions imaginable.

Consider the fundamental challenge of battlefield triage—the rapid assessment and prioritization of wounded soldiers when resources are limited and time is critical. Traditional triage relies heavily on the experience and judgment of medical personnel, but even the most skilled medics can be overwhelmed by the sheer volume of casualties in mass casualty events. AI-powered triage systems are now being developed that can analyze vital signs, wound patterns, and other physiological data in real-time, providing instant recommendations for treatment priority. These systems don't replace human judgment but augment it, helping medical teams make faster, more accurate decisions when every second matters.

One particularly compelling example comes from recent developments in AI-assisted diagnostic imaging. Portable ultrasound devices equipped with machine learning algorithms can now detect internal bleeding, pneumothorax, and other life-threatening conditions within minutes of injury. In conflict zones where access to advanced imaging equipment is limited, these AI-enhanced portable devices can mean the difference between life and death. The algorithms have been trained on thousands of images from both military and civilian settings, allowing them to identify critical conditions with accuracy rates that often exceed those of human operators working under stress.

The integration of AI into telemedicine represents another transformative application. In remote combat zones, local medics can now connect with specialists thousands of miles away through secure networks, with AI systems providing real-time translation, vital sign monitoring, and even surgical guidance. During recent conflicts, AI-powered systems have enabled field medics to perform complex procedures with remote expert guidance, effectively bringing the expertise of major medical centers to the frontlines. The AI component handles the technical aspects—stabilizing video feeds, filtering out background noise, and even predicting potential complications based on patient data—while human experts focus on providing medical guidance.

Perhaps most (continued on next page)

**(Dr. Jodeiri Cont.)**

remarkably, AI is revolutionizing the speed and accuracy of wound assessment and treatment planning. Machine learning algorithms can analyze photographs of wounds and instantly classify their severity, recommend appropriate treatments, and predict healing outcomes. This capability is particularly valuable in triage situations where multiple casualties require immediate attention. The AI system can process dozens of wound assessments simultaneously, providing medics with prioritized treatment protocols that maximize the chances of survival for the greatest number of patients.

The development of AI-powered prosthetics represents a longer-term but equally significant advancement. Modern prosthetic limbs equipped with machine learning capabilities can adapt to user's movement patterns, providing more natural and intuitive control. These devices learn from the user's neural signals and muscle movements, continuously improving their responsiveness and functionality. For military personnel who have suffered amputations, these AI-enhanced prosthetics offer not just mobility but the possibility of returning to active duty or pursuing new career paths.

Drug administration and pain management in combat zones have also been transformed by AI applications. Smart infusion pumps equipped with machine learning algorithms can adjust medication dosages based on real-time patient responses, vital signs, and environmental factors. These systems can account for variables such as altitude, temperature, and stress levels that might affect drug metabolism, ensuring optimal therapeutic outcomes even in challenging conditions. The AI monitors patient responses continuously, alerting medical personnel to any adverse reactions or the need for dosage adjustments.

The impact of these innovations extends far beyond military applications. The urgent nature of battlefield medicine accelerates the development and testing of AI systems that eventually find their way into civilian healthcare. Emergency departments, trauma centers, and disaster response teams worldwide are now benefiting from technologies originally developed for military use. The portable AI diagnostic tools, enhanced telemedicine capabilities, and improved triage systems developed for combat zones are being adapted for use in civilian emergency medicine, rural healthcare, and disaster response.

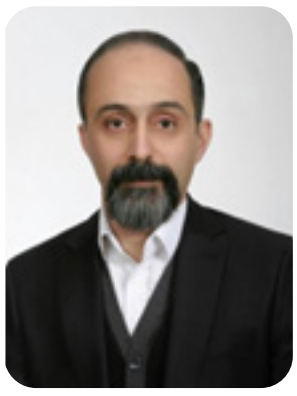
Looking toward the future, researchers are exploring even more ambitious applications of AI in war medicine. Predictive algorithms that can anticipate medical needs based on mission parameters, weather conditions, and historical data are being developed to help medical teams prepare for potential casualties before they occur. AI systems are also being designed to optimize medical supply chains, ensuring that life-saving medications and equipment are available where and when they are needed most.

The ethical implications of these advances cannot be overlooked. As AI systems become more sophisticated and autonomous, questions arise about the appropriate level of machine involvement in life-and-death decisions. The medical community continues to grapple with these challenges, working to ensure that AI enhances rather than replaces human compassion and judgment in medical care.

The integration of artificial intelligence into war medicine represents a profound shift in how we approach healthcare under extreme conditions. By augmenting human capabilities rather than replacing them, AI is enabling medical personnel to save more lives, provide better care, and operate more effectively in the most challenging environments imaginable. As these technologies continue to evolve, their impact will be felt not only on battlefields but in emergency rooms, clinics, and hospitals around the world, ultimately benefiting all of humanity in our shared mission to preserve and protect human life.

## Mass Gatherings

•**Alireza Ala**
Professor of Emergency Medicine
Imam Reza General Hospital
Tabriz University of Medical Sciences, Tabriz, Iran
Email: ala.alireza@gmail.com



Mass Gatherings or large events were previously defined as having at least 1,000 people gathered in one area for at least 4 hours. But now, the time limit is not strictly considered, and just having 1,000 people in such gatherings is enough to call it a Mass Gathering. Sometimes the number of people or the time may be less, but it still counts. Examples include cruise ships, airplanes, deserts, or places like the desert where sports events or drills happen.

When planning to manage such events, it is essential to have an Incident Command System (ICS) beforehand. ICS works with common sections: operations, planning, logistics, and finance. Each part must have a person in charge who reports to the main ICS commander.

There are two extra sections:

**Safety:** responsible for security and safety at the event.

**Liaison:** a person who connects with external systems like the police.

Both report to the main commander.

In Iran, even for events like Friday prayers or football matches, there must be a plan. Fortunately, big cities like Tehran have prepared plans in advance.

**Important points in planning include:**

Clear entry and exit routes

Types of communication tools and backups

Accurate maps and coordinates of the event area

Public health considerations

Medical operational plan parts:

**Medical leadership:** In countries with prehospital emergency specialists, they lead this part; otherwise, people familiar with EMS protocols lead.

**Command and control:** Defining managers and how they communicate with each other and external systems.

**Operations:** Security is part of this. Medical staff here include doctors, EMTs, paramedics, nurses, and assistants. They are the "doers." Support teams are called "getters," who provide resources.

Safety for responders is a top priority because if healthcare providers are injured, it affects the whole team's work.

Preliminary inspection is done by the planning team to check the event area's size, access, communication, and service points.

Negotiation happens with partners like police, Red Crescent, fire department, and city security. This is under logistics.

Human resources and the level of services offered are decided here, including training. It is decided what level of medical service (like BLS[1] or ACLS[2]) **(continued on next page)**

1. Basic Life Support
2. Advanced Cardiovascular Life Support

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(Dr. Ala Cont.)

will be provided at the site. Hospital transfer should be the priority, ideally within 30 minutes from the event site. If this is not possible, some care must be given on-site. Essential equipment includes AEDs, airway management tools, fluids, treatment for heart arrhythmias, asthma attacks, and more. Supraglottic airway devices and intraosseous access tools for adults are also recommended.

**There are two types of service units:**
Fixed units (like clinics)
Mobile units (motorcycles, cars, golf carts, bicycles), equipped differently depending on the vehicle.
As a rule, BLS services should be within 4 minutes and ACLS within 8 minutes of the area. Patient transport can be medical (ambulances) or non-medical (other vehicles). Public health concerns include safe drinking water, waste disposal, preventing disease transmission via food and water, safe roads, injury prevention, and preparedness for natural or man-made disasters including terrorism.
All people in the area should know where medical services are. If not, maps and signs must guide them.

**Communication and information:** Use sirens, walkie-talkies, strong radios, mobile and landline phones connected to outside systems like police and Red Crescent.

**Documentation:** One-page forms with demographic info, brief medical history, initial exam, and possible diagnosis.

**Responsibility for responders:** Issues like payment, insurance, and related matters must be addressed.

**Continuous improvement:** Accurate documentation helps improve quality.
The Hajj pilgrimage in Saudi Arabia is the largest example of Mass Gathering, with about 6 million people attending in 2015. Another example is international marathon events.

## Application of Artificial Intelligence in the Management of Natural and Human-Made Disasters

• Faezeh Farhan
Clinical Research Development Unit
Imam Reza General Hospital,
Tabriz University of Medical Sciences, Tabriz, Iran
Email: faezeh.fa.24@gmail.com

In the face of natural disasters, human crises, and armed conflicts, Artificial Intelligence (AI) has emerged as an increasingly essential tool for analyzing data, accelerating emergency response, and reducing damages. These systems can process massive volumes of information in a short time, supporting decision-making across all stages of crisis management.

**1. Rapid Assessment After Crisis Onset:**
After events such as earthquakes, floods, or explosions, AI can analyze satellite images, weather data, and sensor networks to estimate the extent of damage. For instance, following the earthquake in Myanmar, AI-based systems identified over 1,500 damaged buildings in under 10 minutes. Image recognition and pattern analysis algorithms detect structural changes before and after the event. Additionally, AI can suggest optimal rescue routes by evaluating access paths, traffic conditions, and terrain obstacles.

**2. Early Warning and Risk Forecasting:**
AI-driven early warning systems use historical and real-time data to deliver more accurate alerts. In parts of India and the Philippines, recurrent neural networks and time-series models analyze river levels, cloud density, and soil moisture to predict floods. In earthquake-prone regions, geophysical AI systems assess minor tremors to estimate the likelihood of major quakes. Alerts are delivered via mobile apps, text messages, or local alarms.

**3. Decision Support in Complex Emergencies:**
AI is widely used in crisis simulations to support decision-makers under complex scenarios. In Bihar, India, over 30 crisis managers used reinforcement learning and multi-agent simulations to practice resource allocation and deployment strategies under simultaneous natural and man-made events. These models consider inventory, accessibility, regional vulnerability, and weather forecasts to offer optimal, real-time recommendations.

**4. Mental Health Support During Emergencies:**
Supportive AI chatbots have helped alleviate psychological distress in vulnerable populations. These bots utilize natural language processing (NLP) and conversational AI to simulate empathetic human-like responses. In Middle Eastern war-affected areas, daily interaction with these tools led to a 35% reduction in anxiety among affected women. They can also guide users to professional help and teach coping strategies.

**5. Combating Misinformation:**
Disasters often give rise to rumors and misinformation. Platforms like AIDR and PHEME use classification algorithms and content analysis to filter reliable data from noise. These systems assess message source, linguistic structure, propagation speed, and interconnections to determine credibility scores. This helps authorities act on verified data and maintain public trust.

AI technologies, when integrated with human judgment, improve speed, precision, and resource efficiency in crisis response. Especially under high-risk conditions, AI can serve as a foundational pillar in effective emergency management.

## Guide to Managing and Treating Victims of Chemical Attacks

•Samad Shams Vahdati
Professor of Emergency Medicine
Imam Reza General Hospital
Tabriz University of Medical Sciences, Tabriz, Iran
Email: sshamsv@gmail.com

**What Are Chemical Attacks?**
Chemical attacks involve the deliberate use of toxic substances to harm, disable, or kill individuals. These agents can be released as gases, liquids, or (continued on next page)

(Dr. Vahdati Cont.)

aerosols, and are often colorless, odorless, and fast-acting. Unlike conventional weapons, chemical agents target biological systems and can cause mass casualties with small quantities.

The first widespread use of chemical weapons occurred during World War I, with agents like chlorine and mustard gas. Despite international conventions like the 1993 Chemical Weapons Convention, such attacks have continued in recent decades, including the 1995 sarin gas attack in the Tokyo subway.

These attacks generate widespread fear and place tremendous stress on healthcare systems. Therefore, **preparedness and rapid response** are critical to saving lives and protecting healthcare workers.

**How to Manage and Treat Victims of Chemical Attacks**

Imagine you're in the emergency department when multiple patients arrive with shortness of breath, eye irritation, and skin redness. Reports suggest a nearby chemical attack. What do you do?

Chemical attacks are rare but can paralyze even experienced teams. With calm thinking, prior training, and teamwork, we can manage the crisis and save lives.

**Step 1: Prioritize Your Safety**

First, protect yourself. In chemical incidents, careless responders can become victims themselves. Remember:

«Don't rush. Stay calm. Think. Protect yourself.»

If you›re in a hospital receiving such patients:

• Use personal protective equipment (PPE) such as gloves, cap, goggles, mask, and gown.

• Prevent direct entry of contaminated patients into clean zones.

• Set up a designated area for disrobing and decontamination.

**Disrobing and Washing**

Chemical agents cling to clothes and skin. Removing clothing can eliminate up to 90% of contamination. Wash the skin gently with soap and water. Do not use bleach or alcohol.

Until decontamination is complete, patients should not enter clean areas to avoid secondary contamination.

**How Do Chemical Agents Work?**

These man-made toxins are often invisible and fast-acting. Common types include:

• **Nerve agents** (e.g., sarin): cause nerve paralysis, salivation, breathing difficulty, and seizures

• **Blister agents** (e.g., mustard gas): damage skin, eyes, and lungs

• **Choking agents** (e.g., chlorine): cause severe lung injury and pulmonary edema

• **Blood agents** (e.g., cyanide): block cellular oxygen use and cause rapid unconsciousness

**Warning Signs of Exposure**

Look for:

• Pinpoint pupils
• Shortness of breath
• Excessive saliva and tears
• Skin redness or blisters
• Confusion, unconsciousness, or seizures
• Unusual smells (garlic, bitter almond, bleach)

**Emergency Treatments by Agent Type**

**1. Nerve Agents (e.g., Sarin, VX)**

These inhibit acetylcholinesterase, leading to cholinergic symptoms.

• **Atropine:** 6-2 mg IV, repeat every 10-5 min until secretions dry. No upper limit in severe cases.

• **Pralidoxime** (-2PAM): 2-1 g IV over 30 min; may repeat every 12-6 hr or as continuous infusion. More effective early.

• **Diazepam:** 10-5 mg IV for seizures, max 30 mg/hr. Lorazepam or midazolam can be alternatives.

•**Oxygen & airway support:** %100 O2 via mask or intubation if needed.

**2. Blister Agents** (e.g., Mustard Gas)

These damage DNA and cause delayed skin, eye, and lung injury.

• **Skin wash:** ASAP, ideally within 5 minutes. Use water and mild soap. Avoid bleach.

• **Burn care:** Treat as 2nd-degree burns. Sterile dressing, analgesics, infection prevention.

• **Eye care:** Irrigation with saline. Antibiotic or steroid drops as advised. Protective dressing if photophobia.

• **Lung involvement:** O2 therapy; bronchodilators (e.g., salbutamol) for bronchospasm.

**3. Choking Agents** (e.g., Chlorine, Phosgene)

Cause alveolar damage, pulmonary edema, and hypoxia.

• **High-flow oxygen:** Non-rebreather mask; intubate in severe edema.

• **Monitor and treat pulmonary edema:** ABG, pulse oximetry. Diuretics like furosemide if needed.

• **Anti-inflammatory or bronchodilators:** Nebulized salbutamol. Corticosteroids in moderate to severe cases.

• **Intubation readiness:** For ARDS or severe desaturation.

**4. Blood Agents** (e.g., Cyanide)

Inhibit cellular respiration. Treatment must be immediate.

• **Hydroxocobalamin (Cyanokit):** 5 g IV over 15 min. May repeat up to 10 g total. Side effect: red skin/urine (harmless).

• **Sodium thiosulfate:** 12.5 g IV over 10 min, adjunct or post-cyanokit. Converts cyanide to renal-excretable thiocyanate.

• **Oxygen:** %100 O2 continuously.

• **Hemodynamic monitoring:** BP, cardiac rhythm, urine output. Consider ICU and vasopressors if shock develops.

**Emergency Department Preparation:**

**Roles of Doctors and Nurses**

The ED is the frontline. Swift coordination is life-saving.

• **Doctors** identify toxidromes, prioritize treatment, prescribe antidotes, and assess severity.

• **Nurses** handle triage, assist in decontamination, monitor patients, and ensure safety protocols are followed.

• **Nurse leaders** manage equipment, patient flow, and area hygiene.

Regular drills and education are essential to maintain readiness.

**If the Agent Is Unknown**

• Maintain ABCs (Airway, Breathing, Circulation)
• Full decontamination
• Treat based on clinical signs
• Pattern recognition (multiple similar cases = same agent)
• Staff protection is a priority

**Don’t Ignore Psychological Effects**

Many victims are physically fine but terrified. Panic, hyperventilation, and hallucinations are common. Reassurance, clear communication, and early mental health support are vital.

**Final Words**

Chemical attacks are horrifying but survivable. Calm, training, and timely action turn chaos into rescue.

If someone asks, «What would you do in a chemical attack?»

Answer: **Stay calm. Stay safe. Save lives.**

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# The selection and use of essential medicines 2023: WHO Model List of Essential Medicines, 23rd List (2023)

•Afshin Gharekhani
Associate Professor of Clinical Pharmacy
Imam Reza General Hospital, Tabriz University of Medical Sciences, Tabriz, Iran
Email: anqarekhani@yahoo.com

• Elham Zarghami
Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran
Email: zarghami.sa@gmail.com

• Farzaneh Narimani
student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran
Email: farzanehnarimani@yahoo.

This publication contains the collective views of an international group of experts and does not necessarily represent the decisions or the policies of WHO. The recommendations contained in this publication are based on the advice of independent experts, who have considered the best available evidence, a risk–benefit analysis and other factors, as appropriate. This publication may include recommendations on the use of medicinal products for an indication, in a dosage form, dose regimen, population or other use parameters that are not included in the approved labelling.

The core list presents a list of minimum medicine needs for a basic health-care system, listing the most efficacious, safe and cost–effective medicines for priority conditions. Priority conditions are selected on the basis of current and estimated future public health relevance, and potential for safe and cost-effective treatment.

The complementary list presents essential medicines for priority diseases, for which specialized diagnostic or monitoring facilities, and/or specialist medical care, and/or specialist training are needed. In case of doubt medicines may also be listed as complementary on the basis of consistent higher costs or less attractive cost-effectiveness in a variety of settings.

Some key points:

- In the case of equal efficacy and safety, less expensive medication is of priority. The presence of an entry on the Essential Medicines List carries no assurance as to pharmaceutical quality. It is the responsibility of the relevant national or regional drug regulatory authority to ensure that each product is of appropriate pharmaceutical quality (including stability) and that, when relevant, different products are interchangeable. Medicines and dosage forms are listed in alphabetical order within each section and the order of listing does not imply preference for one form over another. Standard treatment guidelines should be consulted for information on appropriate dosage forms.
- To assist in the development of tools for antibiotic stewardship at local, national and global levels and to reduce antimicrobial resistance, the Access, Watch, Reserve classification of antibiotics was developed – where antibiotics are classified into different groups to emphasize the importance of their appropriate use.

## ACCESS GROUP ANTIBIOTICS

This group includes antibiotics that have activity against a wide range of commonly encountered susceptible pathogens while also showing lower resistance potential than antibiotics in the other groups. Selected Access group antibiotics are recommended as essential first or second choice empiric treatment options for infectious syndromes and are listed as individual medicines on the Model Lists to improve access and promote appropriate use. They are essential antibiotics that should be widely available, affordable and quality assured.

## WATCH GROUP ANTIBIOTICS

This group includes antibiotic classes that have higher resistance potential and includes most of the highest priority agents among the Critically Important Antimicrobials for Human Medicine and/or antibiotics that are at relatively high risk of selection of bacterial resistance. These medicines should be prioritized as key targets of stewardship programs and monitoring. Selected Watch group antibiotics are recommended as essential first or second choice empiric treatment options for a limited number of specific infectious syndromes and are listed as individual medicines on the Model Lists.

## RESERVE GROUP ANTIBIOTICS

This group includes antibiotics and antibiotic classes that should be reserved for treatment of confirmed or suspected infections due to multi-drug-resistant organisms. Reserve group antibiotics should be treated as “last resort” options. These antibiotics should be accessible, but their use should be tailored to highly specific patients and settings, when all alternatives have failed or are not suitable. These medicines could be protected and prioritized as key targets of national and international stewardship programs involving monitoring and utilization reporting, to preserve their effectiveness.

| | | |
|---|---|---|
| **ANAESTHETICS, PREOPERATIVE MEDICINES AND MEDICAL GASES** | | |
| General anaesthetics and oxygen | Inhalational medicines: | Halothane, isoflurane,nitrous oxide,oxygen,sevoflurane |
| | Injectable medicines: | Ketamine, propofol |
| Local anaesthetics | Bupivacaine,lidocaine, lidocaine + epinephrine | |
| Preoperative medication and sedation for short-term procedures | Atropine, midazolam, morphine | |
| **MEDICINES FOR PAIN AND PALLIATIVE CARE** | | |
| Non-opioids and non-steroidal anti-inflammatory medicines (NSAIMs) | acetylsalicylic acid, ibuprofen, paracetamol | |
| Opioid analgesics | Codeine, fentanyl, morphine | |
| Medicines for other common symptoms in palliative care | Amitriptyline, cyclizine, dexamethasone, diazepam, docusate sodium, fluoxetine, haloperidol, hyoscine butylbromide, lactulose, loperamide, metoclopramide, midazolam, ondansetron, senna | |
| **ANTIALLERGICS AND MEDICINES USED IN ANAPHYLAXIS** | | |
| Dexamethasone, epinephrine, hydrocortisone, loratadine, prednisolone | | |
| **ANTIDOTES AND OTHER SUBSTANCES USED IN POISONINGS** | | |
| Non-specific | charcoal, activated | |
| Specific | acetylcysteineAcetylcysteine, atropine, calcium gluconate, methylthioninium chloride, naloxone, penicillamine, potassium ferric hexacyano-ferrate(II) -2H2O, sodium nitrite, sodium thiosulfate | |
| **MEDICINES FOR DISEASES OF THE NERVOUS SYSTEM** | | |
| Antiseizure medicines | Carbamazepine, diazepam, lamotrigine, levetiracetam, lorazepam, magnesium sulfate, midazolam, phenobarbital, phenytoin, valproic acid, | |
| Medicines for parkinsonism | Biperiden, levodopa + carbidopa, | |
| **ANTI-INFECTIVE MEDICINES** | | |
| Anthelminthics | Intestinal anthelminthics | Albendazole, ivermectin, levamisole, mebendazole, niclosamide, praziquantel, pyrantel |
| | Antifilarials | Albendazole, diethylcarbamazine, ivermectin |
| | Antischistosomals and other antitrematode medicines | Praziquantel, triclabendazole |
| Antibacterials | Access group antibiotics | Amikacin, amoxicillin, amoxicillin + clavulanic acid, ampicillin, benzathine benzylpenicillin, benzylpenicillin, cefalexin, cefazolin, chloramphenicol, clindamycin, cloxacillin, doxycycline, gentamicin, metronidazole, nitrofurantoin, phenoxymethylpenicillin, procaine benzylpenicillin, spectinomycin, sulfamethoxazole + trimethoprim, trimethoprim |
| | Watch group antibiotics | Azithromycin, cefixime, cefotaxime, ceftriaxone, cefuroxime, ciprofloxacin, clarithromycin, piperacillin + tazobactam, vancomycin, |
| | | Complementary List: ceftazidime, meropenem |
| | Reserve group antibiotics (Complementary List) | Cefiderocol, ceftazidime + avibactam, ceftolozane + tazobactam, colistin, Fosfomycin, linezolid, meropenem + vaborbactam, plazomicin, polymyxin B |
| | Antileprosy medicines | Clofazimine, dapsone, rifampicin |

(continued on next page)

(Dr. Gharekhani Cont.)

| | | | |
|---|---|---|---|
| | Antituberculosis medicines | Ethambutol, ethionamide, isoniazid, moxifloxacin, pyrazinamide, rifabutin, rifampicin, rifapentine, | |
| Antifungal medicines | amphotericin B, clotrimazole, fluconazole, flucytosine, griseofulvin, itraconazole, nystatin, voriconazole, | | |
| Antiviral medicines | Antiherpes medicines | aciclovir | |
| | Antiretrovirals (HIV) | Nucleoside/Nucleotide reverse transcriptase inhibitors | Abacavir, lamivudine, tenofovir disoproxil fumarate, zidovudine |
| | | Non-nucleoside reverse transcriptase inhibitors | Efavirenz, nevirapine |
| | | Protease inhibitors | atazanavir + ritonavir, darunavir, lopinavir + ritonavir, ritonavir |
| | | Integrase inhibitors | Dolutegravir, raltegravir |
| | | Fixed-dose combinations of antiretroviral medicines | abacavir + lamivudine, dolutegravir + lamivudine + tenofovir, efavirenz + emtricitabine + tenofovir, efavirenz + lamivudine + tenofovir, emtricitabine + tenofovir, lamivudine + zidovudine |
| | | *Medicines for prevention of HIV-related opportunistic infections: Isoniazid + pyridoxine + sulfamethoxazole + trimethoprim | |
| | Other antivirals | Ribavirin, valganciclovir, | |
| | Medicines for hepatitis B | Nucleoside/Nucleotide reverse transcriptase inhibitors | Entecavir, tenofovir disoproxil fumarate, |
| | Medicines for hepatitis C | Pangenotypic direct-acting antiviral combinations | Daclatasvir, daclatasvir + sofosbuvir, glecaprevir + pibrentasvir, ravidasvir, sofosbuvir, sofosbuvir + velpatasvir |
| | | Non-pangenotypic direct-acting antiviral combinations | ledipasvir + sofosbuvir |
| | | Other antivirals for hepatitis C | ribavirin |
| Antiprotozoal medicines | Antiamoebic and antigiardiasis medicines | Diloxanide, metronidazole, | |
| | Antileishmaniasis medicines | amphotericin B, meglumine antimoniate, miltefosine, paromomycin, sodium stibogluconate | |
| | Antimalarial medicines | For curative treatment | Amodiaquine, artemether, artemether + lumefantrine, artesunate, artesunate + amodiaquine, artesunate + mefloquine, artesunate + pyronaridine tetraphosphate, chloroquine, dihydroartemisinin + piperaquine phosphate, doxycycline, mefloquine, primaquine, quinine, sulfadoxine + pyrimethamine, |
| | | For chemoprevention | amodiaquine – sulfadoxine + pyrimethamine, chloroquine, doxycycline, mefloquine, proguanil, sulfadoxine + pyrimethamine |
| | Antipneumocystosis and antitoxoplasmosis medicines | Pyrimethamine, sulfadiazine, sulfamethoxazole + trimethoprim | |
| | Antitrypanosomal medicines | African trypanosomiasis | fexinidazole |
| | | | 1st stage: pentamidine, suramin sodium |
| | | | 2nd stage: eflornithine, melarsoprol, nifurtimox |
| | | American trypanosomiasis | Benznidazole, nifurtimox |
| Medicines for ectoparasitic infections | ivermectin | | |
| Medicines for Ebola virus disease | Ansuvimab, atoltivimab + maftivimab + odesivimab | | |
| ANTIMIGRAINE MEDICINES | | | |
| For treatment of acute attack | acetylsalicylic acid, ibuprofen, paracetamol, sumatriptan | | |
| For prophylaxis | propranolol | | |
| ready-to-use therapeutic food | | | |
| Biscuit or paste | | | |
| MEDICINES AFFECTING THE BLOOD | | | |
| Antianaemia medicines | ferrous salt,ferrous salt + folic acid,folic acid, hydroxocobalamin | | |
| Medicines affecting coagulation | Dabigatran,enoxaparin, heparin sodium, phytomenadione, protamine sulfate, tranexamic acid, warfarin | | |
| BLOOD PRODUCTS OF HUMAN ORIGIN AND PLASMA SUBSTITUTES | | | |
| Blood and blood components | cryoprecipitate, fresh-frozen plasma, platelets, red blood cells, whole blood | | |
| Plasma-derived medicines | Human immunoglobulins | | |
| | Blood coagulation factors | | |
| Plasma substitutes | dextran 70 | | |
| CARDIOVASCULAR MEDICINES | | | |
| Antianginal medicines | bisoprolol | | |
| Antiarrhythmic medicines | Bisoprolol, digoxin, epinephrine, lidocaine, verapamil | | |
| Antihypertensive medicines | Amlodipine, bisoprolol, enalapril, hydralazine, hydrochlorothiazide, lisinopril + amlodipine, lisinopril + hydrochlorothiazide, losartan, methyldopa, telmisartan + amlodipine, telmisartan + hydrochlorothiazide | | |
| Medicines used in heart failure | Bisoprolol, digoxin, enalapril, furosemide, hydrochlorothiazide, losartan, spironolactone | | |
| Antithrombotic medicines | Anti-platelet medicines | | |
| | Thrombolytic medicines | | |
| Lipid-lowering agents | Simvastatin, Therapeutic alternatives: atorvastatin | | |
| Fixed-dose combinations for prevention of atherosclerotic cardiovascular disease | | | |
| DERMATOLOGICAL MEDICINES | | | |
| Antifungal medicines | Miconazole, selenium sulfide, sodium thiosulfate, terbinafine | | |
| Anti-infective medicines | Mupirocin, potassium permanganate, silver sulfadiazine | | |
| Anti-inflammatory and antipruritic medicines | Betamethasone, calamine, Hydrocortisone preferred in neonates | | |

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|---|---|---|
| Medicines affecting skin differentiation and proliferation | benzoyl peroxide, calcipotriol, fluorouracil, podophyllum resin, salicylic acid, urea | |
| Scabicides and pediculicides | benzyl benzoate, permethrin | |
| DIAGNOSTIC AGENTS | | |
| Ophthalmic medicines | Fluorescein, tropicamide | |
| Radiocontrast media | Amidotrizoate, iohexol | |
| ANTISEPTICS AND DISINFECTANTS | | |
| Antiseptics | Chlorhexidine, ethanol, povidone iodine | |
| Disinfectants | alcohol based hand rub,chlorine base compound, chloroxylenol, glutaral | |
| DIURETICS | | |
| Amiloride,furosemide, hydrochlorothiazide, mannitol, spironolactone | | |
| GASTROINTESTINAL MEDICINES | | |
| Antiulcer medicines | omeprazole | |
| Antiemetic medicines | Dexamethasone,metoclopramide, ondansetron | |
| Anti-inflammatory medicines | sulfasalazine | |
| Laxatives | senna | |
| Medicines used in diarrhoea | ORS, zinc sulfate | |
| MEDICINES FOR ENDOCRINE DISORDERS | | |
| Adrenal hormones and synthetic substitutes | Fludrocortisone, hydrocortisone | |
| Androgens | | |
| Estrogens, Progestogens | | |
| Medicines for diabetes | intermediate-acting insulin, long-acting insulin | |
| | Oral hypoglycaemic agents: empagliflozin, gliclazide, metformin | |
| Medicines for hypoglycaemia | glucagon | |
| Thyroid hormones and antithyroid medicines | Levothyroxine, potassium iodide, methimazole,propylthiouracil | |
| Medicines for disorders of the pituitary hormone system | cabergoline | |
| IMMUNOLOGICALS and Vaccines | | |
| Diagnostic agents:PPD test<br>Sera, immunoglobulins and monoclonal antibodies: anti-rabies virus monoclonal antibodies,antivenom immunoglobulin,diphtheria antitoxin<br>Vaccines:<br>Recommendations for all :BCG vaccine, diphtheria vaccine, Haemophilus influenzae type b vaccine<br>Recommendations for immunization programmes with certain characteristics: influenza vaccine, mumps vaccine, varicella vaccine | | |
| MUSCLE RELAXANTS (PERIPHERALLY-ACTING) AND CHOLINESTERASE INHIBITORS | | |
| Atracurium, neostigmine, suxamethonium, vecuronium | | |
| OPHTHALMOLOGICAL PREPARATIONS | | |
| Anti-infective agents | Acyclovir, azithromycin, erythromycin, gentamicin, natamycin,ofloxacin, tetracycline | |
| Anti-inflammatory agents | prednisolone | |
| Local anaesthetics | tetracaine | |
| Miotics and antiglaucoma medicines | Acetazolamide, latanoprost, pilocarpine, timolol | |
| Mydriatics | atropine | |
| MEDICINES FOR REPRODUCTIVE HEALTH AND PERINATAL CARE | | |
| Contraceptives | Oral | |
| | Injectable | |
| | Intrauterine devices | |
| | Barrier methods | |
| | Implantable contraceptives | |
| | Intravaginal contraceptives | |
| Uterotonics | Carbetocin, ergometrine, mifepristone – misoprostol, misoprostol, oxytocin | |
| Antioxytocics (tocolytics) | nifedipine | |
| Other medicines administered to the mother | Dexamethasone, multiple micronutrient supplement, tranexamic acid | |
| Medicines administered to the neonate | caffeine citrate, chlorhexidine | |
| MEDICINES FOR MENTAL AND BEHAVIOURAL DISORDERS | | |
| Medicines for psychotic disorders | Fluphenazine, haloperidol, olanzapine, paliperidone, risperidone | |
| Medicines for mood disorders | Medicines for depressive disorders | Amitriptyline, fluoxetine |
| | Medicines for bipolar disorders | Carbamazepine, lithium carbonate, quetiapine, valproic acid (sodium valproate) |
| Medicines for anxiety disorders | Diazepam, fluoxetine | |
| Medicines for obsessive compulsive disorders | Clomipramine, fluoxetine | |
| Medicines for disorders due to psychoactive substance use | Medicines for alcohol use disorders | |
| | Medicines for nicotine use disorders | |
| MEDICINES ACTING ON THE RESPIRATORY TRACT | | |
| Antiasthmatic medicines and medicines for chronic obstructive pulmonary disease | Budesonide, budesonide + formoterol, epinephrine (adrenaline), ipratropium bromide, salbutamol, tiotropium | |
| SOLUTIONS CORRECTING WATER, ELECTROLYTE AND ACID–BASE DISTURBANCES | | |
| Oral | ORS, potassium chloride | |
| Parenteral | Glucose, glucose with sodium chloride, potassium chloride, sodium chloride, sodium hydrogen carbonate, sodium lactate, compound solution | |
| VITAMINS AND MINERALS | | |
| ascorbic acid, calcium, colecalciferol, ergocalciferol, iodine, multiple micronutrient powder, nicotinamide, pyridoxine, retinol, riboflavin, thiamine | | |
| EAR, NOSE AND THROAT MEDICINES | | |
| acetic acid, budesonide, ciprofloxacin, xylometazoline | | |
| MEDICINES FOR DISEASES OF JOINTS | | |
| Medicines used to treat gout | allopurinol | |
| Disease-modifying anti-rheumatic drugs (DMARDs) | chloroquine | |

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(Dr. Gharekhani Cont.)

**This table is adopted from:**
https://www.who.int/publications/i/item/WHO-MHP-HPS-EML-2023.02

| DENTAL MEDICINES AND PREPARATIONS | |
|---|---|
| Fluoride, glass ionomer cement, resin-based composite, silver diamine fluoride | |
| **Complementary List** | |
| Immunomodulators for non-malignant disease | Adalimumab, azathioprine, ciclosporin, tacrolimus |
| Antineoplastics and supportive medicines | Cytotoxic medicines |
| | Targeted therapies |
| | Immunomodulators |
| | Hormones and antihormones |
| | Supportive medicines |
| Medicines for multiple sclerosis | Cladribine, glatiramer acetate, rituximab |
| GASTROINTESTINAL MEDICINES | pancreatic enzymes |
| OPHTHALMOLOGICAL PREPARATIONS | Anti-vascular endothelial growth factor (VEGF) preparations |
| Ovulation inducers | Clomiphene, letrozole |
| PERITONEAL DIALYSIS SOLUTION | |
| Medicines for opioid use disorders | methadone |
| Medicines for juvenile joint diseases | acetylsalicylic acid, adalimumab, methotrexate, triamcinolone hexacetonide |