# Mass Casualty Management in Earthquakes and Air Crashes

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Two articles on mass casualties published in this issue of *IMAJ* deal with very different incidents. The first, by Friedman and associates [1], analyzes injuries in six victims of a light aircraft crash in 1995 at the Atarot airfield near Jerusalem. The second article, by Peleg et al. [2], deals with management of victims of earthquake disasters. There is little in common between the two types of disasters: The first is caused mainly by human error and technical failures, and the second by the disparity between the forces of nature and the low level of the structural resistance of buildings. Both may result in many casualties, many of them fatal, and success in reducing the death toll requires a common prehospital and hospital response.

I will analyze both incidents separately and discuss the differences and similarities in the health system's response.

## Aircraft crashes

Most aircraft crashes result in the total destruction of the aircraft and the death of most of the passengers. In some accidents, mainly during landing and take-off when the aircraft's speed is lower than its cruising speed, the aircraft may not catch fire or disintegrate immediately. In these instances, many of the passengers may be injured and can be saved if there is immediate extrication from the aircraft, on-site medical care, and early evacuation to hospitals for definitive treatment. Rescue services in larger airports and in all international airports are well trained in these procedures and respond within minutes. If the accident occurs within the boundaries of the airport, outside assistance usually arrives later and the on-site medical teams and ambulances manage the survivors immediately after their extrication. In an impending disaster caused by malfunctioning or highjacking, external rescue services will be available and deployed after the plane lands.

In their article [1], Friedman et al. describe the sequence and results of a light airplane crash. The number of victims was low (six) and the incident was therefore not a mass casualty event. The airplane did not catch fire, and all the survivors suffered mainly orthopedic injuries caused by the kinetic energy impacts on hard and soft tissues of passengers in the relatively intact cabin of the plane. The single fatality was due to a direct injury to the head. It is not clear from the article if the head impacted against any structure in the cabin. It is interesting that none of the victims sustained fractures or dislocations in the cervical area. The burst fractures of lower thoracic and lumbar vertebrae indicate, as mentioned in the article, that the injuries were predominantly caused by the vertical impact of the falling aircraft and not by a horizontal sudden deceleration, as observed in most car accidents. The most important preventive message from this report is that information on the types and mechanism of injuries sustained by victims of aircraft crashes is essential for improving the design of passive restraint and protection devices. We can ask whether improvements in the design of seats, seat belts and side airbags in the cabin may better disperse or distribute kinetic energy impacts, reduce injury severity and improve the survival rates of passengers in light plane crashes.

## Earthquakes

Earthquakes are caused by tectonic plate activity and are therefore a natural phenomenon. But the damage they cause can be prevented or mitigated by land zoning. The most important measure is to prevent construction on active fault lines and to improve anti-seismic building codes. These measures have been implemented in most developed countries in earthquake-prone areas, and have resulted in drastic reductions in risk for death and injury in the last few decades. Improved search and rescue techniques and early resuscitation and surgical care have improved the survival chances of earthquake victims.

Survival rates are, however, more dependent on the immediate response of the survivors on site. Survival rates increase exponentially with the speed of extrication and hospital management of the victims. Medical teams and field hospitals mobilized from national or international resources and deployed at earthquake sites have regrettably had only a minor impact on the survival of the victims. By the time help arrives, severely injured casualties, who could benefit from the intervention, have already been moved to local or distant hospitals or have died. The true function of these external medical teams is to replace primary health services in providing necessary medical care to survivors and to help the search and rescue teams on the site.

Water, food and shelter are the major concern among the survivors on the site during the first days after the quake. These survivors often remain to help search for missing relatives trapped under the rubble. Others are accommodated in makeshift camps with initially rudimentary sanitary conditions. Contrary to common belief, epidemics are infrequent in the immediate post-disaster phase. The corpses of the victims pose no health problems, although the stress they produce is enormous.

Major earthquakes have occurred in the past in Israel and will occur in the future, and Israel needs to implement a national earthquake readiness policy. The costs of preparedness are huge, but they are dwarfed by the costs of not being prepared. The review

by Peleg and colleagues [2] should alert policy makers to these issues.

The scale of damage and the immense organizational and logistic challenges encountered in a major earthquake require a national plan for emergency response. A governmental planning committee is now finalizing a national response plan for earthquake mitigation and emergency response. This committee includes senior representatives of all ministries and related bodies. It has presented a plan, which if implemented, would substantially reduce the loss of life and property. It recommends strict adherence to land zoning and building codes, retrofitting of housing in residential areas – which does not comply with present standards, and the organization of emergency response and training of communities in high risk areas. The authors call for measures to ensure that medical facilities, particularly hospitals, will continue to function after major disasters. There is no alternative to a hospital for ensuring proper surgical care of trauma victims.

A medical subcommittee appointed by the Ministry of Health has presented a national health plan for earthquakes. Recommendations include: command and control of operations, medical treatment of earthquake-related injuries, hospital preparedness, community and primary health response, public health support, rehabilitation of victims, psychological stress management, retrofitting of buildings and infrastructures in medical facilities, international assistance, and the necessary budgets.

In conclusion, Israel has had its share of mass casualties, due chiefly to wars and terrorist activities. There is, however, no guarantee that a major disaster – caused by a large aircraft crash or an earthquake – will not occur in the near future. Preparedness for such events is imperative and requires the mobilization and full cooperation of all emergency services, including the health services.

## References

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