# DISASTER PREVENTION AND MANAGEMENT PLAN

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# Introduction

Himachal Pradesh is a state in the northern part of India. It is bounded by Jammu and Kashmir union territory to the northwest and Ladakh union territory to the northeast, by the Tibet Autonomous Region of China to the east, and by the states of Uttarakhand to the southeast, Haryana to the south, and Punjab to the west. Himachal Pradesh occupies a region of scenic splendour in the western Himalayas, offering a multi textured display of lofty snow-clad mountains, deep gorges, thickly forested valleys, large lakes, terraced fields, and cascading streams. Himachal is in the western Himalayas and it is a mountainous state.

The state of Himachal Pradesh is exposed to a range of natural, environmental and man-made hazards. Main hazards consist of earthquakes, landslides, flash floods, snowstorms, avalanches, GLOF, fires, forest fire, lightning etc. Enormous economic losses are caused due to natural disasters such as earthquakes, floods, landslide, avalanche, etc., erode the development gain and shatter the economy. Most of the fatalities and economic losses occur due to the poor construction practices, lack of earthquake-resistant features of the buildings and low awareness about disasters among people. In order to estimate and quantify risk, it is necessary to carry out the vulnerability assessment of the existing building stocks and lifeline infrastructure. The physical vulnerabilities of Himachal Pradesh include the unsafe stocks of houses, schools, hospitals and other public buildings and infrastructure that may not withstand the shocks of powerful earthquakes. The economic vulnerabilities are mainly the productive assets like industries, hydropower stations, reservoirs, tourism facilities etc. located in hazard zones. Any disruption of these facilities due to disasters may badly affect the economy of the State. The socially vulnerable groups in the State, like most of the States, are the rural and urban poor, the vulnerable women, children, disabled, aged etc. who suffer an unequal burden of disasters. The delicate ecology and environment of the State further make it highly susceptible to the hazards of landslides, forest fires and flash floods. Most of these risks of disasters have accumulated over the years while new risks of disasters are created unwittingly with the process of development. There is an urgent need to develop short term and long term strategies to prevent the disasters to the extent possible and devise way and means to tackle the disasters to minimize the loss. A scientific approach is must to understand the disaster happening in the state.

## Definition of Disaster

The World Health Organization (WHO) defines a disaster as “a sudden ecological phenomenon of sufficient magnitude to require external assistance”. It is also defined as any event, typically occurring suddenly, that causes damage, ecological disruption, loss of human life, deterioration of health and health services, and which exceeds the capacity of the affected community on a scale sufficient to require outside assistance (Landsman, 2001). It is an emergency of such severity and magnitude that the resultant combination of 3 deaths, injuries, illness, and property damage cannot be effectively managed with routine procedures or resources.

Disaster is further defined as an event in which a society or a community undergoes acute deprivation of food and other basic necessities due to natural and manmade calamities to such an extent that the normal function of the society or the community is disrupted and that it cannot subsist without outside intervention.

**Emergency** is a state in which normal procedures are suspended and extra-ordinary measures are taken in order to avert a disaster. An emergency can be defined in the context of the social, political and epidemiological circumstances in which it occurs.

**Hazard** is a rare or extreme event in the natural or human made environment that adversely affects human life, property or activity to the extent of causing a disaster. It is essential to make a distinction between hazards and disasters, and to recognize that the effect of the former upon the latter is essentially a measure of the society’s vulnerability.

**Mitigation:** is permanent reduction of the risk of a disaster. Primary mitigation refers to reducing the resistance of the hazard and reducing vulnerability. Secondary mitigation refers to reducing the effects of the hazard (preparedness). Mitigation includes recognizing that disasters will occur; attempts are made to reduce the harmful effects of a disaster, and to limit their impact on human suffering and economic assets.

**Prevention** is defined as those activities taken to prevent a natural phenomenon or potential hazard from having harmful effects on either people or economic assets. Delayed actions drain the economy and the resources for emergency response within a region. For developing nations, prevention is perhaps the most critical components in managing disasters, however, it is clearly one of the

most difficult to promote. Prevention planning is based on two issues: hazard identification (identifying the actual threats facing a community) and vulnerability assessment (evaluating the risk and capacity of a community to handle the consequences of the disaster). Once these issues put in order of priority, emergency managers can determine the appropriate prevention strategies.

Disaster prevention refers to measures taken to eliminate the root causes that make people vulnerable to disaster.

**Preparedness:** The measures that ensure the organized mobilization of personnel, funds, equipment's, and supplies within a safe environment for effective relief. Disaster preparedness is building up of capacities before a disaster situation prevails in order to reduce impacts. Its measures include inter alia, availability of food reserve, emergency reserve fund, seed reserve, health facilities, warning systems, logistical infrastructure, and shelves of projects.

**Reconstruction:** the full resumption of socio-economic activities plus preventive measures.

**Rehabilitation:** is the restoration of basic social functions.

**Resilience:** is adaptability, capacity to recover.

**Response:** is the set of activities implemented after the impact of a disaster in order to assess the needs, reduce the suffering, limit the spread and the consequences of the disaster, open the way to rehabilitation.

Risk is the expected losses (lives lost, persons injured, damages to property and disruption of economic activity) due to a particular hazard. Risk is the product of hazard and vulnerability. Risk is the probability that a person will experience an event in a specified period of time. Risk as a function of hazard and vulnerability, a relationship that is frequently illustrated with the following formula, although the association is not strictly arithmetic:

**Risk = hazard x vulnerability.**

Risk is the probability of being affected by the unwanted consequences of a hazard. It combines the level of hazard and degree of vulnerability. Disaster mainly occurs when vulnerability and hazard meet. The interaction and association of such phenomena is depicted in the following figure-1:-

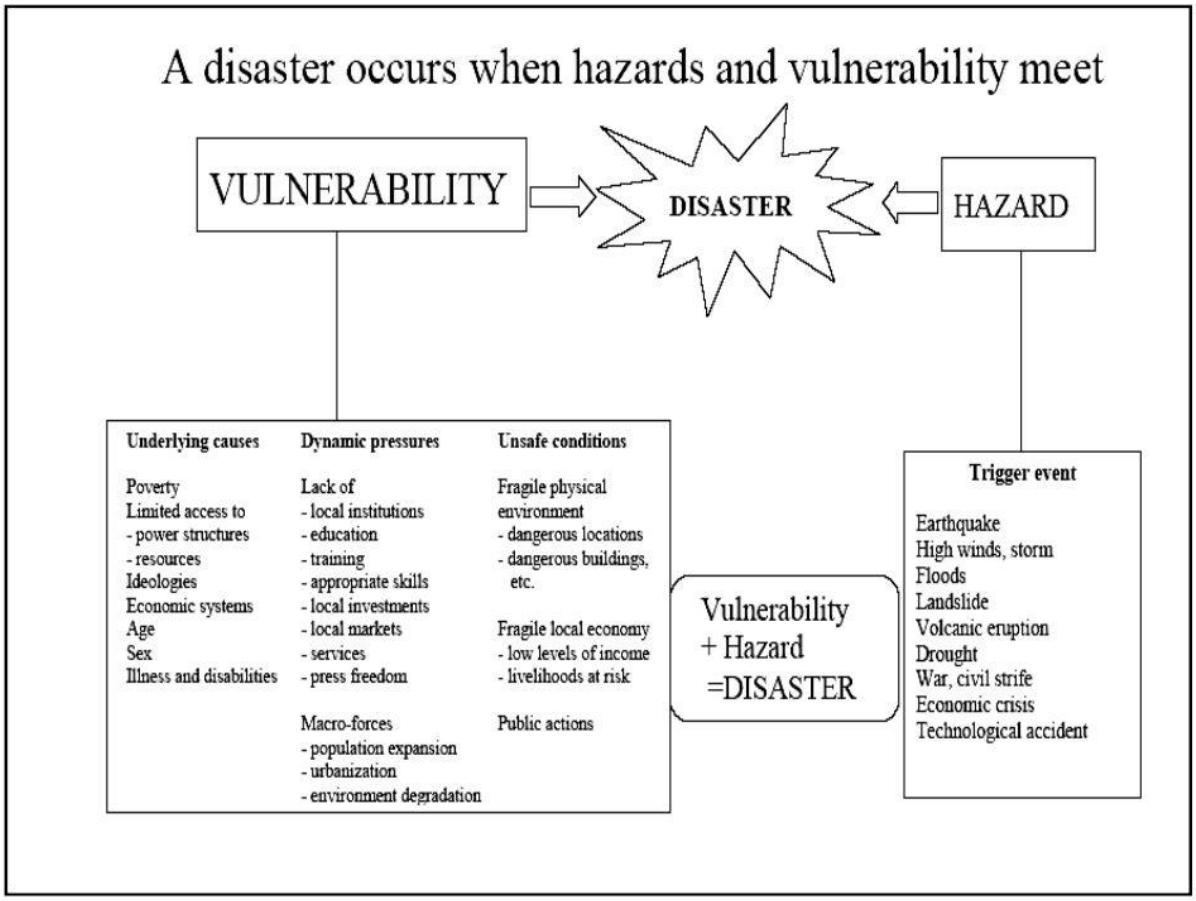


**Figure -1. Relationship of vulnerability, hazard and disaster**

## Disaster Management Plan

The main purpose of the disaster management plan is to mainstream disaster prevention, mitigation, preparedness and response activities into the health sector, with specific focus on hospitals; such that hospitals are not just better prepared but fully functional immediately after disasters and are able to respond without any delay to the medical requirements of the affected community. The main objective of the above-said plan is:

1. To prevent loss of life and reduce morbidity to the minimum possible through preparedness, prevention, mitigation and quick & coordinated response.
2. To provide for uniformity in approach, by using SOP's thus minimizing undue complications.
3. To provide for the coordination mechanisms for different agencies right from the field level to the District Head Quarter and beyond.
4. To ensures efficiency in terms of response and optimal utilization of resources. Moreover, it keeps the administration in a state of readiness to face any eventuality.
5. To bring together the information related to equipment, skilled manpower and critical supplies.
6. To know the standard operating procedures of the department at the time of disaster.
7. To fix the role and responsibility of each and every officer for disaster preparedness.
8. To assess its own capacity in terms of available resources and get ready to mitigate any unexpected disaster effectively and to prevent the loss of human lives and property through preparedness, prevention & mitigation of disasters.
9. To assist the line departments, block administration, communities in developing compatible skills for disaster preparedness and management.
10. To disseminate factual information in a timely, accurate and tactful manner while maintaining necessary confidentiality.
11. To develop immediate and long-term support plans.
12. To have response system in place to face any eventuality.

Medical assistance is a crucial module for response and relief phase of disaster management strategies. The adverse impacts of the disasters on hospitals will also hinder the recovery of the affected community. Economically the impacts of

disasters on health sector are also very high as an enormous investment is required to construct hospitals and its expensive equipment.

The scope of Disaster Management Plan for health sector of the state is:

- Identify the vulnerability of hospitals to different forms of disasters;
- The measures to be adopted for prevention and mitigation of disasters;
- The manner in which the mitigation measures shall be integrated with the development plan and projects;
- Sensitizing the key stakeholders and community on the need for disaster management in health facilities;
- Inform the health institutions and its workforce about emergency management.

| **Types of risks while exposed to different disasters** | | |
|---|---|---|
| | **Hazard** | **Risk** |
| 1 | Earthquake | **Very High Risk:** Distribution of Health infrastructure over space is directly proportional to population distribution. In Himachal Pradesh 60% population lives in the very high-risk zone; 38 % population lives in a high-risk zone and the rest of population lives in moderate to low-risk zone. Limited awareness, Preparedness, structural weaknesses of the buildings and high population density in Health institutions reveal very high vulnerability to daytime earthquake and low capacity. This suggests very high risk. |
| 2 | Flood | **High Risk:** Topography of Himalayan river valleys, glacial fed rivers, damage or sudden release of water from power project dams and densely populated former river beds poses a high risk. |
| 3 | Cloudburst | **High Risk:** Impact of cloudburst is dual. It leads to landslides and flash floods. Settlements on river terraces are at high risk. |
| 4 | Landslide | **High Risk:** landslides pose risk to buildings and disruption in road and communication network. Landslides also choke rivulets and form temporarily |

| | | |
|---|---|---|
| | | lakes. When these lakes burst causes flash floods |
| 5 | Avalanche | **Low Risk:** Six districts viz. Hamirpur, Una, Bilaspur, Mandi, Sirmour, and Solan have no risk of avalanche. Further Kangra, Chamba and Shimla have a medium risk. Kullu falls in the high-risk zone, whereas Kinnaur and Lahaul Spiti are in the very high-Risk zone. Further, there is a small proportion of the population living in High and very Avalanche risk-prone districts. Low vulnerability suggests Low risk. |
| 6 | Fire | **Medium Risk:** Climatic conditions and topography of the State compel to use timber in Hospitals building in very high quantity. Fire incidents pose risk to Health infrastructure with staff and patients. |
| 7 | Road Accident | **Medium Risk:** Steep slopes, Sharp bends in roads, poor road conditions, overloaded buses causes accidents. |

Medical institutions of the State are highly vulnerable especially to the earthquake with a lot of non-structural hazards making these buildings to high risks. Hence there is a need to prepare a standard and uniform disaster operation procedure for the medical institutions to deal with various situations. Human resources of the institutions need training on management and mitigation of different type of disasters including relief, rescue and rehabilitation. Department of Health also needs to establish a monitoring mechanism at the district level to check the district level Disaster management plans. For this, a pool of resource persons is needed in each district to help in the preparation of safety plans. It will also be helpful in the auditing of these plans at grass root level to ensure the implementation of the concerns of risk reduction. Adequate financial powers need to be vested with the district, hospitals and health centres level to manage the crisis.

# Types of Disasters

## 1. Earthquakes :-

Himachal Pradesh is highly seismic sensitive state as over the years a large number of the damaging earthquakes have struck the state and its adjoining areas. Large earthquakes have occurred in all parts of Himachal Pradesh, the biggest being the Kangra earthquake of 1905.. Chamba, Kullu, Kangra, Una, Hamirpur, Mandi and Bilaspur Districts lie in Zone V i.e. very high damage risk zone and the area falling in this zone may expect earthquake intensity maximum of MSK IX or more. The remaining districts of Lahaul and Spiti, Kinnaur, Shimla, Solan and Sirmour lie in Zone lV i.e. the areas in this zone are in high damage risk with expected intensity of MSK VIII or more.

### Seismic Technologies to Build Earthquake Resistant Structures:-

**i. Cardboard Tubes :-**

Teams of engineers are working all over the world to design earthquake-resistant structures using locally available or easily obtainable materials. For example, in Peru, researchers have made traditional adobe structures much stronger by reinforcing walls with plastic mesh. In India, engineers have successfully used bamboo to strengthen concrete. And in Indonesia, some homes now stand on easy-to-make bearings fashioned from old tires filled with sand or stone.

Even cardboard can become a sturdy, durable construction material. Japanese architect Shigeru Ban has designed several structures that incorporate cardboard tubes coated with polyurethane as the primary framing elements. In 2013, Ban unveiled one of his designs -- the Transitional Cathedral -- in Christchurch, New Zealand. The church uses 98 giant cardboard tubes reinforced with wooden beams. Because the cardboard-and-wood structure is extremely light and flexible, it performs much better than concrete during seismic events and if it does collapse, it's far less likely to crush people gathered inside. All in all, it makes you want to treat the cardboard tubes nestled in your toilet paper roll with a little more respect.

**ii. Vibrating Barrier:-**

At the University of Brighton, designed a novel vibrating barrier (ViBa) to reduce the vibrations of nearby structures caused by an earthquake’s ground waves. The device would be buried in the soil and detached from surrounding buildings, and should be able to absorb a significant portion of the dynamic energy arising from the ground motion with a consequent reduction of seismic response (between 40-80%).

The idea behind this is to look at buildings as an integral part of a city model, which also includes the soil underneath and the interaction between each element, rather than as independent structures. Each ViBa can be designed to protect one or more buildings from an earthquake but also it forms part of a network of devices placed at strategic locations in order to protect entire cities.

The ViBa itself is essentially a box containing a solid central mass held in place by springs. These allow the mass to move back and forth and absorb the vibrations created by seismic waves. The entire structure is connected to the foundations of buildings through the soil to absorb vibrations from them. The box's position underground would depend on how deep the surrounding foundations went and could even be placed on the surface.

As the ViBa is designed to reduce all vibrations in the soil, it could also be used to insulate buildings against ground waves from human activities such as road traffic, high-speed trains, large machinery, rock drilling and blasting. In this way, the technology would be able to absorb a larger quantity of energy than traditional measures used to insulate railways such as trenches or buried sheet-pile walls.

The problem with the ViBa is its size – it would need to be at least 50% of the mass of the average building it was protecting – and how much money it would cost to build and install as a result. So compared to current technologies to protect single buildings it would likely come with a much higher price tag. But as the ViBa can be designed to reduce the vibrations of more than one building or for buildings of historical importance for which current technologies are impractical, it can still be considered as a viable solution.

But latest research suggests that ViBa is a viable alternative strategy for protecting buildings from earthquakes. In the long term, it could lead to safer cities that are better equipped to deal with disasters and ultimately save lives.

**iii. The Levitating Foundation :-**

Engineers and seismologists have favored base isolation for years as a means to protect buildings during an earthquake. As its name suggests, this concept relies on separating the substructure of a building from its superstructure. One such system involves floating a building above its foundation on lead-rubber bearings, which contain a solid lead core wrapped in alternating layers of rubber and steel. Steel plates attach the bearings to the building and its foundation and then, when an earthquake hits, allow the foundation to move without moving the structure above it.

Now some Japanese engineers have taken base isolation to a new level. Their system actually levitates a building on a cushion of air. Here's how it works: Sensors on the building detect the tell-tale seismic activity of an earthquake. The network of sensors communicates with an air compressor, which, within a half second of being alerted, forces air between the building and its foundation. The cushion of air lifts the structure up to 1.18 inches (3 centimetres) off the ground, isolating it from the forces that could tear it apart. When the earthquake subsides, the compressor turns off, and the building settles back down to its foundation.

**iv. Seismic Invisibility Cloak**

Pic-I We're used to seeing concentric rings in rippling water. Some seismologists think plastic concentric rings might be handy for protecting buildings from earthquake damage. But what happens to nearby buildings if surface waves continue on their way at full force?

You may think of water or sound when considering the topic of waves, but earthquakes also produce waves, classified by geologists as body and surface waves. The former travel rapidly through Earth's interior. The latter travel more slowly through the upper crust and include a subset of waves -- known as Rayleigh waves -- that move the ground vertically. This up-and-down motion causes most of the shaking and damage associated with an earthquake.

Now imagine if you could interrupt the transmission of some seismic waves. Might it be possible to deflect the energy or reroute it around urban areas? Some scientists think so, and they've dubbed their solution the "seismic invisibility cloak" for its ability to render a building invisible to surface waves. Engineers believe they can fashion the "cloak" out of 100 concentric plastic rings buried beneath the foundation of a building. As seismic waves approach, they enter the rings at one end and become contained within the system. Harnessed within the "cloak," the waves can't impart their energy to the structure above. They simply pass around the building's

foundation and emerge on the other side, where they exit the rings and resume their long-distance journey. A French team tested the concept in 2013.

**2. Landslides:-** Landslides are one of the key hazards in the mountain regions particularly in the state of HP which cause damage to infrastructure i.e. roads, railways, bridges, dams, bio-engineering structures, and houses but also lead to loss of life, livelihood and environment. According to the analysis carried by TARU in 2015, 6824 villages of the state falls under high landslide risk zone whereas 11061 villages are in the medium risk zone. 824 villages are in the low-risk zone of landslides.

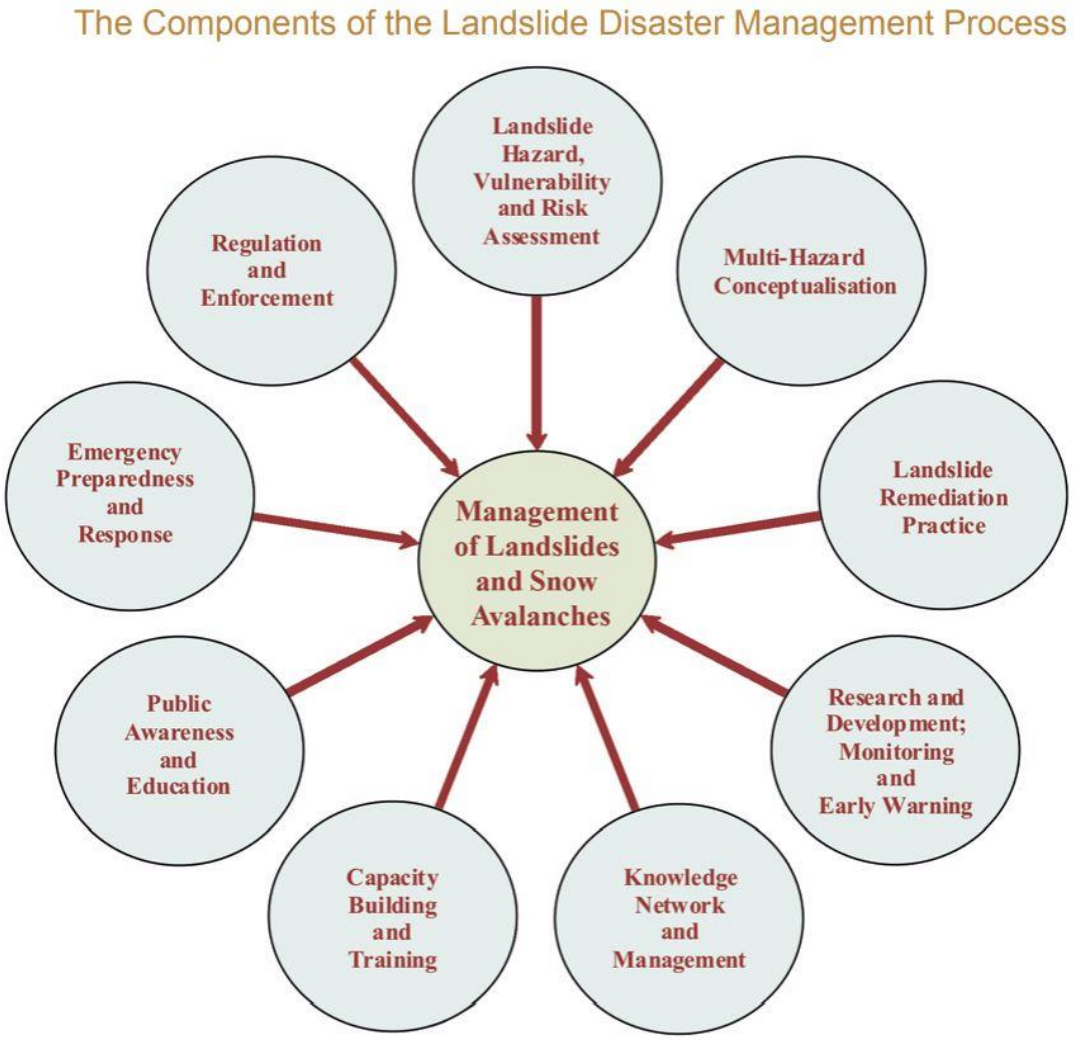


**Figure-2. Management of Landslides and Snow Avalanches**

- **Landslide Hazard, Vulnerability and Risk Assessment:** This includes delineating areas susceptible to landslide hazards and status of landslide hazards in different areas and to assess the resources at risk due to these hazards as per the requirement of communities and for planning and decision

making purposes. This also involves site specific studies of landslides and preparation of landslide inventory. The study of snow avalanches can also be included in this.

- **Multi-Hazard Conceptualisation:** Integrating landslide concerns into multi-hazard disaster management plans at different levels for effective risk assessment, mitigation and response.

- **Landslide Remediation Practice:** Encouraging implementation of successful landslide remediation and mitigation technologies, and execution of pace setter examples in mitigation and remediation strategies to build confidence amongst the affected communities. This also includes monitoring of landslides and development of early warning systems.

- **Research and Development;** Monitoring and Early Warning: The study of landslide hazards is an area that requires active research. Unlike many other violent acts of nature, landslide hazards can be mapped out, predicted and contained, provided that a synergy of detailed plans, an aware community and scientific research are established. Research is of critical importance in managing landslides. Developing a predictive understanding of landslide processes and triggering mechanism; regional real-time landslide warning systems based on threshold values of rainfall; real-time monitoring and establishing early warning systems in case of landslides that pose substantial risk to developmental gains; risk assessment and developing methodologies for assessing the potential co-seismic slides are some of the important fields of research that need immediate attention.
- **Knowledge Network and Management:** Establishing an effective system for gathering information on landslides, loss assessment resulting from landslides, and the effective dissemination of technical information and maps is an essential component of the disaster management process.
- **Capacity Building and Training:** Developing institutional capacity and training for geoscientists, engineers, and planners is necessary for effective management of the landslide hazard. The Directorates of Mining and Geology of the state governments require particular attention in this regard as these can be focal points of most scientific studies for landslides in the future. Risk assessment methodology, detailed site specific studies, etc., have to be

standardised and existing codes for landslide related practices have to be suitably modified.

- **Public Awareness and Education:** Effective communication of landslide hazard issues to the affected communities through education, public awareness programmes, posters, audio-visual aids, media campaigns, etc., is required.

- **Emergency Preparedness and Response:** Development of coordinated landslide rapid response capability involving scientists, engineers, local authorities, the National Disaster Response Force and paramilitary forces. Rescue, relief and rehabilitation are covered in this component.

- **Regulation and Enforcement:** Establishment of a techno-legal mechanism of landslide hazard assessment and mitigation with provisions for enforcing compliance thereof are important.

## 3. Forest Fire :-

Himachal Pradesh frequently witnesses forest fires during the dry weather as pines shed resinous needles that are inflammable. Framing a forest composition policy and replacing the inflammable chir pine monocultures with broadleaved trees in the lower hills will help to curtain the forest fire. Moreover, creating forest protection committees with the support of the forest department can go a long way in solving the problem as local communities are custodians living around forests.

## Techniques to strengthen house against fire:

### i. Fire-resistant Glass for Windows:-

Windows, important for visibility and light, can nonetheless be a fire hazard. Even before a window is in direct contact with flames, the intense heat of a nearby fire can cause the glass to break. And a broken window allows flames to enter a building easily. In addition, the heat from a fire outside might be enough to simply ignite flammable items inside a home without direct contact.

To protect your house, consider installing fire-resistant windows. One example is dual-paned glass windows, which, in addition to providing energy efficiency, also double the time it would take for fire to break the windows. The outer layer will break first before the inner layer. Tempered glass, which is heat-treated to make it about four times stronger than regular glass, is also effective.

Though they don't provide visibility, glass blocks are extremely fire-resistant while still providing light. Perhaps the best is wired glass, which is tempered glass with metal wire reinforcement. Doors that require fire resistance but also visibility often incorporate wired glass windows.

It's also wise to note the importance of window framing. Steel framing offers the best fire protection, followed by wood and aluminium. Vinyl is the least effective.

### ii. Adding Fire Protection

Structurally sound building materials, like steel, that don't have great fire-resistance ratings, can be protected from fire with flame retardant seals using foam, chemical or cementitious-based products.

### iii. Concrete

Concrete, one of the most common building materials, is also an excellent fire-resistant material. It is non-combustible and has low thermal conductivity, meaning that it takes a long time for fire to affect its structural, load-bearing ability, and it protects from the spread of fire. It's actually significantly more fire-resistant than steel, and often used to reinforce and protect steel from fire.

However, it's important to note that not all concrete is created equal. It consists of cement and aggregate, and the particular kinds of aggregate materials used can vary, as well as the amount used. Aggregate can make up 60 to 80 percent of the concrete's volume. The exact fire-resistance properties change depending on the type and amount of aggregate used. Natural aggregates tend not to perform as well. Moisture in the aggregate can expand when heated, causing concrete to sinter after long exposure.

Concrete is often listed as among the best fire-resistant roofing materials, too. And you shouldn't overlook the roof as essential in fire-protection, since it's extremely vulnerable to sparks blown from wild land fire.

### iv. Stucco

**Stucco** is a plaster that has been used for centuries for both artistic and structural purposes. Modern stucco is made of Portland cement, sand and lime, and it serves as an excellent and durable fire-resistant finish material for buildings. It can cover any structural material, such as brick or wood. It usually consists of two or three coats over metal reinforcing mesh. A one-inch (2.54-centimeter) layer of stucco can easily lend a 1-hour fire rating to a wall.

Roof eaves (overhangs) are a fire hazard, but they can be protected with an encasement of fire-resistant material. Stucco is often recommended as one of the best materials for boxing in hazardous eaves.

Stop Fire and Stay Stylish Because of the versatility in finishing techniques, stucco can come in various colors and textures. This means that it's easily adaptable to various architectural styles, including Prairie School, Mediterranean, Tudor and South-western. This way, you don't have to sacrifice beauty for practical fire-resistant protection.

### v. Gypsum :-

Gypsum boards typically are treated to be even more fire-resistant. Many structural materials will require underlying gypsum sheathing in order to

achieve a good fire-resistant rating, and gypsum board is the most commonly used fire-resistant interior finish. Gypsum board, also known as drywall, consists of a layer of gypsum sandwiched between two sheets of paper. Type X gypsum board is specially treated with additives to further improve its fire-resistive qualities.

The paper on the exterior of the type X gypsum board burns slowly and doesn't contribute to fire spread. In addition, gypsum board has a non-combustible core that contains chemically combined water (in calcium sulphate). When affected by fire, the first thing that happens is that this water comes out as steam. This effectively impedes the transfer of heat through the gypsum board. And even after the water is gone, the gypsum core continues to resist fire penetration for a time. Builders often use multiple layers of gypsum board to increase the fire-resistance rating.

**vi. Brick :-** If we learned anything from the popular children's tale of the "Three Little Pigs," it's that you should make your house out of brick. This isn't such bad advice. Brick is not only resistant to a big bad wolf's huffing and puffing -- it's also resistant to fires.

As bricks are made in a fire kiln, they're already highly resistant to fire. However, it's true that individual bricks are much more fire-resistant than a brick wall. A brick wall is held together with mortar, which is less effective. Nevertheless, brick is commonly cited as among the best building materials for fire protection. Depending on the construction and thickness of the wall, a brick wall can achieve a 1-hour to 4-hour fire-resistance rating.

So, although some materials are more fire-resistant than others, several factors might influence a builder's decision, including cost effectiveness, ease of installation and climate.

## 4. Rock Falls :-

Himachal Pradesh is part of the Himalayan range region that are young and fragile in nature, creating cracks and fractures in the rock could widen in future and create a rockfall or slope failure zone—a phenomenon in which a slope collapses abruptly under the influence of rainfall or an earthquake. A rockfall is a type of fast-moving landslide that happens when rock or earth falls, bounces, or rolls from a cliff or down a very steep slope. Rockfalls start from high outcrops of hard, erosion-resistant rock that become unstable for a variety of reasons. Rockfalls can be very dangerous depending on where they occur, the size of the rocks involved, and how fast the rocks fall or bounce downslope. When people, buildings, vehicles, or highways are in their path, these rockfall events can cause property loss, personal injury, or even loss of life. Rockfalls can also create unexpected hazards on roads, causing damage to vehicles. **Recently, major Rockfall occured in Kinnaur District of Himachal Pradesh where a bridge over Baspa River was damaged in the rockslide and killed nine tourists.**

**Bridge collapsed due to a Rockfall at Batseri of Sangla valley in Kinnaur District.**

## Design and construction of Rockfall preventing system :-

In the past few decades, a variety of rockfall protection measures have been developed that are now widely used and have significantly improved safety. Structures designed to protect the areas around a slope from falling rocks include mesh or cable nets, barriers and fences, and catchment areas.

In the mountains, rock falls occur at the end of fall and beginning of spring, when thermal variation is the greatest. Rockfall nets and other types of structures can be installed to protect the buildings and roads below. However, field observations have revealed that mountain forests play a protective role. They slow and can even stop the downward progression of rocks, thus constituting an ecological and economic alternative to human-made structures.

Rock fall Protection is never a simple objective to accomplish. The difficulty is compounded in areas where our highways pass through terrain requiring rock cuts. In mountainous states like Jammu and Kashmir, Himachal Pradesh, many miles of roadways pass through steep terrains where rock slopes adjacent to the highways are common. Rock fall potential is inherent in nature. This potential is partially the result of how the existing system has evolved. Until recently, standard practice was to use overly aggressive blasting and ripping techniques to construct rock slopes. Although this practice facilitated excavation, it frequently resulted in slopes more prone to rock fall than necessary. Where these conditions exist, agencies are faced with the difficult task of reducing the risk of rock fall.

Principal causes of rock falls are earthquakes, weather activity, weather events (extreme precipitation, spring thawing of fissures), weathering of rock (mechanic, chemical, biological) and human encroachment into hill slope. For any critical rock fall project, a detailed geomorphologic investigation is a prerequisite to arrive at the correct solution selection and implementation.

Efficient management of rock slopes is difficult, due to the broad range of conditions related to rock fall hazards, the unpredictability of rock fall events and limited budgets for remediation of rock slopes.

A proactive approach for managing rock fall problems, in which problem areas are systematically identified, can lead to more efficient and economical use of resources, as well as improved safety and increased confidence of the public. The overall management of rock fall hazards has one main goal: efficient use of agency resources for the reduction of rock fall hazard and associated risks.

## Innovative products and technologies for rock fall prevention :-

### i. Active Protection Systems:-

"Active" systems are those which act on the rock-detachment process like armored mesh, where different kinds of steel wire and steel cables form a mesh which is then anchored to the rock slope. Anchoring shall be done by a combination of short nails

and long nails to ensure local stability and global stability together. Mesh will act as the facing which will prevent the local erosion.

**ii. Passive Protection Systems:-**

"Passive" systems are those which do not affect the process of the rock detaching, but rather focus on containing falling debris, thereby averting danger for the infrastructure and its users. Passive systems include Drapery Systems, Rock fall Protection Barriers and Embankments.

**a. Drapery Systems :-**

Drapery system is designed for controlling rock fall, guiding falling debris to collect/ pile up at the foot of the slope.

**Drapery System with Hexagonal Mesh**

Double-twisted Mechanically Woven Hexagonal Steel Wire Mesh is a time tested good solution and popular due to its flexibility in all directions, and to the fact that it will not unravel, even in the event of some of its wires accidental breaking. An overall drapery system must be sized after a realistic assessment of the problem to be addressed. The main stress factors to be taken into account are: permanent shear strength factors like weight of the whole netting or panel, with a recommended factor of safety of 1.35 and variable shear strength factors like weight of debris piled up at

the foot and weight of snow (for slopes of less than 60°), with a recommended factor of safety of 4.

Instabilities may affect the superficial portion of the slope only, or involve the entire slope. Rockfall systems are designed to act on the cortical portion of the slope only, or reach deep within the consolidated mass of large blocks or slopes. A clear distinction must be made upfront between cortical protections (slope consolidation), applied using a combination of steel meshes, steel cables, cable panels, whose sole aim is to stabilize the rock slope against global instability. The same superficial protections are normally applied for the Slope problem. However, it is incorrect to assume that the same intervention techniques dedicated to superficial portion of the slopes can be applied for more deep-seated instabilities.

The netting shall be reinforced with cables to contain boulders of higher mass. Cable reinforced mesh is popularly known as Steel Grid. High Energy Absorption (HEA) panels are the next in the series, manufactured from steel cables that cross diagonally. Where the cables overlap, the joint is made of high-resistance 3 mm wire, which has been twisted onto the cables. Due to their high strength and stiffness, HEA panels are more effective to hold the stone fragments of large volume and mass. HEA panels and Steel Grids are often used with surface anchors and referred as Cortical Strengthening Systems which may be considered as an intermediate system between active and passive protection system.

Mesh with High Energy Absorption Panels

**b.** Rock fall Protection Barriers :-

Variable geometry barriers are made of a complex system of steel cables and double-twist wire mesh panels. The steel cables connect to structural elements, energy absorption device and anchorage lines with a high deformation capacity enabling the system, to withstand great energy (normally in the range of 500–5000 kJ). Barriers intercept and stop falling rocks and boulders. The intercepting panels are connected to structural elements, which in turn are connected to anchorage lines, braking systems and foundations as shown in Figure .

Rock fall Barrier

Rock fall protection barriers must be conceived as “noneasily- replaceable systems”, and therefore must have a durability of around 25 years, while structural works such as reinforced earth embankments for rock fall protection must last for 50 years.

**c. Rock Fall Protection Embankments :-**

Rock fall embankments usually consist of trapezoidal-shaped soil or boulder embankments. It provides greater impact strength, thereby guaranteeing greater energy absorption compared with a natural slope. A trench may be formed in front of the embankment with the dual aim of intercepting the blocks prior to their impact against the embankment and collecting the mobilized blocks of rock.

Rock Fall Protection Embankment

The most frequent types of rock fall embankments are constructed from gabion walls, reinforced soil wall, on which vegetation may grow, with steel or synthetic reinforcement and reinforced soils with stone facings and steel reinforcement. With regard to the mechanism of the design block, it is necessary to identify its volume, the characteristics of the trajectory followed and the kinematic parameters of the block at impact.

# Impact of Disaster on Mental Health

Disasters and mental health are related to a large extent; the effects of disasters might have a negative impact on the affected population. Along with the social and economic losses, the individuals and communities experience a mental instability which might precipitate Post Traumatic Stress Disorder (PTSD), Anxiety and Depression in the population. Generally, the disasters are measured by the cost of social and economic damage, but there is no comparison to the emotional sufferings a person undergoes post-disaster.

Psychological distress is common in the victims, along with socio-economic distress. The psychological interventions have helped the victims to improve over time, but the most common mental disorders such as depression and anxiety are expected to increase as a result of negative impact on mental health.

Disasters are mostly unpredictable, which leaves the victims in a state of shock. The victims tend to deny the loss and try to escape from reality. Being in a denial state makes the victims more vulnerable to stress, anxiety and other different maladaptive reactions. Home is a place which provides safety and security to the people. But, when the unavoidable situations induced by disaster, damage home, properties other valuable assets, it leads to a feeling of insecurity in the victims. Death of a closed one also leaves the victim in a state of insecurity because the sense of love, attachment and belongingness is deprived. There were various factors which lead to the psychological vulnerabilities of the sufferers such as the displacement of the family, death of a loved one, socio-economic loss, environmental loss, and lack of mental preparedness for disaster, disruption in the family bond, lack of social support and negative coping skills.

The psychological effects of the disaster are more drastic among children, women and dependent elderly population. After any sudden disaster or chronic disaster, they become the most vulnerable population.

## What is the principle of disaster mental health?

Disaster mental health services are based on the principles of ‘preventive medicine’. This principle of ‘prevention’ has necessitated a paradigm shift from relief centered post-disaster management to a holistic, multi-dimensional integrated community approach. This has ignited the paradigm shift from curative to preventive aspects of

disaster management. This can be understood on the basis of six 'R's such as Readiness (Preparedness), Response (Immediate action), Relief (Sustained rescue work), Rehabilitation (Long term remedial measures using community resources), Recovery (Returning to normalcy) and Resilience (Fostering).

## What are the different phases of disaster mental health?

Community's and individual's reactions to the disaster usually follow a predictable phase as shown in Figure-3. They are heroic phase, honeymoon phase, disillusionment phase and restoration phase. Immediately after the disaster, survivors in the community usually show altruistic behaviour in the form of rescuing, sheltering, feeding, and supporting the fellow human beings. Hence this phase is called as heroic phase. This phase usually lasts from a day to weeks depending upon the severity, duration of exposure and availability of the relief sources from various agencies. Once the relief agencies step in, survivors are relocated to safer places like relief camps. Media attention, free medical aid, free food and shelter, VIP visits to the camp, administrations' sympathy, compensation package, rehabilitation promises provides immense sense of relief and faith in survivors that their community will be restored in no time and their loss will be accounted through monetary benefits. Hence this phase is called honeymoon phase, which usually lasts for 2-4 weeks.

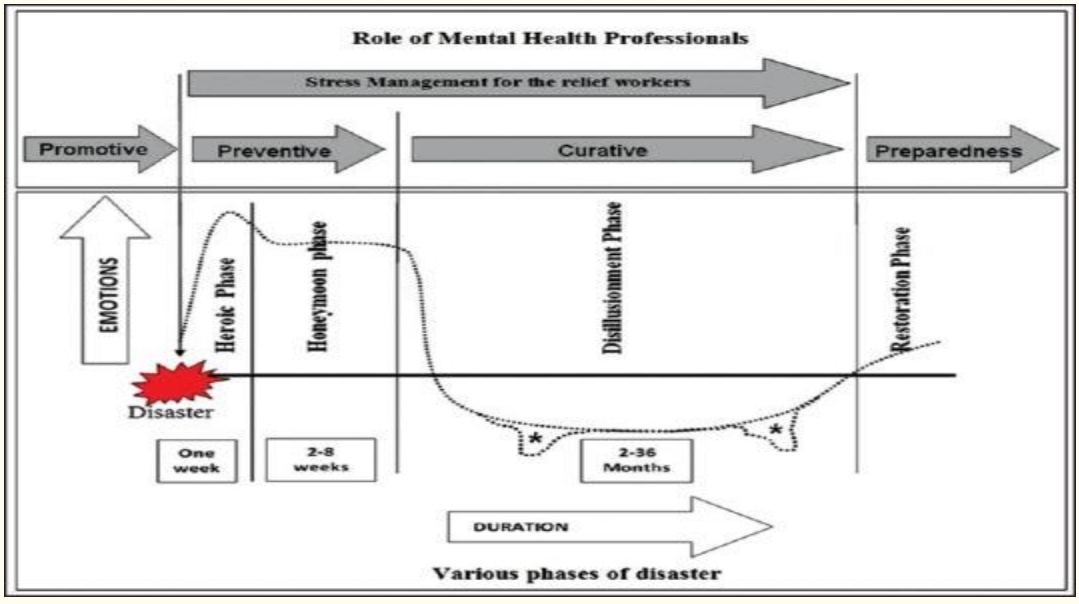


**Figure-3:- Community's and individual's reactions to the disaster usually follow a predictable phase**

Depicts the various phases of disaster and role of mental health professionals. Immediately after the disaster, heroic phase sets in this is followed by honeymoon phase. Disillusionment phase is the longest and prevalence of mental health morbidity is high during this period. At the end of 2-4 weeks, relief materials and resources start weaning. VIPs and politicians visit stops. Media coverage reduces. Administration, relief agencies and NGO's involvement start fading. This brings the survivors to the ruthless world of post disaster life. The reality of complex process of rebuilding and rehabilitating appears a distant dream because of administration hurdles, bureaucratic red tapism, discrimination, injustice and corruption. This harsh reality of the disillusionment phase provides a fertile soil for breeding mental morbidity which lasts for 3-36 months before the community restores to harmony. The role of mental health workers is immense during this phase.

## WHAT ARE THE NORMAL HUMAN RESPONSES TO A DISASTER?

Grief is the response to any loss. Grief reactions are normal responses to abnormal situations. Its intensity is directly proportional to the severity, duration and intensity of exposure to the disaster. Grief process occurs through various stages and are often experienced in waves or cycles or episodes with periods of intense and painful emotions. Usually normal grief follows the above phases with a possibility of some variation and resolves over a period of few months. Remember, survivours are normal people in abnormal situations. This issue needs to be kept in mind. The validation of their emotions needs to be done during the therapy to address the issue of:

a. Survivor's guilt,
b. Fear of losing control on overwhelming emotions,
c. Becoming mentally ill,
d. Substance use,
e. Death wishes and suicidal ideas by validation of emotions a sense of justification is provided to the overwhelming emotions.

## WHAT ARE THE ABNORMAL HUMAN RESPONSES TO A DISASTER?

A recent study reported that the existence of complicated grief in more than two-thirds of the survivors of the earthquake. Abnormal grief reactions can be grossly classified into delayed, absent, oscillating and exploding grief responses. Abnormal or complicated because they interfere in the process of healing and also interfere in the biological, social and occupational functioning. Resolution of abnormal grief reaction can be facilitated in these groups by fostering the cultural-religious rituals of grieving. Hence, the mental health professional needs to liaison with the disaster relief administration, educate them regarding proper closure of the missing people and to facilitate the mass grieving through cultural-religious death rituals of grieving. Many of the survivors may require trauma/grief-focused interventions, within a comprehensive disaster recovery programme.

### What is the prevalence of mental health morbidity in disaster affected population?

Prevalence of mental morbidity in disaster affected population varies from 8.6 to 57.3 percent. This magnitude of variation can be attributed to methodology of the study, defining a ‘case’, sampling procedure, timing of the study, recall bias, systematic under-reporting, cross-cultural differences and type and severity of the disaster.

Mental health disorders noted during disasters can be classified into acute phase (1-3 months) and long-term phase (>3 months). Majority of the acute phase reactions and disorders are self-limiting, whereas long-term phase disorders require assistance from mental health professionals. Along with the diagnosable mental disorders, affected community also harbors large number of sub-syndromal symptoms population. Majority of them report of medically unexplained somatic symptoms, and unusual symptom clusters are classically seen. Mental health professionals should be aware of this phenomenon and restrain themselves from labeling this population with mental disorder and treating them aggressively with medications. Overall, prevalence rates of mental morbidity can be approximately estimated to be two to three times higher than that in the general population.

## What are the common mental disorders seen in the disaster affected population?

Common disorders are: Adjustment disorders, depression, post-traumatic stress disorder (PTSD), anxiety disorders, non-specific somatic symptoms and substance abuse. Researchers have assigned that the PTSD as the signature diagnosis among post disaster mental morbidity. Prevalence of PTSD reported in literature varies from 4-60%.

Mood disorders PTSD and substances use disorders are diagnosed frequently along with other psychiatric disorders. Depression is a well-known co-morbidity and can pose a challenge to any treating team. Mental health morbidity continues to be prevalent even after 3-5 years in the disaster affected community.

**Common mental health problems among adults were :-**

- Relapse of any pre-existing psychiatric disorders;
- Adjustment disorders/Abnormal grief;
- Anxiety disorders like panic disorders, phobic disorders, NOS, Non specific anxiety symptoms and startle response Acute stress reactions;
- Insomnia;
- Depression/death wishes/suicidal ideas or attempts;
- Substance abuse & dependence (Monetary relief given is spent on substance abuse);

**Post traumatic stress disorders**

- Non-specific somatic symptoms such as dizziness, headache, bodyache recollection of the disaster events through images & thoughts, might mares, night terrors and so forth;
- Dissociative symptoms;
- Somatoform disorders;

**Common Mental Health problems among children were :-**

- Non-specific symptoms such as dizziness, vertigo, startle response, sleep wake cycle disturbances, clinging behaviour, excessive crying, withdrawal, fear, anger, irritability, numbing of affect, food refusal and decreased appetite and regressive behaviour;
- School refusal, school dropout and academic decline;

- Anxiety disorders like panic disorders, phobic disorders NOS, Non specific anxiety symptoms and so-forth;
- ODD symptoms;
- Conduct symptoms-like truancy, stealing, lying and so forth;
- Post-traumatic stress disorders;
- Depression;
- Somatoform disorders;

Disasters and mental health are related to a large extent; the effects of disasters might have a negative impact on the affected population. Along with the social and economic losses, the individuals and communities experience a mental instability which might precipitate Post Traumatic Stress Disorder (PTSD), Anxiety and Depression in the population. Generally, the disasters are measured by the cost of social and economic damage, but there is no comparison to the emotional sufferings a person undergoes post-disaster.

Psychological distress is common in the victims, along with socio-economic distress. The psychological interventions have helped the victims to improve over time, but the most common mental disorders such as depression and anxiety are expected to increase as a result of negative impact on mental health.

Disasters are mostly unpredictable, which leaves the victims in a state of shock. The victims tend to deny the loss and try to escape from reality. Being in a denial state makes the victims more vulnerable to stress, anxiety and other different maladaptive reactions. Home is a place which provides safety and security to the people. But, when the unavoidable situations induced by disaster, damage home, properties other valuable assets, it leads to a feeling of insecurity in the victims. Death of a closed one also leaves the victim in a state of insecurity because the sense of love, attachment and belongingness is deprived. There were various factors which lead to the psychological vulnerabilities of the sufferers such as the displacement of the family, death of a loved one, socio-economic loss, environmental loss, and lack of mental preparedness for disaster, disruption in the family bond, lack of social support and negative coping skills.

The psychological effects of the disaster are more drastic among children, women and dependent elderly population. After any sudden disaster or chronic disaster, they become the most vulnerable population

## Who are at risk of developing mental health morbidity?

Earlier studies predicted the following high risk variables: Severity of the disaster, threat to life, loss of life, loss of family members and duration of exposure. Recent additions are: Female gender, children, elderly, physically disabled, single, ethnic minority, displaced population, poverty, substance use like smoking, loss of economic livelihood, poor social support and family support.

Most children and young people are resilient, but also very vulnerable to the psychosocial effects of disasters. People with pre-existing mental disorders are well known to relapse during disasters. Similarly, people with poor coping capacity, substance use and chronic general medical conditions are also at the high risk. Hence, general physician practicing in the area of disaster zone should be aware of high prevalence of mental health disorders in chronic medically-ill patients. Similarly, disaster rescue workers are at high risk of developing psychiatric morbidity.

## What is the role of mental health professionals in disaster situation?

Many mental health professionals have poor understanding of their role in a disaster response team. They are neither part of a pre-existing or post- disaster response team. They have to play a multi-dimensional role from educating, training, negotiating, administrative, fund raising, collaborative, skill transferring, treating, advocating and rehabilitating.

### I. During pre-disaster period (preparedness) :-

Public Education Activities-Life skills education, educating about the disaster mental health.

Disaster Response Network- to develop collaboration with various existing agencies like government agencies, NGO's and community health workers.

Disaster response training of trainers in-

-disaster mental health;

- first aid training (both medical and psychological);

- counselling skills;

-stress management;

- identifying common mental disorders and referral;

-life skills training;

- Psycho education regarding mental health in trauma/disaster for the general population;

- Community level support and community resilience training;

- Strengthening Information, Education and Communication (IEC) activities.

**II. Immediately after the disaster (heroic and honeymoon phases)**

- Being part of multi-disciplinary relief item;

- Rapid assessment (mental health surveillance);

- Magnitude of the psychological impact

- Available mental health resources in the affected community;

- Need assessments;

- Social, cultural and religious perspective of the community;

Providing health care

- Medical and psychological first aid;

- The pre-existing mentally ill patients;

- Substance intoxication and withdrawal in survivors;

- Crisis intervention;

- Establishing the referral system;

Providing targeted disaster mental health interventions to the needy;

- Disaster psychiatry outreach teams to provide care;

- Promoting of resilience and coping;

- Dealing with the victims and volunteers stress (Stress management);

- Fostering the mass grieving/mourning;

- Collaborating with administrative and funding agencies;

- Mental health education- do's and do not's;

- Educating the administrative personnel, local leaders and public;

- Utilizing mass media to reach the survivors;

- Initiating collaboration with the local agencies for capacity building and outside agencies for support
- Planning research;

**III. During disillusionment phase :-**

- Providing care for the mental ill patients;
- Attending to the referrals;
- Continuing and expanding the capacity building activities;
- Training of resourceful community members like private physicians/doctors, primary health care staff, paramedical staffs, school teachers, anganwadi workers, alternative complimentary medicine personnel's, religious leaders, spiritual leaders and faith healers;
- Community outreach camps;
- Hand holding of the community health workers;
- Assessment of the interventions and feedback mechanism;

In addressing the spectrum of problems during post-disaster, mental health clinics in relief camps are useful in identifying and treating moderate-to-severe cases only. Hence, the role of specialist as a clinician is very minimal. However, specialist has very important role in training local resources in simple community-based interventions. These include art therapy; informal education; group discussions; drama; structuring of daily activities; engaging in activities such as yoga, meditation, prayers, relaxation, sports, and games; spiritual activities; providing factual information; educating parents and teachers. They were intended to provide important components of psychosocial rehabilitation such as normalizing, stabilizing, socializing, defusing of emotions and feelings, and restoration of a sense of identification with others and of safety and security. These will not only help in the recovery of milder and sub-syndromal symptoms, but also in the prevention of adverse mental health consequences. Such interventions, when feasible, should begin as early as possible, targeting all high-risk populations in the affected area; however to encourage participation and avoid stigmatisation, the 'mental health/psychiatric' label needs to be avoided.

Specialised care is required only in a small group of population. Majority of the care occurs informally outside the medical settings by community level workers. Training these community level workers is highly essential ingredient of the disaster

management. There is a need to de-medicalise the survivor's disaster response and also to de-professionalise the service delivery and focus on capacity building of the local community. By de-medicalising and de-professionalizing, gives us an opportunity to train the survivors, lay-public, local administration, community leaders, NGO's, faith healers, religious leaders, community level workers and significant others in providing care to the survivors during disaster.

Another important role is providing care to the disaster relief workers. Disaster relief workers encounter considerable stress while providing services to people affected by a disaster and they are exposed to the same risk factors that affect clients, hence disaster workers are at risk for compassion fatigue, burnout and vicarious traumatisation. In simple words it is the 'emotional cost on the relief workers by caring the disaster victims'. Vicarious trauma can also impact the relief worker's personal life, as well as the relief operation. It is essential to monitor the disaster relief workers mental and physical health status during disaster pre-deployment (assessment of personality and training), deployment (hand holding) and post-deployment phase (to build resilience).

Majority of the disasters require temporary external aids. These should be culturally appropriate and targeted towards empowering the affected community to enhance their camaraderie and competence to cope with future disasters. Disaster management needs to follow the *principle of democracy*. That is 'of the people, by the people and for the people' for disaster assistance to be acceptable, accessible, adaptable and adoptable for long-term community participation and empowerment.

Recent, Uttarakhand Disaster relief work team in 2013 from National Institute of Mental Health Neuro sciences, Bangalore reported that the mental health infrastructure and manpower is abysmally inadequate, none of the district in the Uttarakhand had District Mental Health Programme and Substance use was highly prevalent in the community and at the same time it is to be noted that there are no treatment for de-addiction or de-addiction rehabilitation centre was available across the entire state of Uttarakhand. Hence, the disaster relief team submitted a report to the Government of India to implement the National Mental Health Programme to increase the mental health infrastructure at least in the four major disaster affected districts in Uttarakhand. Thus, mental health professional plays crucial role in various

forms from providing care, training, advocacy, rehabilitation to hand holding of the other disaster relief workers.

## What is the efficacy of the psychological interventions?

### Psychological First Aid

Survivors may exhibit a range of physical, emotional, and cognitive symptoms. This heightened emotional state is similar to classical fight/flight/freeze reaction of stress. Affected person may not be in a position to think and act rationally during disaster. Similar to medical first aid, psychological first aid techniques can be performed by minimally trained non professionals within the affected community. Disaster relief workers need to be trained in assessing the high-risk survivors. The assessment need to be initiated by the relief worker for assessment of:

a. Dangers to self and others
b. Disoriented to time/place/person
c. Death of family member/s in disaster
d. Direct threat to life because of disaster
e. Disaster related significant physical injury to self or family members
f. Delayed relief/evacuation
g. Missing family member/s and
h. Past history of mental illness and substance use.

After the brief assessment appropriate steps needs to be taken by providing psychological first aid as given below.

**Getting in touch with survivors:** to respond and to initiate contacts in a nonintrusive, compassionate, and maintain a calm presence with helpful manner.

**Protection from further threat and distress:** Providing accurate information about the disaster, about the current disaster response and available services. Protecting survivors from unnecessary exposure to additional traumatic events and trauma reminders.

**Immediate physical care:** Addressing physical health needs (medical first aid), injuries, access to medicine and referral to triage.

**Helping to locate family members:** To address issues like helping to locate family members, protection and safety concerns of loved ones.

**Sharing the experience (but not forced):** In simple words "telling one's story" in detail.

**Normalization or Validation of the emotions:** To allow people to ventilate and process their thoughts, emotions, and experiences while providing them with appropriate validation or normalization of their reactions. At times brief handling of survivors syndrome.

**Facilitating a sense of being in control:** To provide psychoeducation to survivors about stress reactions and coping to reduce distress, Information on adaptive and maladaptive coping is provided, along with very brief relaxation techniques that can be used in acute post disaster settings.

**Linking survivors with sources of support and resources :** This includes using appropriate referral procedures, Linking with available resources and promoting continuity of services. Providing practical assistance in vulnerable individuals like children, females and elders. Information about social support and how they can seek or give support.

**Identifying those who need further help and referral:** Monitoring high-risk individuals like substance/drug users, pre-existing mental illness, prolonged or intense exposure to trauma, death of loved ones and survivors guilt for future interventions.

More recently, there has been a revived interest in 'psychological first aid' (PFA). It was initially described by Raphael (1986) for use in the civilian domain. The main goal of this is to relieve immediate distress and to prevent or minimize the development of pathological sequelae. The concept of psychological first aid for individuals exposed to highly traumatic events has been used in the field of crisis management and disaster mental health for many years. The psychological first aid was developed to reflect current best practices in disaster mental health based on

research, expert consensus, and practical experience. However, there are no systematic studies to answer the efficacy and usefulness of the PFA.

**Debriefing**

It is defined as group discussions that occur within 48-72 hour after an event and are often referred to as 'psychological de-briefings'. In general, these sessions encourage participants to describe and share both factual and emotional aspects of their disaster experience. Principle behind this debriefing is that immediate processing gives an individual the ability to cognitively restructure the perceived disaster event so that it is remembered in a less traumatic way. There are various modified forms of debriefing such as Critical Incident Stress Debriefing (CISD) and Critical Incident Stress Management (CISM). Debriefing is successfully used and implemented in military combat settings and in relief workers. However, effectiveness of debriefing in survivors is controversial. While some studies do suggest, it may actually produce harm. However, debriefing occurring outside the therapeutic setting is unaccounted till date. Many of the survivors and relief workers like to talk about the disaster responses to family members, spouse, friends, colleagues and significant others. Effect of such debriefing is not been explored in a systematic way.

**Cognitive Behavioural Intervention (CBT)**

CBT have been found to be effective in reducing subsequent psychopathology after the exposure to disaster. There are randomised controlled studies to support the findings that early intervention CBT group had less of PTSD when compared a control group. Although these studies report of positive results but there are no long-term follow-up studies. Recent review by Robert and his colleagues reported that trauma-focused CBT within 3 months of a traumatic event appears to be effective CBT appears to be promising in mitigating the suffering of disaster. However, in a developing country like India, where the availability of the trained manpower is meagre, use of computerised version of CBT requires to be explored.

**Other interventions**

Recently there has been re-emergence of interventions such as Eye Movement Desensitization and Reprocessing (EMDR) and trauma counselling in management of disaster. However, the effectiveness of these procedures requires to be

established. In a recent Cochrane review by Bisson and Andrew 2007, reported that there was evidence individual CBT, EMDR, stress management and group TFCBT are effective in the treatment of PTSD.

**Community-Based Interventions**

Non-specific community based interventions plays major role in fostering the healing process. These intervention include, structuring of daily activities; avoiding displacement; fostering the family, cultural and religious rituals; group discussions; validation of the emotions of the survivor's experience and also survivor's guilt; providing factual information; educating parents and teachers; engaging the children in various informal education methods with innovative ideas like drawing, sketching, singing, miming and so forth by using available community resources; engaging the adult survivors in camp activities like cooking, cleaning and assisting in relief work; to start schools in the disaster affected area at the earliest so that normalisation and structuring of the daily activities occurs in children; at least to initiate informal education; teaching simple sleep hygiene techniques; educating survivours about harmful effect of substance use; community-based-group interventions can be planned like art therapy (painting/drawing), group discussions, dramas, storytelling, structuring their day, engaging in activities, prayers, yoga, relaxation, and sports/games; stress management of the relief worker is essential; engaging the willing survivors in spiritual activities and involving the survivors in re-building their community is essential. These non-specific interventions not only help the high-risk population but also the affected disaster general population.

## WHAT IS THE ROLE OF PSYCHOTROPIC MEDICATIONS IN DISASTER MANAGEMENT?

Generally use of psychotropic medications is discouraged in disaster management because of the popular notions like a) disaster reactions are generally normal people in abnormal situations and b) majority of the symptoms are self limiting. Prophylactic uses of psychotropic medications in survivors are discouraged. There are no well controlled studies to say that prophylactic use of medicine decreases psychiatric morbidity. Various medications have been tried such as Propranolol, Clonidine, Guanfacine, Prazosin, Amitriptyline, Imipramine and Risperidone. Use of benzodiazepines such as Clonazepam and Temazepam for longer duration have been considered to be greater risk factors for developing PTSD. None of the

medication has been found to be effective in preventing psychiatric morbidity in well-controlled studies. Majority of the studies were open label trial, small sample size and from different population such as combat veterans, accidents victims and burns victims. Extrapolation of data from these studies cannot be used as justification to use in a disaster settings. However, use of prophylactic psychotropic medications may be justified in pre-existing mental illness to avoid relapse, in acute substance withdrawal to avoid complications, suicidal attempt and severe depression. Considering the paucity of evidence it is difficult to recommend prophylactic psychotropic medication in the disaster setting.

## WHAT RESILIENCE FACTORS NOTED IN MITIGATING THE SUFFERING?

Resilience means the speed with which homeostasis is achieved after displacement. This concept of resilience has been applied to describe the adaptive capacities of individuals or community in response to adversity like disaster. Majority of the research on disaster is on psychopathology rather than on resilience factors which protect the people in developing mental health morbidity. There are no systematic studies, however preliminary research have yielded following resilience factors; a cohesive community, community resources, minimal displacement, good social support and network, preserved family system and support, altruistic behavior of the community leaders, minimal materialistic needs, religious faith and spirituality have been associated with the good outcome and community resilience. This was noted in the native population of the Andaman and Nicobar Islands of India and in survivors of Thailand. Contemporary civilised world requires much learning from the native's of Andaman and Nicobar islands. The resilience factors need to be identified and studied systematically in a well controlled disaster population.

## Policy recommendations to improve science during crisis

Changes in current international, national, state, and local policies are needed to improve science during crisis. These changes will advance the conduct of science, access to and use of scientific data, the role of science in decision-making, and improve crisis response and recovery. In addition to government policies, improvements are needed in policies governing academic institutions, communities of practice, nongovernmental organizations, and private industry. Implementation of policy recommendations will vary by country, province/state, and local political institutions. Gaps or lack of understanding between different professional cultures can lead to a mismatch between scientific activity, emergency response, and on-the-ground needs. It can also lead to a lack of institutional support for science during crisis at the regional and local level. State and provincial governments should create a Chief Science Officer position (and/or strengthen existing positions) to facilitate science during crisis. Creating a Chief Science Officer position would reduce confusion and facilitate effective conduct and application of science during crisis. The Chief Science Officer would serve as a critical liaison between national, state or provincial, and local government offices, emergency responders, and the scientific community. Publishers of scientific journals and books should develop and implement policies that improve accessibility of scientific information during a crisis. During a crisis, access to upto-date research is critical for the scientific community to identify gaps that need immediate attention and to find scientific solutions to pressing problems.

Further, the rapid dissemination of data collected during a crisis but prior to publication is often critical for decision-making and to avoid unnecessary duplication of effort. Publishers should adopt a policy of providing free, publicly available, full-text access to journals, e-books, and databases with relevant information during and immediately following major crises. Recent advances within the biomedical community provide a potential model. The scientific community should develop a code of conduct that addresses ethical and professional practices to which scientists engaged in science during crisis would adhere. A science during crisis code of conduct would describe scientists' distinct ethical responsibilities during a major crisis. The code of conduct should favor altruism over competition in scientific research and should recognize the primacy and rights of the communities and sovereign tribes immediately affected by the crisis. The code of conduct would

recognize that science during crisis operates differently than science during non-crisis times and should be developed and agreed upon by the burgeoning science during crisis community of practice.

# Suggestions

It is suggested that a fully functional **Department of Disaster Prevention and Management Studies** should be established in the state preferably in H.P. University with liberal support provided by the State of Himachal Pradesh. The Department should have well qualified faculty, state of the art laboratories and library and suitable courses should be started for the benefit of not only of the state of Himachal Pradesh but also neighbouring states. In addition, collaboration with National and International institutions may be explored to bring in the best available skill and knowledge in the field. Atal Medical and Research University shall provide the necessary support as per the need and requirement and also look in to the various aspects of different physical and mental health issues.

## Conclusions

Disasters are inevitable truth of life. Planning and preparedness is highly essential to meet challenges. Disaster management is a continuous and integrated cyclical process of planning, organizing, coordinating and implementing measures to prevent and to manage disaster effectively. Thinking from ‘when’ the disaster strikes to ‘if’ the disaster strikes has necessitated a paradigm shift from relief centered post-disaster management to a holistic, integrated and preventive approach based upon principles of disaster prevention, preparedness and mitigation. It revolves in responding to the emotional and psychosocial needs of people affected by disaster. Community-based group interventions should begin as early as possible, targeting all high-risk populations in the affected area; however to encourage participation and avoid stigmatisation, the ‘mental health/psychiatric’ label needs to be avoided with disaster mental health programmes. Approach towards management should be conservative in medication and avant-garde in psychosocial approach. There is a need to de-medicalise the survivor's disaster response and also to de-professionalise the service delivery through local community level workers. Rehabilitation efforts planned should be culturally appropriate and targeted towards empowering the affected community to enhance their camaraderie and competence to cope with future disasters. Involving the local affected community not only helps in capacity building but also in community participation.

**This is a collection of findings taken from various sources because University does not have its own expertise. Sources have been mentioned in the References.**

# References


1. NPDM, 2009 – National Policy on Disaster Management, GOI, 2009, by National Disaster Management Authority, Govt. of India.
2. Department of Health & Family Welfare, Govt. of Himachal Pradesh.
3. Maccaferri Environmental Solutions Pvt Ltd.
4. Disaster Prevention and Preparedness by Jimma University in collaboration with the Ethiopia Public Health Training Initiative, The Carter Centre, the Ethiopia Ministry of Health and the Ethiopia Ministry of Education.
5. WIT Transactions on the Built Environment, (WIT Press) in collaboration Clemson University, USA.
6. Iranian Journal of Public Health in collaboration with Tehran University of Medical Sciences.
7. Indian Journal of Psychological Medicine.
8. Wikipedia.
9. Internet.