MSWE-03/2019-20

1) Describe the evolution of the disaster management system in India. 20

Disaster management in India refers to conservation of lives and property during a natural or man-made disaster. Disaster management plans are multi-layered and are planned to address issues such as floods, hurricanes, fires, mass failure of utilities and the rapid spread of disease. India is especially vulnerable to natural disasters because of its unique geo-climatic conditions, having recurrent floods, droughts, cyclones, earthquakes and landslides.Due to the vastness of the country different regions are vulnerable to different natural disasters. For example, during rainy season the peninsular regions of South India is mostly affected by cyclones and states of West India experience severe drought during summer.

The new approach started from the conviction that development cannot be sustained unless mitigation is built into the development process. Another cornerstone of the approach is that mitigation must be multi-disciplinary, spanning across all sectors of development.The new policy also emanates from the belief that investments in mitigation are much more cost effective than expenditure on relief and rehabilitation. Disaster management occupies an important place in India's policy framework, as poor people are most affected by disaster and they are India's predominant population.

The steps being taken by the Government emanate from the approach,has been outlined above. The approach has been translated into a National Disaster Framework (a roadmap) covering institutional mechanisms, disaster prevention strategy, early warning systems, disaster mitigation, preparedness and response and human resource development. The expected inputs, areas of intervention and agencies to be involved at the National, State and district levels have been identified and listed in the roadmap. This roadmap has been shared with all the State Governments and Union Territory Administrations. Ministries and Departments of the Government of India and the State Governments/Union Territory Administrations have been advised to develop their respective roadmaps taking the national roadmap as a broad guideline. There is, therefore, now a common strategy underpinning the action being taken by all the participating organisations/stakeholders.

National Disaster Management Authority, abbreviated as **NDMA**, is an agency of the Ministry of Home Affairs whose primary purpose is to coordinate response to natural or man-made disasters and for capacity-building in disaster resiliency and crisis response. NDMA was established through the Disaster Management Act enacted by the Government of India in 23 December 2005. The Prime Minister is the ex-officio chairperson of the same. The agency is responsible for framing policies, laying down guidelines and best-practices and coordinating with the State Disaster Management Authorities (SDMAs) to ensure a holistic and distributed approach to disaster management.

It is headed by a nine-member board chaired by the Prime Minister of India. The remainder of the board consists of members nominated based on their expertise in areas such as planning, infrastructure management, communications, meteorology, and natural sciences. The day-to-day management of the agency is overseen by the office of the Vice Chair.

NDMA is operationally organized into the following divisions:

- Policy & Planning
- Mitigation
- Operations & Communications
- Administration
- Capacity Building

NDMA equips and trains other Government officials, institutions and the community in mitigation for and response during a crisis situation or a disaster. It operates the National Institute of Disaster Management, which develops practices, delivers hands-on training and organizes drills for disaster management. It also equips and trains disaster management cells at the state and local levels.

NDMA also collaborates with the Lal Bahadur Shastri National Academy of Administration and Sardar Vallabhbhai Patel National Police Academy to impart training to administration and police officers in planning and incident response. It monitors and develops guidelines for the local Firefighting Services across the country. It collaborates with the Ministry of Health and Family Welfare in developing emergency health and ambulance services. Specifically, it focuses on capacity building in dealing with mass casualty at local hospitals.

Functions and responsibilities

NDMA, as the apex body, is mandated to lay down the policies, plans and guidelines for Disaster Management to ensure timely and effective response to disasters. Towards this, it has the following responsibilities:

- Lay down policies on disaster management;
- Approves the National Plan;
- Approve plans prepared by the Ministries or Departments of the Government of India in accordance with the National Plan;
- Lay down guidelines to be followed by the State Authorities in drawing up the State Plan;
- Lay down guidelines to be followed by the different Ministries or Departments of the Government of India for the Purpose of integrating the measures for prevention of disaster or the mitigation of its effects in their development plans and projects;
- Coordinate the enforcement and implementation of the policy and plans for disaster management;
- Recommend provision of funds for the purpose of mitigation;
- Provide such support to other countries affected by major disasters as may be determined by the Central Government;
- Take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with threatening disaster situations or disasters as it may consider necessary;
- Lay down broad policies and guidelines for the functioning of the National Institute of Disaster Management.

2) Describe the component of community based disaster management.

Communities are the first responders in case of a disaster. Therefore, community-based disaster risk reduction (CBDRR) should be the core of any risk reduction approach. Disaster risk reduction focuses more on reducing underlying risk, encouraging preventive action before a disaster. Disaster risk management, in contrast, focuses on broader aspects of disaster issues, from prevention and mitigation to relief, response, and recovery. Yodmani (2001) defined community-based disaster risk management (CBDRM) as an approach that reduces vulnerabilities and strengthens people's capacity to cope with hazards, which seeks to: (1) reduce vulnerabilities and increase capacities of vulnerable groups and communities to cope with, prevent, or minimize loss and damage to life, property, and the environment, (2) minimize human suffering, and (3) hasten recovery.

Based on past disasters, it has been found that communities become actively involved in search and rescue, relief, and postdisaster recovery. To enhance community participation before a disaster strikes, it is important to focus on risk reduction issues, and therefore CBDRR has become increasingly emphasized. CBDRR emerged as a result of a shift from reactive emergency management to disaster risk reduction. It focuses more on predisaster interventions such as prevention, mitigation, and preparedness-related activities. For instance, prevention measures aim to avoid the occurrence of disasters, which may not be possible in the case of natural disasters, but the intensity and frequency of disasters could be reduced through poverty alleviation and asset redistribution plans and the provision of basic services such as education and health care (Victoria, 2002). Mitigation measures reduce and limit the impact of natural hazards on elements of risk such as population, infrastructure, and properties through structural measures such as bridges, protective dikes, embankments, and safety building design and nonstructural measures like community risk assessment, community risk reduction planning, public awareness, food security programs, group saving, cooperatives, strengthening community disaster management organizations and advocacy on disasters and development issues, legislation, and land use zoning, among others.

Twigg, Charlotte, and Mary (2000) emphasized that disaster mitigation is intrinsic to sustainable development. Preparedness measures are developed in anticipation of future disasters so that effective and appropriate actions are taken during emergencies, including public awareness, evacuation, and emergency management, search and rescue, immediate repair, restoration of critical facilities and utilities, capacity assessment, non-food relief assistance, and evacuation center management (Victoria, 2002). The key elements and features of CBDRR or CBDM explain the core of community-based approaches for disaster risk reduction and movement (Shaw, 2012; Victoria, 2002):

- **People's participation is important:** Community members are the main actors, involved not only in the process but its content. They share the benefit or gain through improved disaster risk reduction and development. Ultimately, this will lead to safer conditions, security of livelihood, and sustainable development.

- **Priorities are set for the most vulnerable groups, families, and people in the community:**Participation from all sectors is required for disaster risk reduction, but priority is given to the most vulnerable groups—in urban areas the poor or informal settlers, in rural areas farmers, fisherfolk, and indigenous people. The most vulnerable also include the elderly, the differently abled, children, and women.
- **Risk reduction measures are community-specific:** Measures provided for risk reduction are mainly community-specific, which are identified after an analysis of the community's disaster risk (hazards, vulnerabilities, and capacities and perceptions of disaster risk).
- **Existing capacities and coping mechanism are recognized:** The strength of CBDRR lies in the existing capacities and coping mechanism of the community members. They often lack material assets but rely heavily on their traditional wisdom, local knowledge and resources, social organizations, shared values, cooperative coping mechanisms, close family ties, and perseverance and resourcefulness.
- **Disaster risk reduction is linked with development:** The aim of CBDRR is to reduce people's vulnerabilities by strengthening the capacities of individuals, families, and communities. It addresses vulnerabilities and the core factors behind it, such as poverty, social inequalities, and environmental resource depletion and degradation. Ultimately, the idea is to develop a people-centered development as well as equitable and sustainable development. The goal is to build a resilient community.
- **Outsiders have supporting and facilitating roles:** In CBDRR, nongovernmental organizations (NGOs) support community members, whereas the government role is integral to the institutionalization of the CBDRR process. Partnerships with less vulnerable groups and other communities are forged in the interest of disaster risk reduction.

  Community-based approaches can be defined as "an umbrella term for approaches to programming which involve beneficiaries in their identification, design, or management. It also refers to a set of approaches, applied within community-level projects or as part of national programs" (Slaymaker & Christiansen, 2005, p. 11). The degree of community participation varies along a spectrum from consultation with communities to devolution of resources, decision-making, and implementation at the community level (Slaymaker & Christiansen, 2005). In the field of development planning, Arnstein (1969) defined eight levels of community participation to demonstrate the quality of participation to aspire to and work for. These involve "the redistribution of power that enables the have-not citizens, presently excluded from the political and economic processes, to be deliberately included in the future" (Arnstein, 1969, p. 1).

  This article discusses the essentials of CBDRR with specific focus on Asian examples. It provides a historical overview of the evolution of the concept, followed by some new issues in CBDRR in our changing world. A few examples from Asia are provided, followed by discussion of future perspectives of CBDRR.

  Disaster risk reduction has evolved over time. While in 1960s and 1970s disasters were considered extreme events, the 1980s saw a strong emphasis on predisaster preparedness, which led to the United Nations (UN) International Decade of Natural Disaster Reduction (1990–1999). The first half of the decade focused mainly on government actions, up to the 1994 Yokohama Conference and the "Yokohama Plan of Action for a Safer World," possibly the first

official document agreed upon by the UN member states that strongly emphasized the role of communities and NGOs in disaster risk reduction approaches (IDNDR, 1994). The following year, in 1995, the world saw the devastation of the Great Hanshin earthquake (popularly known as the Kobe earthquake), which shook Japan, one of the most disaster-prone as well as prepared countries. The aftermath of the disaster involved a long-lasting recovery process, and Japan's concept of civil society and NGO's role changed quite drastically (Shaw & Goda, 2004).

After 1995 several changes took place in the risk reduction arena. Applying the lessons of Kobe that neighbors helped each other the most, community-focused issues became paramount. Multi-stakeholder and multi-disciplinary evolution was more emphasized at the global and regional levels. The need for predisaster mitigation measures was emphasized. Major disasters like the 1999 Taiwan earthquake, the 1999 Turkey earthquake, and the 2001 Gujarat, India, earthquake also took place. These events highlighted the need for mainstreaming risk reduction in local and national development policy. Also important was the establishment of the International Strategy for Disaster Reduction (ISDR) as the key coordinating UN body for disaster risk reduction.

Then came the 2004 Indian Ocean tsunami, another turning point in the risk reduction arena. This one event killed more than 200,000 people from more than 65 different countries. The highest death tolls were reported in Indonesia, Sri Lanka, India, the Maldives, and Thailand. This required global help in postdisaster response and recovery. In 2005, the 10th anniversary of the Kobe earthquake, the Hyogo Framework for Action (HFA; 2005–2015) was adopted at the 2nd World Conference on Disaster Reduction (WCDR) in Hyogo, Japan. This was a landmark event and framework in the sense that, for the first time, the disaster field had a measureable framework to monitor the progress in risk reduction approaches in countries and communities.

Thus, there has been significant progress in the methods, policies, and approaches of disaster risk reduction over time, with risk reduction becoming truly multi-disciplinary with the involvement of different stakeholders. The role of communities and civil societies has been recognized, practiced, and re-emphasized in different documents and policies. Briceno (2015), in his analysis of the evolution of risk reduction approaches, enumerated the following goals: (1) integration of risk management into sustainable development policies and climate change adaptation, (2) shifting to vulnerability reduction and resilience building, (3) ensuring a strong institutional basis for implementing disaster risk reduction, and (4) developing resilience awareness and consciousness-raising.

In 2015, the Third World Conference on Disaster Risk Reduction was hosted by government of Japan and the city of Sendai (SFDRR, 2015). The Sendai Framework for Disaster Risk Reduction (SFDRR) was adopted by the member states for the period of 2015–2030. SFDRR has seven specific goals:

1. Reduce global disaster mortality
2. Reduce number of affected people
3. Reduce direct disaster economic loss
4. Reduce disaster damage to critical infrastructures
5. Increase number of countries with DRR strategies

6. Enhance international cooperation
7. Increase access to multi-hazard EWS, risk information, and assessment

To achieve these goals, there are four key targets:

1. Understanding disaster risk
2. Strengthening disaster risk governance
3. Investing in risk reduction
4. Enhancing disaster preparedness for collective response and being able to "build back better" in recovery, rehabilitation, and reconstruction

Thus, from 1990 to 2015 there has been a big change in the concepts, approaches, and methods used to reduce the impacts of disasters. While in the 1990s focus was more on multi-stakeholder and local governance, since 2000 more risk-sensitive investment planning has been emphasized, and risk-informed decision-making has become the core of the risk reduction.

3) Answer any two of the following questions in about 300 words each:

b) Explain the salient features of man-made disasters. 10

Man-made disasters are the result of carelessness or human errors during technological and industrial use. The disasters are in the form of accidents, which occur all of a sudden and take a huge toll on life and property. Mostly such disasters cause injuries, diseases and casualties where they occur.

Man-made disasters are mainly of two types:

Local disasters:

These are small-scale disasters such as train accidents, plane crashes and shipwrecks.

Industrial and technological disasters:

These are much larger in scale and are the result of technology failures or industrial accidents. Such disasters affect both local population and may even cover a much larger area. Industrial disasters result due to accidental leakage of water or air pollutants. Many of the chemicals are extremely toxic and carcinogenic which affect the human population in an adverse way. Some people die instantly while others are crippled for whole life in the form of blindness, paralysis and many other chronic diseases.

Impact on the environment:

Leakage of toxic chemicals from the industries and accidents in the nuclear reactors has short-term and long-term effects on the environment and human health. Short-term effects on human health relate to casualties and diseases like blindness, cancer, paralysis, heart trouble, gastric and respiratory abnormalities. Long-term effects include genetic imbalances in humans

and its impact on the future generations. Soil and water sources also remain polluted for long durations of time.

Prevention, control and mitigation:

Man-made disasters can be minimized to a large extent by adopting the following measures:

1. Proper training of personnel working in the hazardous industries.

2. Proper maintenance and care of safety measures.

3. Removing human encroachments around hazardous industries.

4. Making the people aware about the first-aid methods in case of accidents.

5. Applying wet cloth over the mouth and nose in case of gas leakages minimizes the health hazards.

6. Remaining indoors in case of radioactive accidents.

7. Providing the people with proper medical care, in some cases throughout their life.

8. Providing adequate compensation to the affected people by way of money and employment.

Bhopal Gas Tragedy (BGT):

The most serious industrial disaster occurred on December 3, 1984 at Bhopal, India, which is known as the Bhopal Gas Tragedy (BGT). The Bhopal gas tragedy occurred due to leakage of methyl isocyanide (MIC) gas from the factory of Union Carbide of India Ltd. MIC gas is used as an ingredient in pesticides.

It leaked from the factory and formed the deadly cloud over Bhopal. People living in slums in the vicinity of the factory were the most affected and more than 5000 people were killed, half of them due to direct exposure and other half due to after affects. MIC is a colourless gas which causes severe irritation, violent coughing, swelling of the lungs, bleeding and death due to direct inhalation. It also caused loss of eye-sight in more than 1000 people. More than 50,000 people were affected with respiratory, eye, gastric, neurological and gynaecological problems (Figs. 18.8 and 18.9).

Another technological disaster is due to the potential damages of nuclear fallout. An example is the Chernobyl Nuclear Disaster.

Chernobyl Nuclear Disaster:

This nuclear disaster occurred at the Chernobyl Nuclear Power Plant, which was one of the largest power plants in the Ukrainian Republic of erstwhile USSR, on April 26, 1986. It is the worst nuclear disaster recorded in a nuclear power plant. This nuclear power plant had four reactors of 1000 megawatt each for electricity generation. A sudden power surge resulted in two explosions, which destroyed the reactor core and blasted a large hole in the roof of the reactor building.

The Radioactive debris moved up through that hole to heights of 1 km. Approximately 100 to 150 million curies of radiation (radioactive isotopes of iodine and caesium) escaped into the atmosphere. To reduce emissions, the rescue team bombarded the reactor with 5,000 metric tonnes of shielding material consisting of lead, boron, sand and clay. Soviet officials placed the toll of human lives to 31.

However, according to western estimates, 2000 people were killed. Large areas of the Ukrainian, Byelorussia Republics of the USSR and even parts of Poland, Denmark and Sweden were contaminated. Around 200,000 people had to be evacuated and resettled. The after affects lasted for many years and a rise in the incidence of thyroid and blood cancer has been observed in a wide group of people. Other affects on the human health included skin diseases, hair loss, nausea, anemia, respiratory and reproductive diseases.

c) Differentiate between structural and non-structural mitigation. 10

Mitigation refers to a concrete set of actions that are put into practice in order to decimate the risks of destruction. There are two types of mitigation namely structural and non-structural.

Lindell, Prater and Perry (2006) assert that structural motivation denotes all the physical constructions that are made to eradicate the effects of environmental hazards such as floods, tsunamis and earthquakes.

Additionally, structured mitigations employ engineering measures to build up infrastructure for controlling hazards. Contrastingly, non structural mitigation comprises of policies, knowledge development and awareness used to control hazards (Lindell, Prater & Perry, 2006).

Notably, both structural and non-structural mitigations have distinct effectiveness. In this case, there are outstanding features that distinguish one from the other.

From a careful review of literature, studies have shown that the other difference in these two types of mitigation is cost-effectiveness. Notably, non-structural mitigation is quite cost effective

since it employs measures, policies and procedures that aim at preventing disasters. This can be done through public awareness.

Contrastingly, structural mitigation is very demanding in terms of labor and capital since it entails establishing infrastructural facilities. In line with this, Lindell, Prater and Perry(2006) point out that structural mitigation requires expertise that are competent in designing buildings, canals, roads and renovating old structures.

In connection to this, Lindell, Prater and Perry (2006) analyze that people with poor skills cannot ensure good management and maintenance of structures.

In the case of non-structural mitigation, people with little expertise can participate in planning and preventing disasters from occurring in risky sites through awareness campaign or other effective means.

One of the notable differences between the two types of mitigation is that structural mitigation one is more technical. This implies that it is quite physical since it involves construction of infrastructures that control hazards.

On the other hand, non-structural mitigation is relatively abstract since it deals with development and prevention policies. Therefore, one can argue that this type is theoretical and not practical at all. Lindell, Prater and Perry (2006) observe that structural mitigation is more effective since it provides common alternatives for disasters.

This is due to the fact that it is practical and hence easily reduces the effects of disasters than non-structural mitigation.

Empirical studies have shown that structural mitigation requires expertise with high skills such as civil engineers. This enables them to execute their competent skills in designing buildings, canals, roads and dams.

Moreover, they establish new infrastructures while renovating the old ones. Notably, non-structural mitigation does not require competent skills and hence can lead to poor maintenance that eventually leads to indirect damage.

In this case, structural mitigation has an added advantage since it is more effective than the latter. In connection to this, Lindell, Prater and Perry (2006) analyze that non-structural mitigation often consumes lesser time to implement policies, plans and preventive measures than it is the case with structural mitigation.

Notably, the latter has complex undertakings which include designing and construction which usually takes much time.

In the case of non-structural mitigation, it only entails disseminating information, plans and policies to restrict public from risky sites such as mines, flooded rivers and landslide prone

zones. This type takes minimum time especially through the use of press in fostering public awareness.

4) Answer any four of the following in about 150 words each:
a) What are the various types of vulnerability? 5

A set of prevailing conditions which adversely affect the community's ability to prevent, mitigate, prepare for or respond to a hazard. Absence of coping strategies is also a part of vulnerability and has to be considered in vulnerability assessment e.g. living in hazard prone locations like near to a sea or river, above the fault lines, at the base of a mountain etc.

Physical Vulnerability

The physical vulnerability of an area also depends on its geographic proximity to the source and origin of the disasters e.g. if an area lies near the coast lines, fault lines, unstable hills etc. it makes the area more vulnerable to disasters as compared to an area that is far away from the origin of the disaster. Physical vulnerability includes the difficulty in access to water resources, means of communications, hospitals, police stations, fire brigades, roads, bridges and exits of a building or/an area, in case of disasters. Furthermore, the lack of proper planning and implementation in construction of residential and commercial buildingsresults in buildings that are weaker and vulnerable in earthquakes, floods, landslides and other hazards.

Economic Vulnerability

Economic vulnerability of a community can be assessed by determining how varied its sources of income are, the ease of access and control over means of production (e.g. farmland, livestock, irrigation, capital etc.), adequacy of economic fall back mechanisms and the availability of natural resources in the area.

Social Vulnerability

A socially vulnerable community has weak family structures, lack of leadership for decision making and conflict resolution, unequal participation in decision making, weak or no community organizations, and the one in which people are discriminated on racial, ethnic, linguistic or religious basis. Other social factors such as culture, tradition, religion,local norms and values, economic standard, and political accountability also play a vital role determining the social vulnerability of a community

Social vulnerability to natural phenomena is greatest among the poorest people in developing countries owing to a lack of information and resources with which to take the appropriate measures. Within this group, children, women and the elderly are considered to be the most vulnerable. To reduce social vulnerability, all of the above factors must be addressed but this

requires knowledge and understanding of the local conditions, which can – in most cases – only be provided by local actors.

Attitudinal Vulnerability

A community which has negative attitude towards change and lacks initiative in life resultantly become more and more dependent on external support. They cannot act independently. Their sources of livelihood do not have variety, lacks entrepreneurship and do not possess the concept of collectivism. This brings about disunity and individualism in the society. Thus, they become victims of conflicts, hopelessness and pessimism which reduces their capacity of coping with a disaster.

b) Why are women considered to be more vulnerable to disasters? 5

Disasters tend to discriminate along generational and gender lines, as well. Several studies analyzing the impact of disasters have revealed that women and children have greater risks to their survival and recovery in the aftermath of natural disasters. The vulnerability of women and children to natural disasters can be further aggravated by other elements of discrimination such as race, poverty, and disability.

During the 2017 Hurricane Harvey in the U.S., many women—especially women of color—decided to not evacuate risk areas despite all the warnings. Why? All over the world, women and girls are overwhelmingly tasked, personally and professionally, with caring for children, the elderly, and people with disabilities. So, simple life-saving decisions, like discerning whether to evacuate a disaster area, can become a difficult choice.

Poverty and gender norms shape basic survival capabilities as well. For example, according to an Oxfam survey, four times as many women than men were killed in Indonesia, Sri Lanka, and India during the 2004 tsunami, because men were taught how to swim and climb trees at young ages, while women were not.

However, disasters can also shake social norms and power relations, and can offer opportunities for progress.

Governments across the world are increasingly recognizing the importance of engaging all members of communities in disaster risk reduction at national and local levels. The World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR), through the Africa Hydromet Program, are supporting several countries in Africa to prepare for droughts and floods. The Africa Hydromet Program mandates the inclusion of women in technical fields like meteorology and hydrology as well as decision-making. The program also builds the capacity of government officials to understand the gender dimension in disaster risk reduction.

In Togo, the program will enhance national hydro-meteorological and civil protection services. It will also expand the Togolese Red Cross' efforts to empower women's groups or clubs des mères(mothers' clubs) in increasing community resilience. According the Red Cross, including women in preparing contingency and emergency plans at grassroots levels has not only saved many lives, but has also contributed to elevating the status of women as agents of change in

their communities.

Post-emergency settings tend to be male-dominated; most jobs in construction and utility rehabilitation are mainly occupied by men, so women are often excluded from the decision-making process. As UN Volunteers reported in the case of the 2016 Ecuador earthquake, including women in debris removal and other productive, non-traditional activities and reconstruction jobs has contributed to changing gender stereotypes.

c) How does GIS help in preventing epidemics? 5

Geographic information systems (GISs) and geographic information science (GIScience) combine computer-mapping capabilities with additional database management and data analysis tools. Commercial GIS systems are very powerful and have touched many applications and industries, including environmental science, urban planning, agricultural applications, and others.

Public health is another focus area that has made increasing use of GIS techniques. A strict definition of public health is difficult to pin down, as it is used in different ways by different groups. In general, public health differs from personal health in that it is (1) focused on the health of populations rather than of individuals, (2) focused more on prevention than on treatment, and (3) operates in a mainly governmental (rather than private) context.[1] These efforts fall naturally within the domain of problems requiring use of spatial analysis as part of the solution, and GIS and other spatial analysis tools are therefore recognized as providing potentially transformational capabilities for public health efforts.

This article presents some history of use of geographic information and geographic information systems in public health application areas, provides some examples showing the utilization of GIS techniques in solving specific public health problems, and finally addresses several potential issues arising from increased use of these GIS techniques in the public health arena.

Today's public health problems are much larger in scope than those Dr. Snow faced, and researchers today depend on modern GIS and other computer mapping applications to assist in their analyses. For example, see the map to the right depicting death rates from heart disease among white males above age 35 in the US between 2000 and 2004.[4]

Public health informatics (PHI) is an emerging specialty which focuses on the application of information science and technology to public health practice and research. As part of that effort, a GIS – or more generally a spatial decision support system (SDSS) – offers improved geographic visualization techniques, leading to faster, better, and more robust understanding and decision-making capabilities in the public health arena.

For example, GIS displays have been used to show a clear relationship between clusters of emergent Hepatitis C cases and those of known intravenous drug users in Connecticut. Causality is difficult to prove conclusively – collocation does not establish causation – but confirmation of previously established causal relationships (like intravenous drug use and Hepatitis C) can strengthen acceptance of those relationships, as well as help to demonstrate the utility and reliability of GIS-related solution techniques. Conversely, showing the coincidence of potential

causal factors with the ultimate effect can help suggest a potential causal relationship, thereby driving further investigation and analysis (source needed?).

Alternately, GIS techniques have been used to show a lack of correlation between causes and effects or between different effects. For example, the distributions of both birth defects and infant mortality in Iowa were studied, and the researchers found no relationship in those data. This led to the conclusion that birth defects and infant mortality are likely unrelated, and are likely due to different causes and risk factors.

GIS can support public health in different ways as well. First and foremost, GIS displays can help inform proper understanding and drive better decisions. For example, elimination of health disparities is one of two primary goals of Healthy People 2010, one of the preeminent public health programs in existence today in the US. GIS can play a significant role in that effort, helping public health practitioners identify areas of disparities or inequities, and ideally helping them identify and develop solutions to address those shortcomings. GIS can also help researchers integrate disparate data from a wide variety of sources, and can even be used to enforce quality control measures on those data. Much public health data is still manually generated, and is therefore subject to human-generated mistakes and miscoding. For example, geographic analysis of health care data from North Carolina showed that just over 40% of the records contained errors of some sort in the geographic information (city, county, or zip code), errors that would have gone undetected without the visual displays provided by GIS. Correction of these errors led not only to more correct GIS displays, but also improved ALL analyses using those data.

d) What is the difference between a forecast and warning? 5

A prediction of an earthquake needs to state exactly where and when the event will happen, with enough specifics to be useful for response planning purposes. For example, the statement "there will be an earthquake tomorrow at 7:45 AM" is almost certainly going to be correct somewhere in the world, but it has no value as a prediction. Similarly, saying that there will eventually be a large earthquake on a very active fault is useless; while it is true, almost nothing can be done with this information. Without a specific date or location, a statement cannot be a prediction.

Currently, no one can predict where or when big earthquakes will occur to meet these criteria. However, seismologists have gotten much better at forecasting earthquakes. On a sunny Monday afternoon, meteorologists may forecast a wet weekend ahead, and can add an estimate of how certain they are that their forecast will be accurate; i.e. “we forecast a 60% chance of rain on Saturday.” That can also be expressed as “there is a 40% chance that it will not rain on Saturday.” Earthquake forecasting is very similar, and comes in different flavors that inform how to build appropriately in a given area. The USGS National Seismic Hazard Maps provide us with information on how strongly the ground is likely to shake in any given area within a 50 year period.

The probability of a specific fault producing an earthquake of a certain size can also be calculated, but these estimates are much rougher; in many cases, we only know about a few (or maybe only one) earthquakes that occurred there in the past. Inevitably, some guesswork goes

into estimating how likely it is that another earthquake will occur in the next 50 years. In a region such as the Puget Sound area, we can collect additional information to help keep forecasts reasonable. By using GPS instrumentation to track how much strain accumulates as the Puget Sound region is squeezed up against British Columbia, it's possible to calculate a strain or deformation "budget". The regional strain accumulation can only justify so many earthquakes over a 10,000 year period, and tracking it can help to avoid forecasting unrealistically high or low numbers of earthquakes on faults in the region.

5) Write short notes on any five of the following in about 100 words each:

a) Disaster crunch model 4

Globally disasters are occurring more often and in larger scale. Many policies and measures have been developed to analyse their causes and consequences, in order to strengthen the resilience of individuals, communities and institutions. Such measures and policies often disregard that the effects of disasters are likely to be different for women, men, girls and boys. Women's and men's (of whatever age) different roles, responsibilities, and access to resources influence how each will be affected by different hazards, and how they will cope with and recover from disaster. Inequality between women and men means that, despite the incredible resilience and capacity for survival that women often exhibit in the face of disaster, they also experience gender-specific vulnerabilities. The odisaster pressure and release model also known as the disaster ocrunch model , helps practitioners to understand and react to people's vulnerability to disasters. The current Guidelines introduce new elements into the 'crunch model' so that it is able to take into consideration how women and men experience different levels and types of vulnerability to disasters. This booklet is intended for practitioners and researchers engaged in disaster risk reduction (DRR) work in the context of a changing climate.

b) Hazard assessment 4

A hazard assessment is a thorough check of the work environment. The purpose of a hazard assessment is to identify potential risks and hazards in the area, as well as to identify appropriate safety measures to be used to mitigate the identified hazards.

A hazard assessment can be a checklist, or simply an investigation of the working area. Hazard assessments should be done daily, even if the work area is the same. The purpose of completing hazard assessments daily is to avoid becoming complacent, or simply not noticing the environment around you. Hazard assessments allow the workers to assess the work area each day, and determine which safety measures to put in place according to the current risk. Daily assessments allow workers to view safety measures as situational, and change the measures as the environment and hazards change. They are also known as field level hazard assessments (FLHA), or, simply, risk assessments.

d) Incident command system 4

The **Incident Command System** (**ICS**) is a standardized approach to the command, control, and coordination of emergency responseproviding a common hierarchy within which responders from multiple agencies can be effective.

ICS was initially developed to address problems of inter-agency responses to wildfires in California and Arizona but is now a component of the **National Incident Management System** (**NIMS**) in the US, where it has evolved into use in All-Hazards situations, ranging from active shootings to HazMat scenes. In addition, ICS has acted as a pattern for similar approaches internationally.

ICS consists of a standard management hierarchy and procedures for managing temporary incident(s) of any size. ICS procedures should be pre-established and sanctioned by participating authorities, and personnel should be well-trained prior to an incident.

ICS includes procedures to select and form temporary management hierarchies to control funds, personnel, facilities, equipment, and communications. Personnel are assigned according to established standards and procedures previously sanctioned by participating authorities. ICS is a system designed to be used or applied from the time an incident occurs until the requirement for management and operations no longer exist.

ICS is interdisciplinary and organizationally flexible to meet the following management challenges:

- Meets the needs of a jurisdiction to cope with incidents of any kind or complexity (i.e. it expands or contracts as needed).
- Allows personnel from a wide variety of agencies to meld rapidly into a common management structure with common terminology.
- Provide logistical and administrative support to operational staff.
- Be cost effective by avoiding duplication of efforts, and continuing overhead.
- Provide a unified, centrally authorized emergency organization.

e) Disaster recovery plan 4

A disaster recovery plan (DRP) is a documented, structured approach with instructions for responding to unplanned incidents.

This step-by-step plan consists of the precautions to minimize the effects of a disaster so the organization can continue to operate or quickly resume mission-critical functions. Typically, disaster recovery planning involves an analysis of business processes and continuity needs.

Before generating a detailed plan, an organization often performs a business impact analysis (BIA) and risk analysis (RA), and it establishes the recovery time objective (RTO) and recovery point objective (RPO).

Recovery strategies

A disaster recovery strategy should start at the business level and determine which applications are most important to running the organization. The RTO describes the target amount of time a business application can be down, typically measured in hours, minutes or seconds. The RPO describes the previous point in time when an application must be recovered.

Recovery strategies define an organization's plans for responding to an incident, while disaster recovery plans describe how the organization should respond.

In determining a recovery strategy, organizations should consider such issues as:

- Budget
- Resources -- people and physical facilities
- Management's position on risks
- Technology
- Data
- Suppliers

Management approval of recovery strategies is important. All strategies should align with the organization's goals. Once disaster recovery strategies have been developed and approved, they can be translated into disaster recovery plans.

Disaster recovery planning steps

The disaster recovery plan process involves more than simply writing the document.

In advance of the writing, a risk analysis and business impact analysis help determine where to focus resources in the disaster recovery planning process. The BIA identifies the impacts of disruptive events and is the starting point for identifying risk within the context of disaster recovery. It also generates the RTO and RPO. The RA identifies threats and vulnerabilitiesthat could disrupt the operation of systems and processes highlighted in the BIA. The RA assesses the likelihood of a disruptive event and outlines its potential severity.

A DR plan checklist includes the following steps, according to independent consultant and IT auditor Paul Kirvan:

- Establishing the scope of the activity;
- Gathering relevant network infrastructure documents;
- Identifying the most serious threats and vulnerabilities, and the most critical assets;
- Reviewing the history of unplanned incidents and outages, and how they were handled;
- Identifying the current DR strategies;
- Identifying the emergency response team;
- Having management review and approve the disaster recovery plan;
- Testing the plan;
- Updating the plan; and
- Implementing a DR plan audit.

Disaster recovery plans are living documents. Involving employees -- from management to entry-level -- helps to increase the value of the plan.

f) Disastermanagement cycle 4

A disaster is any occurrence that causes damage to life, property or environment. The disaster can be either a natural or a manmade disaster.

Natural Disasters: includes floods, tsunami, cyclone, earthquake, volcanic eruptions, landslides, asteroids, global warming, ozone depletion, etc.. **Man-Made Disasters:** includes transport failure, fire, chemical spills, radioactive spills, war, terrorism, civil unrest, etc..

According to Red Cross & Red Crescent Societies

Disaster Management can be defined as the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular, preparedness, response, and recovery in order to lessen the impact of disasters.

Disaster Management Cycle/Phases: majorly involves four broad phases to handle to emergencies. Every time any disaster happens, all the 4 stages repeat itself. Thus, this ongoing process can reduce the efforts & disaster with better planning & execution.

The Four Phases of Emergency Management

Prevention

Preventing future emergencies or minimizing their effects

: Includes any activities that prevent an emergency, reduce the chance of an emergency happening, or reduce the damaging effects of unavoidable emergencies.

: Buying flood and fire insurance for your home is a mitigation activity.

: Mitigation activities take place **before** and **after** emergencies.

Public Education, Awareness, Hazard and vulnerability, assessment, improved infrastructure

Preparedness

Preparing to handle an emergency

: Includes plans or preparations made to save lives and to help response and rescue operations.

: Evacuation plans and stocking food and water are both examples of preparedness.

: Preparedness activities take place **before** an emergency occurs.

National emergency, telecommunications, response plans, training and exercises, early warning, standard operating and procedures.

Response

Responding safely to an emergency

: Includes actions taken to save lives and prevent further property damage in an emergency situation. The response is putting your preparedness plans into action.

: Seeking shelter from a tornado or turning off gas valves in an earthquake are both response activities.

: Response activities take place **during** an emergency.

Communication, coordination with locals, saving lives, minimizing losses

Recovery

Recovering from an emergency

: Includes actions taken to return to a normal or an even safer situation following an emergency.

: Recovery includes getting financial assistance to help pay for the repairs.

: Recovery activities take place **after** an emergency.

Restoring, telecommunications, infrastructure, improving lives, recovery, and rehabilitation of services, etc.

Along with government organizations, non- government organizations also play a vital role in disaster management. Most **NGOs** like Oxfam India are getting involved to help the government in making strategies and to implement right at the grassroots level during each phase.