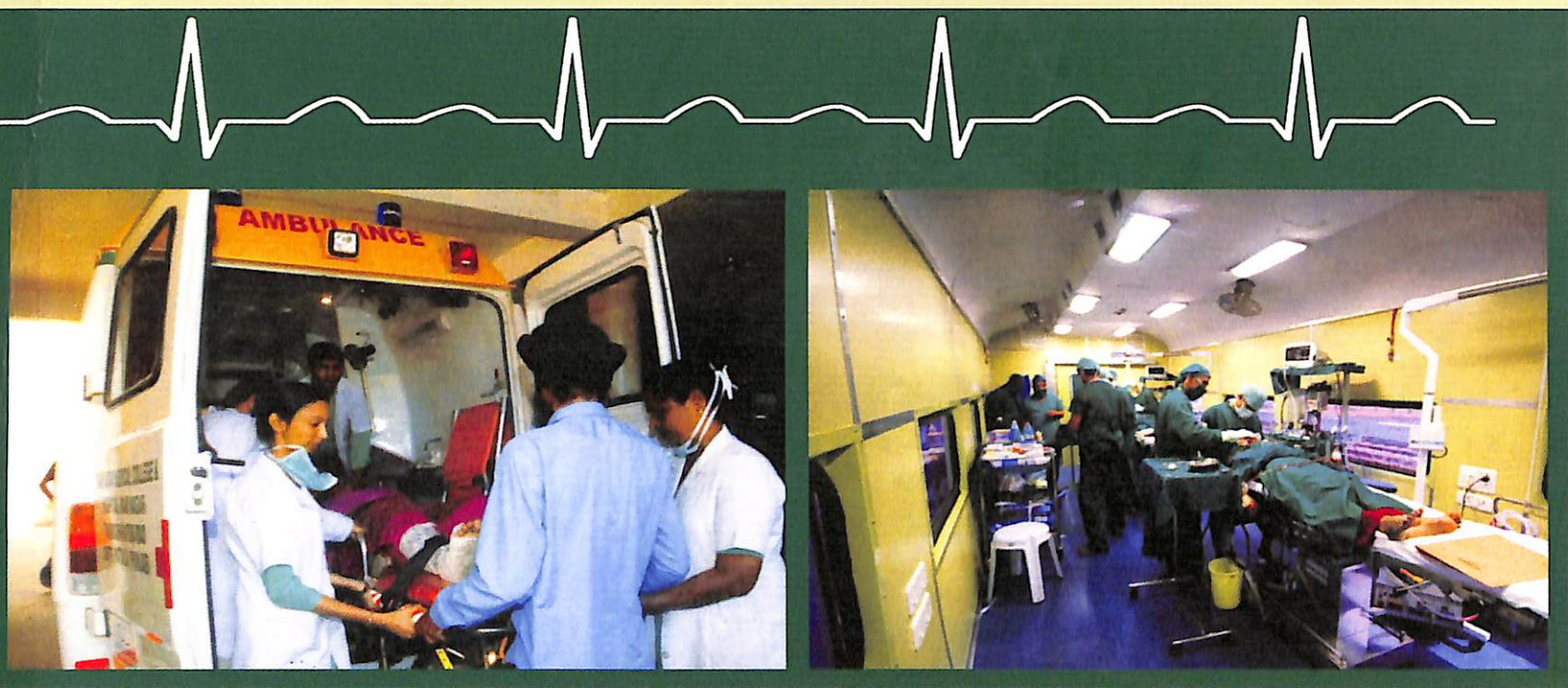




NATIONAL DISASTER MANAGEMENT GUIDELINES

MEDICAL PREPAREDNESS AND MASS CASUALTY MANAGEMENT



October 2007



NATIONAL DISASTER MANAGEMENT AUTHORITY
GOVERNMENT OF INDIA

National Disaster Management Guidelines

Medical Preparedness and Mass Casualty Management



National Disaster Management Authority
Government of India



Contents

<i>Contents</i>		v
<i>Foreword</i>		ix
<i>Acknowledgements</i>		xi
<i>Abbreviations</i>		xii
<i>Executive Summary</i>		xvii
1.	Introduction	1
1.1	Mass Casualty Events	2
1.2	Aims and Objectives	3
2.	Present Status and Context	5
2.1	Major Stakeholders in Medical Preparedness and Mass Casualty Management (MPMCM)	5
2.2	International Initiatives	15
2.3	Initiatives for Specialised Facilities for Medical Preparedness and Mass Casualty Management	19
2.4	Recent National Developments	20
2.5	Genesis of the National Disaster Management Guidelines—Medical Preparedness and Mass Casualty Management	21
2.6	Approaches to Mass Casualty Management	22
3.	Salient Gaps	24
3.1	Preventive Measures	24
3.2	Preparedness for Emergency Medical Response	24
3.3	Hospital Disaster Preparedness	27
3.4	Post-Disaster Phase	29
3.5	Finance	31
3.6	Disaster Management Plans	31
4.	Guidelines for Mass Casualty Management—Preparedness	32
4.1	Legislative and Regulatory Framework	32
4.2	Preventive Measures	32
4.3	Preparedness	33
4.4	Capacity Development	37
4.5	Community Preparedness	39

CONTENTS

4.6	Hospital Preparedness	40
4.7	Specialised Health Care and Laboratory Facilities	41
4.8	Role of Alternative Systems of Medicine	44
4.9	Preservation and Identification of the Dead	44
4.10	Psychosocial Support and Mental Health Services	46
4.11	Research and Development	47
5	Guidelines for Response, Rehabilitation and Recovery	49
5.1	Response	49
5.2	Public-Private Partnership	55
5.3	Rehabilitation and Recovery	56
5.4	Post-Disaster Documentation	56
5.5	Media Management	57
5.6	Important Medical Management Aspects of the District Disaster Management Plan	57
6	Medical Preparedness for Chemical, Biological, Radiological and Nuclear (CBRN) Management	61
6.1	Prevention of CBRN Emergencies	61
6.2	Education	63
6.3	Training	63
6.4	Community Awareness	64
6.5	Research and Development	64
6.6	CBRN Casualty Management at the Incident Site	65
6.7	Hospital Disaster Management Plan	66
6.8	Critical Infrastructural Development	69
6.9	Psychosocial Support and Mental Health Services	69
6.10	Medical Response to CBRN Disasters	70
6.11	Prevention and Control of Panic Reaction	71
7	Approach to Implementation of the Guidelines	72
7.1	Implementation of the Guidelines	73
7.2	Financial Resources for Implementation	75
7.3	Implementation Model	76

	Annexures	80
Annexure-A	Damage Caused by Mass Casualty Events due to Natural Disasters in India	80
Annexure-B	Complex Socio-Economic Environmental Problems in Mass Casualty Events and Public Health Emergencies with Mass Casualty Potential	81
Annexure-C	Important Health Legislation	83
Annexure-D	Distribution of Health Care Facilities in India	86
Annexure-E	National Health Programmes	89
Annexure-F	List of DNA Fingerprinting Laboratories	93
Annexure-G	Epidemiological Surveys, Surveillance Programmes and Prevention of Epidemics	95
Annexure-H	Important Features for Mobile Hospitals	103
Annexure-I	Important Considerations for Developing the Hospital Disaster Management Plan	104
Annexure-J	List of Important National Referral Laboratories	114
Annexure-K	Important Components of the Epidemic Outbreak Investigation Kit	116
Annexure-L	Sample Collection for DNA Analysis	120
Annexure-M	CBRN Management Equipment for QRMTs/MFRs	124
Annexure-N	Major Components of CBRN Management	126
Annexure-O	Cold Chain System for Storage and Transportation of Blood and Blood Component	129
Annexure-P	Important Websites	135
	Core Group for Medical Preparedness and Mass Casualty Management	136
	Contact Us	144



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FOREWORD

Disasters, both natural and man-made, generally result in heavy loss of life; sometimes even leading to mass casualties. The Guidelines for Medical Preparedness and Mass Casualty Management have, thus, been one of the primary areas of our focus.

Medical preparedness needs to encompass all the issues related to health and related effects as a consequence of disasters and their aftermath. In addition to the immediate trauma and suffering, these may also result in a long-term deleterious impact on the affected community. Consequently, preparedness is also required to focus on various issues like mental health and psychosocial support, identification of vulnerable groups and creation of community awareness to meet the challenges posed by various disaster situations. The experiences gained during interaction while visiting different states and conducting mock exercises, have led to identification of a large number of aspects warranting improvement, in terms of infrastructure, trained medical officers, specialists, nurses and paramedics at the Primary Health Centres (PHCs) and districts hospitals. There is a pressing need for addressing important facets of medical preparedness urgently, so that measures required for proper management of casualties are well established across the country.

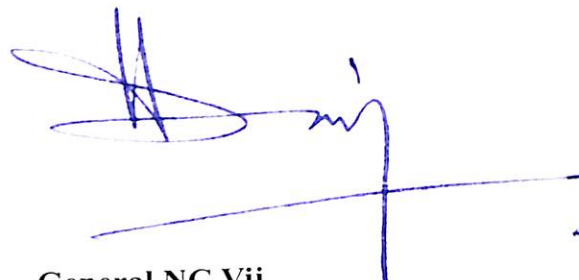
The formulation of these guidelines has involved the active participation and contribution of over 230 experts from various stakeholder groups like Ministry of Health and Family Welfare (MoH&FW); Armed Forces Medical Services (AFMS); Department of Health, Ministry of Railways (MoR) and other line ministries. Representatives from various professional and academic institutions, laboratories, medical experts from various deemed universities and corporate hospitals, Director General Health Services (DGHS) of states and chief medical officers of districts have also made valuable contributions.

These guidelines have documented important preparatory measures which, though already existing, require definite upgradation both qualitatively and quantitatively. Latest best practises and concepts in the medical and scientific fields have also been included, which may be adopted, based upon the area and need assessment analyses. These guidelines also provide important baseline information to various planners and implementers regarding different specialised facilities and methodologies required for effective management of Chemical, Biological, Radiological and Nuclear (CBRN) disasters.

Contd.

I express my deep appreciation of the commitment of all the medical professionals and others who have extended their wholehearted support and cooperation in the preparation of these guidelines. I would also like to commend the significant contribution made by MoH&FW, AFMS, DRDO, Department of Health, MoR, experts from various private medical hospitals and universities, and members of the core group, steering and extended groups in preparation of these guidelines.

Finally, I am pleased to place on record my deep appreciation for Lt Gen (Dr) J.R. Bhardwaj, PVSM, AVSM, VSM, PHS (Retd), Member, NDMA who has commendably steered the formulation of these guidelines.



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New Delhi
12 October 2007



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I would like to express my sincere thanks to the representatives of the other central ministries and departments concerned, regulatory agencies, Defence Research and Development Organisation, professionals from scientific and technical institutes, eminent medical professionals from leading national institutions like the All India Institute of Medical Sciences, Post Graduate Institute of Medical Education and Research, National Institute of Mental Health and Neurosciences, Institute of Human Behaviour and Allied Sciences, Centre for DNA Fingerprinting and Diagnostics, National Institute of Disaster Management and consortiums of the corporate sector for their valuable inputs that helped us in improving the content and presentation of this document.

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12 October 2007

Abbreviations

ACADA	Automatic Chemical Agent Detector and Alarm
ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
AFMS	Armed Forces Medical Services
AIDS	Acquired Immune Deficiency Syndrome
AIHPH	All India Institute of Health and Public Hygiene
AIIMS	All India Institute of Medical Sciences
ALS	Advanced Life-Support
ARME	Accident Relief Medical Equipment
ARMV	Accident Relief Medical Van
ASD	Acute Stress Disorder
ASHA	Accredited Social Health Activist
ATC	Apex Trauma Centre
AYUSH	Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy
BARC	Bhabha Atomic Research Centre
BIS	Bureau of Indian Standards
BLS	Basic Life-Support
BMW	Bio-Medical Waste
BMW (M&H)	Bio-Medical Waste (Management and Handling)
Bn	Battalion
BSNL	Bharat Sanchar Nigam Limited
BTLS	Basic Trauma Life-Support
CAM	Chemical Agent Monitor
CATS	Centralised Accident and Trauma Services
CBRN	Chemical, Biological, Radiological and Nuclear
CBSE	Central Board of Secondary Education
CDFD	Centre for DNA Fingerprinting and Diagnostics
CHC	Community Health Centre
CLW	Community Level Worker
CME	Continuing Medical Education
CMO	Chief Medical Officer
CPR	Cardio-Pulmonary Resuscitation
CSIR	Council of Scientific and Industrial Research
CSR	Corporate Social Responsibility
CTI	Central Training Institute
CW	Chemical Warfare
DAE	Department of Atomic Energy
DBT	Department of Biotechnology
DDMA	District Disaster Management Authority

DDMP	District Disaster Management Plan
DEBEL	Defence Bioengineering and Electro-chemical Laboratory
DF	Dengue Fever
DFID	Department For International Development
DG	Director General
DGAFMS	Director General Armed Forces Medical Services
DGHS	Director General Health Services
DHF	Dengue Hemorrhagic Fever
DM	Disaster Management
DMHP	District Mental Health Programme
DMSRDE	Defence Materials and Stores Research & Development Establishment
DNA	Deoxy-ribonucleic Acid
DOA	Dead On Arrival
DOTS	Directly Observed Treatment Short-Course
DRDE	Defence Research Development Establishment
DRDO	Defence Research and Development Organisation
DST	Department of Science and Technology
DTPA	Diethylene triamine penta-acetate
DVIC	Disaster Victim Identification Cell
EAG	Empowered Action Group
EMR	Emergency Medical Response
EMRI	Emergency Management and Research Institute
EMT	Emergency Medical Technician
EOC	Evacuation of Casualties
ERCP	Emergency Response Care Physician
ERC	Emergency Response Centre
ESF	Emergency Support Function
ESI	Employees' State Insurance
ESIC	Employees' State Insurance Corporation
EWS	Early Warning System
FAC	Family Assistance Centre
FDTRC	Food and Drug Toxicology Research Centre
FISH	Fluorescence <i>In-Situ</i> Hybridization
GFATM	Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria
GIS	Geographical Information System
GOARN	Global Outbreak Alert and Response Network
GoI	Government of India
GPS	Global Positioning System
HAZMAT	Hazardous Material
HEICS	Hospital Emergency Incident Command System
HIV	Human Immunodeficiency Virus
HOPE	Hospital Preparedness and Emergency Response
HSC	Hospital Surgical Capacity
HTC	Hospital Treatment Capacity

ABBREVIATIONS

IAN	Integrated Ambulance Network
IC	Incident Command
ICMR	Indian Council of Medical Research
ICS	Incident Command System
ICT	Information and Communication Technology
ICU	Intensive Care Unit
IDSP	Integrated Disease Surveillance Programme
IHBAS	Institute of Human Behaviour and Allied Sciences
IHR	International Health Regulations
IMS	Incident Management System
IND	Improvised Nuclear Device
INMAS	Institute of Nuclear Medicine and Allied Sciences
IRCS	Indian Red Cross Society
ISM&H	Indian Systems of Medicine and Homeopathy
ISRO	India Space Research Organisation
MAH	Major Accident Hazard
MCE	Mass Casualty Event
MCI	Medical Council of India
MCM	Mass Casualty Management
MFR	Medical First Responder
MoD	Ministry of Defence
MoH&FW	Ministry of Health And Family Welfare
MoL&E	Ministry of Labour and Employment
MoR	Ministry of Railways
MoU	Memorandum of Understanding
MPMCM	Medical Preparedness and Mass Casualty Management
MPO	Modified Plan of Operation
NACP	National AIDS Control Programme
NDMA	National Disaster Management Authority
NDMG—MPMCM	National Disaster Management Guidelines—Medical Preparedness and Mass Casualty Management
NDRF	National Disaster Response Force
NEC	National Executive Committee
NFCP	National Filaria Control Programme
NGO	Non-Governmental Organisation
NICD	National Institute of Communicable Diseases
NIDM	National Institute of Disaster Management
NIMHANS	National Institute of Mental Health and Neurosciences
NIOH	National Institute of Occupational Health
NMHP	National Mental Health Programme
NOIDA	New Okhla Industrial Development Authority
NPCIL	Nuclear Power Corporation of India Limited
NRHM	National Rural Health Mission
NVBDCP	National Vector Borne Disease Control Programme

OT	Operation Theatre
PDK	Personal Decontamination Kit
PEER	Programme for Enhancement of Emergency Response
PGIMER	Post Graduate Institute of Medical Education and Research
PHC	Primary Health Centre
PHFI	Public Health Foundation of India
POMKA	Portable Medical Kit for Accidents
PPE	Personal Protective Equipment
PPP	Public-Private Partnership
PRI	Panchayati Raj Institution
PRO	Public Relations Officer
PSS	Psychosocial Support
PSU	Public Sector Undertaking
PTSD	Post-Traumatic Stress Disorder
PVO	Private Voluntary Organisation
QRMT	Quick Reaction Medical Team
R&D	Research and Development
RDD	Radiological Dispersal Device
RCH	Reproductive and Child Health
RNTCP	Revised National Tuberculosis Control Programme
RoI	Return on Investment
RRT	Rapid Response Team
SARS	Severe Acute Respiratory Syndrome
SDMA	State Disaster Management Authority
SDRF	State Disaster Response Force
SOP	Standard Operating Procedure
SSG	Sodium Stibo Gluconate
TB	Tuberculosis
ULB	Urban Local Body
UN	United Nations
USAID	United States Agency for International Development
UT	Union Territory
VRC	Village Resource Centre
VSAT	Very Small Aperture Terminal
WB	World Bank
WHO	World Health Organization

Executive Summary

Background

India is highly vulnerable to both natural and man-made disasters. The last few decades have shown an increased frequency of disasters resulting in a large number of human casualties and huge economic losses. In the case of many such disasters, human and economic losses can be minimised to quite an extent even though they may not be totally preventable. In the aftermath of a major disaster/accident, a trail of misery is left behind in the form of injuries, death, and short- and long-term medical disorders among a large number of people. Psychological effects are also caused. Equally important are the 'peripheral emergencies' like road, rail and air accidents, fire, drowning and stampedes that have inherent potential to convert into a Mass Casualty Event (MCE). This is further compounded by the lack of adequate medical facilities both qualitatively and quantitatively all across the country. Hence, there is a concerted need for a quantum leap in the existing medical facilities and creation of newer modalities based on well-tested international practices.

Genesis of the National Disaster Management Guidelines—Medical Preparedness and Mass Casualty Management

There has been a paradigm shift in the government's focus from a rescue, relief and recovery-centric approach to a planning, prevention, mitigation and preparedness driven approach. It has been realised that morbidity, mortality and long-term health effects can be reduced and mitigated through prevention and preparedness measures.

With this renewed emphasis, the National Disaster Management Authority (NDMA) took up the task of strengthening medical preparedness in recognition of the gravity of the health risk posed by both natural and man-made disasters. The main stakeholders in the Medical Preparedness and Mass Casualty Management (MPMCM) are the Ministry of Health and Family Welfare (MoH&FW); Ministry of Labour and Employment (MoL&E) through Employees State Insurance Corporation (ESIC); Ministry of Defence (MoD); Ministry of Railways (MoR); state governments and Union Territories (UTs) and private health care providers. As a first step, a meeting of all the stakeholders was held during 22-23 August 2006 with a view to pool the knowledge in this multidisciplinary field. This included representatives from MoH&FW, Armed Forces Medical Services (AFMS), Department of Health and Family Welfare, MoR; Indian Council of Medical Research (ICMR), Defence Research and Development Organisation (DRDO) and National Institute of Communicable Diseases (NICD); professionals from scientific and technical institutes like All India Institute of Medical Sciences (AIIMS), Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, Centre for DNA Fingerprinting and Diagnostics (CDFD) and Institute of Human Behavior and Allied Sciences (IHBAS); and various academics, technocrats from leading national institutions of government, non-governmental and private sector. A core group of experts was constituted from amongst these participants. Several meetings of the core group were subsequently held and a draft document was evolved for bridging the gaps that were identified. These deliberations acknowledged several initiatives taken by the government and other stakeholders in health and related

sectors. The draft document was reviewed by the experts of the steering group on 22 June 2007, for evolving a consensus among various stakeholders including the nodal ministry. Detailed inputs from various stakeholders were obtained during a national conference held during 24-25 July 2007. The recommendations and action points that emerged out of these deliberations have resulted in the development of the National Disaster Management Guidelines—Medical Preparedness and Mass Casualty Management (NDMG—MPMCM), hereinafter referred to as the Guidelines.

Structure of the Guidelines

The present work is an important step towards development of plans for medical preparedness and management of mass casualties at all levels. The Guidelines have been prepared to provide directions to the central ministries, departments and state authorities for the preparation of their detailed 'medical preparedness' plans. These Guidelines call for a proactive, participatory, well-structured, fail-safe, multidisciplinary and multi-sectoral approach at various levels.

The Guidelines consist of seven chapters, the details of which are as follows:

Chapter 1 provides an introductory brief of risks, vulnerabilities and effects of various natural and man-made disasters including peripheral emergencies in terms of mortality and morbidity; short- and long-term health effects including the socio-economic problems faced by the community during, and in the aftermath of MCE. The need for creation of an institutional mechanism and system is stressed. This would result in enhancing capacities and capabilities of hospital and health care workers. The need for strengthening existing procedures that allow emergent activities to meet the challenge of surge capacity because of mass casualty events is elaborated. The chapter also discusses the

definition of mass casualty event and enumerates other potential disasters including Chemical, Biological, Radiological and Nuclear (CBRN) emergencies which may lead to MCE.

The aims and objectives of the Guidelines focus on all aspects of medical preparedness phases of the disaster cycle to assist the ministries and departments of the Government of India (GoI), state governments and other agencies to prepare 'all hazard' medical preparedness plans.

Chapter 2 reviews the existing health framework, preparedness of the MoH&FW, MoD, MoR and MoL&E in relation to their capacity for handling casualties caused by various disasters. MoH&FW is assigned with legislative capacity for a number of subjects including all matters relating to the medical, dental, nursing and pharmacy professions and education; mental health standards for drugs; prevention of food adulteration; and, prevention and control of epidemics. Its capacities and programmes have been discussed in detail. Medical preparedness of MoD, MoR and ESIC have also been elaborated. A brief outline of the arrangements with the state health departments is enumerated. A bird's eye view of the health care infrastructure of the private sector, Indian Red Cross Society (IRCS), certain Non-Governmental Organisations (NGOs) and various laboratories is also given. Among the various international initiatives, the role of the recently operationalised International Health Regulations (IHR) in limiting the spread of epidemics and other public health emergencies by the member states has been highlighted. In addition, various initiatives for development of specialised facilities for MPMCM have also been discussed.

Recent national developments highlight the enactment of the Disaster Management Act, 2005 for establishment of an institutionalised mechanism for effective management of all disasters. The powers and functions of the

NDMA are also discussed. An approach to Mass Casualty Management (MCM) and the major pillars that need to be strengthened have been elaborated.

Chapter 3 gives an overview of salient gaps in various aspects of medical preparedness that need to be bridged for the effective management of MCE.

Medical preparedness aims at preventive and mitigation measures. Preventive measures include upgrading public health laboratories and establishing an Integrated Disease Surveillance Programme (IDSP). Preparedness for Emergency Medical Response (EMR) for the management of mass casualties at the incident site and, their quick and safe evacuation by ambulance services is an important step in this direction. Inadequacy and lack of appropriate capabilities and capacities in existing medical arrangements have been indicated. The need for hospital disaster preparedness plans along with the non-availability of medical logistics in critical care have been highlighted. The cold chain system in blood transfusion services needs to be established all across the country. The requirement of specialised facilities for CBRN management has also been deliberated. Experiences from recent disasters in the country have stressed the need for providing psychosocial and mental health services through the national mental health policy and programmes. The availability of adequate funding, participation of all stakeholders including the private and corporate sector and development of medical preparedness plans for hospitals, needs to be ensured at all levels.

Chapter 4 includes comprehensive guidelines for a legislative and regulatory framework, preventive measures, preparedness, capacity development, hospital preparedness, specialised health care and laboratory facilities, role of alternative systems of medicine, preservation and identification of the dead, psychosocial care and mental health services and, Research

and Development (R&D) for MPMCM. The roles and responsibilities of various stakeholders at the centre, state and district levels are also described. The salient highlights include:

- Preventive measures like strengthening of epidemic control programmes, immunisation, HIV control etc., development of minimum standards of food and water; IDSP and its integration at all levels converged to develop an effective Early Warning System (EWS) operable at all levels.
- The Medical First Responders (MFRs) of mobile medical teams will be fully trained in triage and resuscitation; well-equipped and supported by all emergency services and material logistics; informed continuously about the dynamics of the disaster, based on indicators; and have communication backups at the Incident Command (IC) site to handle all kinds of mass casualty events within the golden hour.
- Emergency medical evacuation requires development of an Integrated Ambulance Network (IAN) including road, aerial and water ambulance networks integrated with self-propelled Accident Relief Medical Vans (ARMVs) of the railways at various levels. It will work in conjunction with Emergency Response Centres (ERCs), ESIC medical services and related emergency functionaries with laid down Standard Operating Procedures (SOPs) for all stakeholders in the evacuation plan of the district, based on the Public-Private Partnership (PPP) model.
- Full-fledged containerised mobile hospitals will be acquired and attached with hospitals earmarked by states/districts. The scale of authorisation of such hospitals will be decided by the central and state governments. These hospitals will also be used for training of medical teams during the pre-disaster phase.

- Disaster-resilient communication network systems will be established all across the country. The development of intra-hospital horizontal network with emergency functionaries of the Incident Command System (ICS), nearby district medical services, IAN and vertical network from district to state/national level will be established. The usage of specialised communication networks, broadband connectivity of Bharat Sanchar Nigam Ltd (BSNL) at taluka level, tele-medicine and inputs of Geographical Imaging System (GIS) data will be encouraged.
- Capacity development will include training of all stakeholders including doctors, nurses, paramedics and other resource persons in triage and Basic Life Support (BLS), and development of specialists.
- State/district authorities will ensure the development of basic infrastructure and other supporting facilities commensurate with human resources available.
- ICS will be adopted and rehearsed for coordination at district and state level using mock drills.
- Education in Disaster Management (DM) related topics will be imparted using modes of symposia, exhibition, demonstration, medical preparedness weeks and workshops in all national and vernacular languages. Disaster related education already incorporated by the Central Board of Secondary Education (CBSE), will be replicated by other national and state-level boards. The disaster plan will be rehearsed as a part of training every six months using mock drills.
- Community preparedness starts with identification of different community groups, detailing their roles like documentation of local data, provision of sanitation facilities, first aid, BLS, social support and psychosocial care, and community awareness for controlling the spread of epidemics etc., as identified in DM plans.
- Hospital preparedness should aim at planning the use of hospital resources in a well coordinated and simple way with defined roles for all medical personnel. Such activities will be drafted in the hospital DM plan which will be a part of the district DM plan. The plan will be rehearsed twice a year using mock drills.
- Establishment of apex (100-bed) and zonal (25-bed) trauma centres at state level and 10 designated trauma beds in the regional/district hospitals. These centres should have all the requisite infrastructure such as trained manpower and logistic equipment. Ambulances for trauma care supported by trained manpower and equipment will be placed every 50 km and a trauma centre every 100 km under a national highway trauma care project.
- Establishment of 30-bed dedicated burn centres at all medical colleges and tertiary care hospitals with 200 and above beds. It should be made mandatory to develop 30-bed burn centres in every district with more than 10 Major Accident Hazard (MAH) units.
- Blood bank facilities all across the country will be networked and encouraged to use concepts like the cold chain system, blood component separation, multi-stock storages, online information dissemination rare blood group availability, plan to manage surge in demand during disasters and quick modes of transportation.
- Networking of laboratory facilities will be initiated by mapping risk,

databases, quality certification, role assessment, upgrading and creating new laboratories in previously unattended areas. The network will have referral laboratories as the apex point of the vertical network. As part of the horizontal network, a focal laboratory at the district level will be identified. These laboratories will be indented to perform various activities like investigation and monitoring of epidemic outbreaks, public health issues, environmental monitoring and identification of the dead by Deoxy Ribonucleic Acid (DNA) fingerprinting.

- Psychosocial support and mental health services has three aims—its inclusion as an integral component in DM planning, training of specialised health care providers and the creation of a mechanism to encourage best community practices by involving Community Level Workers (CLWs).
- R&D will focus on adoption of newer technologies that have been proved, testing of different models, table top exercises at each level for quick decision making and response, and technology upgradation for effective medical management based on global best practices.

Chapter 5 deals with guidelines related to response, rehabilitation and recovery, PPR post-disaster documentation, media management and important medical management aspects which need to be integrated into the district DM plans. The major guidelines include:

- Development of an EWS and indicators for the progress of disaster and SOPs for emergency response functions.
- Development of incident command site to provide pre-hospital care and triage.

- Safe evacuation of casualties and the creation of specialised forces and their various roles will be defined.
- Provisions for necessary hospital care as per the hospital DM plan including the role of the Public Relations Officer (PRO) to manage media effectively in order to prevent the dissemination of wrong messages to the public that may cause panic and fear.
- Minimum standards for food, water, shelter, environmental sanitation and personal hygiene to be laid down. Proper disposal of human waste and vector control measures will be developed.
- The mechanism for involvement of the community at the local-level response and the provisions for providing special care to vulnerable groups including psychosocial and mental health response will be worked out.
- Mock drills will be based on the simulation of worst scenario in the identified vulnerable areas to check the preparedness level of the MFRs.
- State health departments will make adequate provisions for medical relief to the affected people. In addition, necessary rehabilitation options will be identified, based upon the post-disaster analysis.
- Certain research projects will be undertaken on the basis of the lessons learnt to re-engineer future management processes.
- The mechanism to incorporate the private sector in the overall medical preparedness and mass casualty management practices including necessary strategies for funding will be worked out.
- Media plan will be developed in coordination with different district, state

and national authorities. Standardisation of press releases for disaster developments and providing information about the victims will be worked out.

- Important medical management aspects including disaster specific medical manuals to harmonise the micro-level emergency functioning at the district level will be identified and necessary mitigation activities will be taken up.

Chapter 6 comprises specific guidelines for medical preparedness for handling CBRN emergencies besides the basic aspects of medical preparedness. It covers the following areas:

- Specific education and skill based training of MFRs and necessary community awareness about various Dos and Don'ts to deal with CBRN incidences in a participative approach.
- SOPs for CBRN management at the incident site, triage, personal protection, decontamination, resuscitation, and casualty evacuation. followed by management of victims at the hospital level.
- The necessary resource inventory in terms of Personal Protective Equipment (PPE), various detectors, decontamination and decorporation agents, antidotes, essential medicines, specialised mobile laboratories and ambulances fitted with CBRN filters. Special CBRN stores and necessary laboratory facilities will be established at various levels.
- Critical infrastructure for medical management including CBRN casualty treatment centres/wards and training facilities will be developed.
- SOPs for specialised response will be laid down to deal with covert CBRN attack at strategic vulnerable locations.

- Necessary provisions for the management of long-term effects of CBRN agents will be made.
- Planning of evacuation routes using under-ground metros to satellite and other towns will be done in the developmental phase.

Chapter 7 sets out the approach for the implementation of the Guidelines and also highlights the key points for ensuring the implementation of plans prepared by central ministries, departments, states and districts.

The milestones for implementation of the guidelines are as follows:

(i) Phase-1 (0-3 Years)

- Development of a national medical emergency plan which will include all the resources of various government, private and public hospitals.
- Harmonisation of the existing regulatory framework by dovetailing the existing acts, rules and regulations with the Disaster Management Act, 2005. Necessary enactment/amendments will be done in the existing legislations.
- Strengthening of the existing institutional framework for health management and its integration with the activities of the NDMA, state authority/State Disaster Management Authority (SDMA), district administration/ District Disaster Management Authority (DDMA) and other stakeholders for effective implementation.
- Development of an integrated surveillance system based on epidemiological surveys, detection and investigation of disease outbreaks to establish an early warning system along with institution of necessary public health measures.

- Mechanism for emergency medical care at the incident site, equipping MFRs/ Quick Reaction Medical Teams (QRMTs) with all material logistics for providing basic life-support, disaster resilient communication network, containerised mobile hospitals and provision for prompt evacuation by development of the integrated ambulance network.'
- Specialised provisions for detection, protection, decontamination and decorporation facilities at the incident site and during evacuation for CBRN management.
- A planned effort in the direction of enhancing the capacity to respond to any mass casualty event including mental health and psychosocial support. It would also provide for identifying, stockpiling, supply chain and inventory management of drugs, equipment and consumables including vaccines, antidotes, and agents for protection, detection, decontamination and decorporation for CBRN disasters.
- Sensitisation of the public, private and corporate sectors for their active participation and development of adequate human resource for emergency response, management of delayed health effects and providing short and long-term psychosocial support and mental health services.
- Inclusion of the knowledge of mass casualty management in the present curriculum for medical undergraduates and postgraduates along with special refresher training programmes in the area of emergency medicine.
- Establishment of information networking systems for hospital administrators, specialists, medical officers and paramedics.
- Establishing an information networking system with appropriate linkages with state ambulance/transport services, state police departments and other emergency services including fire. The states will ensure proper education and training of the personnel manning these information networking systems.
- Strengthening the NDRF, fire services, MFRs, paramedics and other emergency responders. Identification and recognition of institutes for training medicos, paramedics and MFRs.
- Adequate community awareness programmes for first aid, general triage, various disaster specific mitigation modalities and for the participation of the community as a whole.
- Preparation of hospital disaster management plans by all the hospitals across the country—defining surge capacity, stockpiling, supply chain and inventory management of drugs, equipment and consumables including vaccines, antidotes and other agents required for mass casualty management.
- Development of trauma centres, blood banks and laboratory services network at the regional level and strengthening of poison centres.
- Specialised facilities including CBRN regional centres for protection, detection, decontamination and decorporation in highly vulnerable zones.
- Upgradation of scientific and technical institutions for applied research and training including post-disaster medical documentation procedures and epidemiological surveys. A continuous process of regularly updating research programmes by adopting activities in R&D mode, initially by pilot studies.
- Development of radiation injury treatment centre, CBRN simulation model facility, CBRN detectors and mobile decontamination facilities.

- Upgradation of PPE and production of vaccines and prophylactic modalities for CBRN management.

(ii) Phase-II (0-5 years)

- Strengthening of integrated surveillance systems and EWS at regional levels and incorporation of disaster specific risk reduction measures.
- Institutionalisation of the advanced EMR system (networking ambulance services with hospitals).
- Strengthening of scientific and technical institutions for knowledge management and for applied research and training in CBRN.
- Development of community resilience in disaster related issues specifically micro-level vulnerabilities to which they are maximally exposed.
- Testing of various elements of the emergency plan through table top exercises and mock drills based upon standardised modules.
- Development of trauma centres at district level and new poison centres at various vulnerable locations based upon the risk assessment studies.
- R&D activities identified in phase-I will be intensified and new facilities will be developed at vulnerable locations.

(iii) Phase-III (0-8 years)

The long-term action plan will intensify the areas identified in phase-I and phase-II along with the following important issues:

- All hospitals and laboratories will be accredited to address the issue of quality medical care.
- Integration of the concept of mock drills, training and retraining schedules, monitoring the mechanism of HRD and critical infrastructure at all levels to tackle natural and man-made disasters.

- Based upon the need assessment analysis, facilities like mobile hospitals, QRMTs, network of laboratories, burn centres, radiation injury treatment centres and blood banks will be developed.

- Institutionalising a continuous upgrading mechanism based upon the gaps identified in various activities performed in phase-I and phase-II.

- Modes to integrate the various community practices in the institutionalised framework of PMCM.

- Identification of gaps based on the R&D activity in phase-I and phase-II that need further research and intervention.

The MoH&FW as the nodal ministry will prepare a detailed action plan in accordance with these guidelines with specific tasks, activities, targets, and time-frames that will also be part of the national 'all hazard' medical preparedness plan. Other ministries like MoD, MoR, and MoL&E will also prepare their respective medical preparedness plans as part of the 'all hazard' DM plans. The departments of health of different states will also prepare the medical preparedness plans based upon these guidelines.

The activities mentioned above will be initiated with immediate effect and will be further intensified in due course of time. An institutional framework for medical preparedness and management of mass casualties will be set-up at the national level, which will integrate and strengthen with other aspects of disaster management. For an efficient and coordinated management, the state governments will issue guidelines for the preparation of district and local level plans in accordance with these Guidelines. The objective is to evolve an attainable and practical approach for the medical preparedness and management of mass casualties throughout the country with the participation of all stakeholders including local communities.

India's unique geo-climatic conditions make it vulnerable to natural disasters like floods, drought, cyclones, earthquakes, and outbreak of diseases leading to a sizable number of human casualties. The Super Cyclone in Orissa in October 1999 caused more than 9,000 deaths; the Bhuj earthquake in January 2001 resulted in 14,000 deaths; while the Tsunami in December 2004 left behind 15,000 death in India. The Bhopal Gas Tragedy of 1984 accounted for more than 15,000 deaths over a period of more than two decades. The above events underline the mass casualty potential of natural and man-made disasters.

The increased vulnerability to man-made disasters due to industrialisation and probability of terrorist attacks using 'dirty bombs' and/or chemical bombs underscores the need to adopt a multidisciplinary and multi-sectoral approach for preparedness, prevention/mitigation strategies and to develop capacities to improve response.

Equally important are the 'peripheral emergencies' which result in mass casualties. These include road, rail and air accidents, fire, drowning, stampede, and epidemic outbreaks. These incidents occur more frequently than natural disasters. The deaths due to man-made disasters, between 2001-03 were nearly 12 times higher than those caused by natural calamities. This established the importance of setting up an institutionalised mechanism for medical preparedness across the nation. The analysis of mortality data of the last decade also revealed more than 1,20,000 deaths with economic losses of approximately Rs. 1,50,000 crore. The

damage caused by mass casualty events due to natural disasters is given in Annexure-A.

Complex socio-economic environmental problems which may arise due to occurrence of such events and public health emergencies with mass casualty potential are given in Annexure-B. This situation calls for the need of an institutionalised mechanism having an 'all hazard' approach. The approach will advocate various areas of capacity development both in manpower and materials. All aspects of preparedness including the role of the community will be involved as a valuable resource.

An important aim of medical preparedness and management of mass casualty events approach is the minimisation of the loss of life and prevention of disabilities during such events, which can occur at various levels. We must be prepared in terms of comprehensive planning, preparedness and capacity development to respond to any type of disaster, resulting from man-made or natural events that have the capacity to cause multiple casualties. The goal is to create an institutional mechanism and systems that would result in the coordinated working of emergency responders, hospital managers, and local and regional officials. It would combine real-time reports from responders in the field with databases of hospital capacity and resources to show, for example, how 100 burn victims might be distributed among four hospitals. Mechanism needs to be devised to keep track of resources such as beds; intensive care units; emergency departments; operating

rooms; doctors, nurses, paramedics and other health professionals; transportation assets such as ambulances and other emergency medical services units; and even supplies like bandages and fuel for generators. The focus of such arrangements is to prepare and equip district and sub-district hospitals to handle such events. Mass casualty management poses a significant challenge distinct from normal clinical practice. It needs establishment of a system characterised by a set of pre-established procedures that can handle day-to-day occurrences as well as surge requirements during mass casualty events.

1.1 Mass Casualty Events (MCE)

Any event resulting in a number of victims large enough to disrupt the normal course of emergency and health care services is called a mass casualty event. MCE present unprecedented challenges as they significantly impact the health care system and other resources.

The reasons for heavy losses during MCE can be attributed to the reactive and response-centric approach adopted in the erstwhile DM without assigning due importance to pre-disaster aspects of prevention, mitigation and preparedness in a proactive and holistic approach. Preparedness will help save an enormous number of lives.

1.1.1 Emergencies with Mass Casualty Potential

All disasters have an inherent potential to convert into a mass casualty event with increased number of morbidity and mortality. Dimensions of disaster have increased manifold in the light of the 9/11 attacks, 1995 Sarin gas attack in the Tokyo subway, 2004 Madrid railway attack and the 2005 London subway bombings.

India is vulnerable to most natural and man-made disasters including earthquakes, tsunamis, landslides, avalanches, flash flood; terrorist strikes; industrial emergencies; Chemical, Biological, Radiological and Nuclear (CBRN) emergencies; and road, rail and air accidents, all having an inherent potential to convert into MCE.

Trauma includes bone injuries, head injuries, and crush syndrome. Burns commonly result from fires in buildings and in a majority of cases due to electrical short circuits. Burns sustained due to forest fires are less common. MCE of burns may also be caused following earthquakes, chemical injuries, and potential nuclear and chemical warfare. Burns due to terrorist strikes are on the rise in the terrorism prone states. Road, rail and air accidents may also result in burn injuries.

Drowning in flood/flash flood situations, stampede in mass gatherings and chemical (industrial, terrorist, warfare) agents cause MCE of asphyxia requiring airway maintenance and critical care support for a large number of victims. During floods, it has been observed that there are an increased number of snakebites that require hospitalisation and anti-venom treatment.

The tropical and subtropical climate coupled with geological and hydrological events occurring in increasing frequency makes the country vulnerable to public health emergencies with mass casualty potential. An enabling environment for mosquito breeding due to water collection—both man-made and natural, as in flood, tsunami, earthquake etc., result in outbreak of vector-borne diseases such as malaria, dengue, Japanese encephalitis and Chickungunya. Water-borne diseases due to poor sanitation and consumption of contaminated water generally cause gastro enteritis, dysentery, cholera, viral hepatitis, polio and food poisoning requiring hospitalisation in large numbers.

Emerging and re-emerging zoonotic diseases such as leptospirosis, avian influenza (bird flu), plague, and hanta virus pulmonary syndrome are increasingly gaining attention mainly due to displacement of animals from their natural habitats. Adverse condition of living such as overcrowding in temporary shelters make the population vulnerable to outbreak of measles. Another area of concern is threat due to biological agents, which if not handled properly, may lead to medical emergencies.

To summarise, increasing geological and hydrological events, population explosion, poverty, and uncontrolled urbanisation are resulting in disasters with mass casualty potential.

1.1.2 Mass Casualty Potential of CBRN Events

The Chernobyl accident which occurred on 26 April 1986 revealed the possibility of a nuclear incident in today's world. Further, metropolitan cities, state capitals and major cities of the country are potential targets with possible CBRN emergencies which may cause enormous casualties. Medical management in such situations needs certain specialised facilities like protection, detection, decontamination, antidote administration and decontamination along with usual care required for other injuries. Medical facilities in the affected cities will be non-functional due to extensive damage and contamination. Therefore, hospitals in satellite and other towns need to be designated with the necessary facilities. Arrangements need to be detailed for evacuation of casualties by road, rail, helicopters and ships depending upon their suitability.

1.2 Aims and Objective

Under Section 6 of the Disaster Management Act, 2005, the National Disaster Management

Authority (NDMA) is *inter alia* mandated to issue guidelines for preparing action plans for holistic and coordinated management of all disasters. The Guidelines will focus on all aspects of medical preparedness and mass casualty management with a focus on prevention, mitigation, preparedness, relief, and medical response, etc.

The Guidelines will form basis for the central ministries/departments and states concerned to evolve programmes and measures to be included in their action plans. MoH&FW is the nodal ministry for the said issue. The health services of other important line ministries with important roles to play are MoD, MoR and Employees' State Insurance Corporation (ESIC) of the MoL&E. The private sector is also encouraged to participate in mass casualty management by adoption of the Public-Private Partnership (PPP) model.

The approach followed will emphasise medical preparedness and risk education measures by developing a rigorous medical management framework to reduce the number of deaths during MCE. This is to be achieved through strict conformity with existing and new policies and proactive involvement of all stakeholders.

In addition to the above stakeholders, the Guidelines will be utilised by the following responders and service providers :

- a) District administrator in coordination with Chief Medical Officers and other health care providers will use these Guidelines for the development of medical management aspects in the DM plan.
- b) All the hospital (government, local bodies, NGOs, private and others) will develop their hospital DM plans using these Guidelines.

c) State Medical Management plan covering macro issues of capacity development and micro issues pertaining more vulnerable districts will be developed based upon these Guidelines.

d) All stakeholders connected directly or indirectly with medical management to mitigate effects of disasters will make use of these Guidelines.

2

Present Status and Context

India is a vast country with a population of more than one billion. Health being a state subject, medical care is being provided to citizens based on the National Health Policy and Programmes. The states have a three-tier framework consisting of tertiary care hospitals, district hospitals and primary health care facilities at the local level. The programmes and procedures suited to the needs of the people in the state are formulated and implemented by the state governments. Besides these, the national health programmes are implemented by the MoH&FW which also plays a key role in augmenting the capacities in terms of training and capacity development at all levels including extending necessary help during disasters/epidemics.

2.1 Major Stakeholders in Medical Preparedness and Mass Casualty Management

2.1.1 Central Government

A) Ministry of Health and Family Welfare

The health care service organisations in the country extend from national to village level. The organisation responsible at the national level is the MoH&FW. Under Allocation of Business rules of the GoI, the MoH&FW is assigned the legislative capacity for a number of subjects including all matters relating to the medical, dental, nursing and pharmacy professions and education; mental health; standards for drugs; prevention of food adulteration; and epidemic prevention and control, etc. It is also responsible for executing these legislative functions in the

UTs. The various legislations governing the medical system of India is given in Annexure-C. In addition it runs national programmes for prevention, control and elimination of diseases having public health importance; it pioneers medical research; and provides medical care through eminent tertiary care teaching/training institutions. It also develops public health, drug and food laboratories, port/airport quarantine and health services depending upon the requirements of the society. These services are rendered through about 100 subordinate offices/autonomous institutions. The state- and population-wise break up of hospital beds distributed in rural and urban areas is given in Annexure-D.

The MoH&FW is also responsible for policy and organisation of all matters related to Family Welfare and Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH). It is headed by the Union Minister of Health and Family Welfare. The ministry has two departments viz.—Health and Family Welfare and AYUSH. At the executive level the department is headed by two secretaries, one for Health and Family Welfare and the other for AYUSH.

The Department of Health and Family Welfare is supported by a technical wing—the Directorate General of Health Services, headed by the Director General Health Services (DGHS). The directorate is responsible for framing technical guidelines and policies to guide the states for implementation of health programme strategies, monitoring of programme implementation and evaluation of the programmes from time to time. The National Institute of Health and Family

Welfare has conducted training and research in the health sector from 1977.

The basic paradigm for health sector reforms was determined by the National Health Policy, 2002, which provides for prevention and promotion of health services along with curative care towards building a healthy nation. Major policy initiatives included Pradhan Mantri Swasthya Suraksha Yojna for establishment of AIIMS like institutions in identified states, consolidation of the Reproductive and Child Health Programmes in the form of the National Rural Health Mission (NRHM). The Hon'ble Prime Minister launched the NRHM on 12 April 2005 throughout the country with special focus on 18 states, including eight Empowered Action Group (EAG) states—the North-Eastern States, Jammu and Kashmir and Himachal Pradesh. The framework, articulates the goals, major strategies and timelines for various activities under the NRHM. It elucidates the overarching umbrella status of the mission and provides a road map as well as inclusive norms for additional activities to be undertaken as part of the NRHM. This includes integration of all vertical programmes at the operational level. NRHM is an effort to provide a fully functional platform for health action with full community ownership at all levels—the village, the sub-centres, the Primary Health Centres (PHCs), the Community Health Centres (CHCs) and the district level. Accredited Social Health Activist (ASHA) and other community workers have been selected and funds for local health action have been made available to each and every health facility (sub-centres, PHCs, CHCs) in rural areas. Over 1,00,000 village health and sanitation committees have been constituted. All the districts of the country will complete their district health action plans in the stipulated period of time. These plans, reflecting complete horizontal integration of vertical schemes, will form the basis for further financing of the mission.

Reproductive and Child Health (RCH) is the flagship programme under NRHM. This programme has been reoriented and

revitalised to give it an outcome oriented and pro-poor focus. A paradigm shift is envisaged in the manner in which the RCH program has been conceptualised and implemented, based upon key learning from the first phase of the programme to make it consistent with the requirements of the NRHM. The immunisation programme, which has a nationwide presence, is one of the key interventions for protection of children from life threatening conditions, which are preventable. To strengthen routine immunisation, Gol under the NRHM, has planned new interventions to improve the performance of the immunisation programme.

Responding to the immense challenge of the Human Immunodeficiency Virus (HIV)/Acquired Immuno Deficiency Syndrome (AIDS) threat, National AIDS Control Organisation (NACO) has articulated a clear and effective response to increase access to services and communicate effectively for behavior change. The risk of Tuberculosis (TB) infection in HIV positive persons increases manifold. NACO is working closely with The Revised National Tuberculosis Control Programme (RNTCP) for promoting cross referrals for early diagnosis and prompt treatment of tuberculosis. For ensuring blood safety which is one of the well known modes of transmission, over 1,230 blood banks have been modernised, over 52% of the total blood units required are collected through voluntary blood donation and a system of mandatory screening of blood for HIV, Hepatitis B and C, malaria and syphilis has been enforced. This has reduced transmission of HIV infection through contaminated blood from about 9% in 1993 to about 2% in 2005.

The National Vector Borne Disease Control Programme (NVBDCP) is an umbrella programme for prevention and control of vector borne diseases viz.. Malaria, Filariasis, Kala-azar, Japanese Encephalitis, Dengue/Dengue Haemorrhagic Fever (DF/DHF) and Chickungunya. These diseases pose immense public health concerns and are major impediments in the path of socio-economic development.

The RNTCP using Directly Observed Treatment Short-course (DOTS) strategy, with the objective of curing at least 85% of new sputum positive patients and detecting at least 70% of such patients, was implemented in the country in a phased manner from 1997 and the entire country had been covered by March 2006. The programme is being implemented with assistance from the World Bank, Department for International Development (DFID), United States Agency for International Development (USAID) and the Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria (GFATM). Till date, the RNTCP has placed more than 63 lakh patients on DOTS treatment, averting more than 11.33 lakh deaths. The overall performance of the RNTCP has been excellent with cure/treatment completion rate consistently above 85% and the death rate reduced to less than 5%.

The plan of action to implement the National Programme for Control of Blindness has been prepared in line with the Global initiative Vision 2020: The Right to Sight'. It focuses on development of comprehensive eye care services targeting common blinding disorders including cataract, refractive errors, glaucoma, diabetic retinopathy and corneal blindness.

The Yaws Eradication Programme and National Leprosy Elimination Programme achieved noteworthy success and the country achieved the goal of eliminating yaws and leprosy. The recorded prevalence rate of leprosy per 10,000 of population declined from 57.6 in March 1981 to 0.84 in March 2006 with 0.95 lakh cases on record. 26 states/UTs have achieved elimination and the other nine states/UTs are progressing towards elimination.

The MoH&FW also plans and executes nation wide the programme for emerging diseases which are of national and international concern such as avian influenza, Severe Acute Respiratory Syndrome (SARS) etc. The various national programmes initiated from time to time are given

in Annexure-E. The decentralised state based disease surveillance under the Integrated Disease Surveillance Programme (IDSP) has been initiated to detect early warning signals of impending outbreaks and to help initiate an effective response in a timely manner. Under the IDSP, 800 sites are being provided connectivity, out of which 50% will be through both broadband and Very Small Aperture Terminal (VSAT) and the remaining 50% through broadband only. The idea is to cover all state headquarters, districts, government medical colleges, premier institutions and state institutions of health and family welfare.

In disaster settings, the Emergency Medical Response (EMR) division of DGHS is the focal point for implementing the Emergency Support Function (ESF) plan that includes identification of nodal officers for coordination, crisis management committee and quick response teams at headquarter and field level, resource inventory, etc. The decision making body is the Crisis Management Group under the Secretary, Health and Family Welfare, which is advised by the Technical Advisory Committee under DGHS. To support medical care in disaster settings, MoH&FW is procuring a prefabricated, self-contained, container based mobile hospital which is in an advanced stage of procurement. This 100-bed container based hospital can be transported by rail, road or air to the incident site. It has facilities like Operation Theatre (OT), Intensive Care Unit(ICU), post-operative care, water purification unit, kitchen, sanitary unit and power backup.

MoH&FW runs tertiary care institutions such as AIIMS, Dr. RML Hospital and Safdurjung Hospital situated in Delhi; PGIMER, Chandigarh; Jawaharlal Institute of Post Graduate Medical Education and Research, Pondicherry; North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Shillong; Regional Institute of Medical Sciences, Imphal; and National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore. The large pool of medical

and paramedical personnel available with the Central Government Health Scheme and the central government hospitals come handy for large scale mobilisation of medical personnel. Similarly the public health personnel are deputed from NICD, All India Institute of Hygiene and Public Health (AIIPH) and ICMR institutions.

For capacity development, MoH&FW is in the process of institutionalising the mass casualty management training programme in the country. For this purpose, the training of instructors for hospital preparedness during emergencies has been undertaken and so far 100 instructors have been trained. These instructors were drawn from state government hospitals/medical colleges. In the next phase, hospital managers up to the district level will be trained. Training in investigating and managing outbreaks is being done by NICD Under the IDSP programme.

For investigating outbreaks, NICD is the nodal agency. NICD/ICMR institutions provide teaching/ training, research and laboratory support. Most of the states have a regional office for health and family welfare and the regional director liaisons with the state government for effective management of the health consequences of disasters.

The department of Indian Systems of Medicine and Homoeopathy (ISM&H) was created in March 1995 and renamed as AYUSH in November 2003 with a view to providing focused attention to development of education and research in AYUSH systems. The department continues to lay emphasis on upgrading AYUSH educational standards, quality control and standardisation of drugs, improving the availability of medicinal plant material, R&D and awareness generation about the efficacy of the systems domestically and internationally. Mainstreaming of AYUSH under the NRHM with the objective of optimum utilisation of AYUSH infrastructure is essential for meeting the unmet health needs of the Indian population.

The MoH&FW has taken initiatives for upgrading selected government hospitals to strengthen emergency facilities for national highways. In addition, establishment of trauma centres every 100 km and an ambulance every 50 km along the highways in the Golden Quadrilateral Network has recently been initiated in coordination with the Ministry of Road Transport.

The Public Health Foundation of India (PHFI) is an autonomous institution set up in 2005 for redressing the existing institutional capacity of India's public health programme, in the areas of training, research and policy matters. It is promoting the concept of PPP to achieve high standards for public health education, establishing public health institutes of excellence, applied research and advocating policies linked to broader public health goals.

B) Ministry of Defence

The armed forces invariably provide the first organised response to any disaster or natural calamity. In future also the Armed Forces Medical Services (AFMS) will continue to provide timely and sterling services to assist civil authorities in times of need. However, availability of these assets would be limited in case of war since these will be diverted to treat war casualties. The AFMS has well-trained and equipped personnel, ready to respond to any eventuality at short notice.

All service hospitals, spread out across the entire length and breadth of the country have exhaustive and well-rehearsed DM plans catering to all types of disasters/natural calamities. The hospitals have 3,000 special crisis expansion beds authorised to them. These can be utilised in case of emergency for management of mass casualties from within their existing resources. These beds are always maintained and kept in a high state of readiness.

Equipment and medical stores for disaster management are identified, segregated and kept ready to move out at short notice in all medical units and hospitals. Adequate portable emergency medical equipment is also held for on-site treatment and management of casualties en route.

The AFMS have mobile field hospitals and mobile surgical teams which can be moved to the affected areas as and when required at short notice. These mobile hospitals are self-contained in terms of medical stores, drugs, equipment, beds and tentage. Identified personnel are kept earmarked in all medical units, to move out in times of disasters. Even ambulances and transport are earmarked for emergencies. Transport can also be pooled from other army units, if required.

Specially equipped units have been earmarked as Quick Reaction Medical Teams (QRMTs) for aid to civil authorities in cases of CBRN disasters/acts of terrorism. These medical teams comprise doctors, nurses, paramedics, medicines, tentage and ambulances. They are capable of moving in two hours within India and 6-12 hours to any part of the world. Identified service hospitals have also been earmarked for handling casualties arising from use of CBRN agents.

The echelons for DM have been well-defined and delineated. It continuously initiates, evaluates and monitors the various training and awareness programmes at all levels of the armed forces. The DM cell under the office of Director General Armed Force Medical Services (DGAFMS) maintains an over all supervision over DM activities.

Medical and paramedical personnel are trained in DM at various training establishments as a part of normal curriculum. Training is imparted right from induction to senior levels of medical officers, nurses and paramedics at various training establishments of the armed forces. The training is in the form of workshops, Continuing Medical Education

(CME) programmes and exercises with troops. The paramedics are being trained regularly in their units and participate in mock drills, etc.

All the hospital and medical units rehearse their DM plans at least twice a year so as to ensure a prompt and efficient response in the shortest possible time. All the stores and equipment are checked regularly for their serviceability.

Progress, upgradation and refinement are a continuous process. The AFMS has taken up the case for procurement of specialised dedicated 'disaster bricks' containing essential medical equipment and drugs for various types of disasters. These will be procured and strategically located to be dispatched to affected areas at short notice.

The armed forces have been deployed to manage various disasters like earthquakes in Latur, Bhuj, and Jammu and Kashmir, floods in Maharashtra, Gujarat and Assam, avalanche in Jammu and Kashmir, Tsunami in coastal India and abroad, and recently for checking the outbreak of Chickungunya fever in June 2007.

C) Ministry of Railways

The MoR, over the past 153 years has built a network spread over 63,332 route km and 6,974 railway stations, carrying 15.68 million passengers and 1.83 million tonnes of freight traffic per day.

It also has a strong and well-developed training infrastructure consisting of six Central Training Institutes (CTIs) for officers and more than 200 training centres for meeting the training needs of non-gazetted personnel on a continuing basis. The Indian Railways also have a state-of-the-art, nationwide telecommunication network having more than 2,85,000 lines in digital electronic exchanges, 7,093 route km of digital microwave (7 GHz), 989 route km with trial communication through wireless (18 GHz), 1,686 route km with mobile train radio

communication system and 25,269 route km of optical fiber cable communication system.

The Medical Department of the Indian Railways fulfil the needs of:

- i) Working and retired railway employees,
- ii) The railway administration,
- iii) The travelling public.
- iv) Central and state governments through its network of 121 hospitals having 13,770 indoor beds and 678 health units/polyclinics/lookup dispensaries, and 144 recognised hospitals and 54,337 personnel.

This infrastructure is spread across 16 zonal railways and 67 railway divisions across the length and breadth of India providing comprehensive prevention and promotion of health care services along with curative and rehabilitative services under a single management structure. During the year 2005-06, 2,70,84,229 OPD cases were attended and 4,56,429 indoor cases were admitted. More than 36,500 major surgeries were performed during the year. More than 53,293 pre-employment medical examinations and more than 1,31,000 periodical medical examinations of serving employees were carried out during the year. 17,189 sick passengers were attended to by railway doctors during 2005-06.

The Indian Railways has an established network system capable of emergency medical response and mass evacuation. The system is based on an infrastructure consisting of 172 Accident Relief Medical Vans (ARMV)—Scale I (Unit of accident relief trains situated at an average distance of every 50-100 km on main lines and 200 km on branch lines), 325 Accident Relief Medical Equipment (ARME)—Scale II (situated at every 80-100 km on either side of ARMV—Scale I and consisting of three sets of Portable Medical Kit for Accidents (POMKA), first aid boxes with guards, train superintendents,

station superintendents etc. POMKAs are available at all health units, sub-divisional and divisional/zonal hospitals. Trained manpower of medical and all other departments of the Indian Railways provide first aid, immediate and necessary emergency medical treatment to save the life and limbs of persons involved in train accidents and arrange rapid evacuation to the nearest government/private hospital by the first available means of transport. There is a well-rehearsed action plan to handle railway accidents.

To manage railway accidents, the Indian Railway's administration has evolved a well-developed and well-defined infrastructure synergistically linked to an efficient, well-rehearsed and tested system for treating victims of train accidents in government/railway/private hospitals. The system is committed to the primary goal of meeting the needs of the MoR, though this resource may be available in a limited manner for assistance of the district administration for mass casualty management.

D) Ministry of Home Affairs

There are a number of health care facilities available with the paramilitary forces like the Border Security Force, Central Reserve Police Force, Indo-Tibetan Border Police, etc. It is important to include it in the resource list pertaining to mass casualty management.

E) Ministry of Labour and Employment (Employees' State Insurance Corporation)

In accordance with the ESI Act, 1948, the state government has been entrusted the responsibility for providing reasonable medical, surgical and obstetric facilities for the insured persons and their dependants. Employees' State Insurance Scheme of India is an integrated social security scheme tailored to provide protection to workers in the organised sector and their dependants in contingencies, such as

sickness, maternity or death and disablement due to an employment injury or occupational disease. Under the scheme, the various benefits are medical benefit, sickness benefit, maternity benefit, disablement benefit, dependent benefit and other benefits like funeral expenses, vocational rehabilitation, preventive health care, confinement allowance, unemployment allowance, etc.

Employees' State Insurance (ESI) scheme is implemented in 25 states and UTs of the country. This covers 3.05 lakh establishments and 91.48 lakh insured families covering a population of more than 35 million. Medical services are provided by a network of 144 hospitals, 1,422 dispensaries and 2,041 empanelled clinics. A total of 28,000 indoor beds are available for patients. These services are managed by approximately 10,000 doctors and 20,000 full-time paramedical staff. Medical services in the states are provided by the state governments except in Delhi and New Okhla Industrial Development Authority (NOIDA), where services are provided directly by ESIC. Besides this, 21 ESI hospitals out of 144 hospitals are managed by ESIC directly.

F) Other Line Ministries and Departments

The Ministry of Shipping, Road Transport and Highways through the Department of Road, Transport and Highways is to ensure the development and maintenance of national highways. At present, there are a few ambulance services deployed on the national highways under the directions of the National Highway Authority of India. Upgrading of this vital asset is under progress in the XIth Five-Year Plan.

Medical and ambulance services are available through many other ministries/ departments/ organisations like the Ministry of Civil Aviation, Shipping Corporation of India, Oil and Natural Gas Commission and others.

These services need to be assessed at the micro-level while developing the complete resource inventory of a particular district in its medical management plan.

2.1.2 State Government

Health is a state subject under the present constitutional provisions. The administrative responsibility for medical preparedness and management of mass casualty events primarily rests with the state health departments. The health system of the states is structured as a three-tier system. It comprises of:

- PHCs and CHCs at block level.
- District hospitals at district level.
- Tertiary care institutions at state headquarters/major cities.

However, the states show wide variation in the multiplicity of agencies/departments which administer these institutions such as medical education/public health/medical services under local bodies.

The infrastructure at block level is not adequate to support mass casualty events. The sub-district hospitals and the district hospitals have 100-250 beds and are planned to provide secondary level care including trauma care. But there is wide differential among the states in the range and quality of services provided by the district level hospitals. The state capitals and other major cities have medical college hospitals or other tertiary care institutions run by the state health departments or municipalities. All these institutions are overwhelmed even with the routine load and their surge capacity is limited.

Many state governments have established DM authorities and are in the process of preparation of State DM plans including medical preparedness aspects.

Centralised Accident and Trauma Services

Centralised Accident and Trauma Services (CATS) was established in 1991 for providing services to the people of Delhi for transporting patients in emergency situations and those involved in accidents to hospitals.

There are 35 ambulances with 28 ambulance stations located all over Delhi with the control room at Shushruta Trauma Centre, which can be accessed by dialing 102 or 1099. The ambulances are placed for duty at various intersections within the city and will also be stationed in health centres/ hospitals of the state as per the requirements of the plan. Each ambulance is manned by two assistant ambulance officers who are recruited with a basic qualification of graduation and are given six months of classroom training and six months of on-site training.

CATS have recently been involved in transporting pregnant women for delivery to the nearest hospital as and when requested. It has been proposed to procure 450 ambulances shortly. The following projects are also in the pipeline:

- i) Establishment of 10 ambulance stations per district. Each district will have 50 ambulances with five at each station.
- ii) The manpower to be recruited will be Bachelor of Science (Nursing) graduates with a license for driving ambulances.
- iii) After recruitment all ambulance operators will be trained in Advanced Life-Support (ALS).
- iv) Master trainers (anaesthetists, surgeons and public health nurses) drawn out of various public and private hospitals within Delhi have already been trained for conducting training of the existing

ambulance operators and those to be recruited.

2.1.3 Private Sector

Nearly 70% of health services are provided by the private sector. There is a tremendous growth of medical facilities in the private sector in all major cities. These hospitals are providing secondary and tertiary medical care to the population. In addition there are large numbers of nursing homes in smaller cities having basic facilities for treating all types of patients at the primary level. Private hospitals are better organised and equipped. As per the census of hospital beds of 2005 the total number of beds were 4,69,672. Almost half the number of beds were available in the private sector (government 51.6%, private 48.4%). This statistical data brings out the gross inadequacy of hospital beds in the country. Of the existing 258 medical colleges in India, 137 have been established by the private sector and six institutions are under deemed university status or have All India Institute status. The statutory agency Medical Council of India (MCI) has prescribed a minimum of five beds to be made available per student admitted. In all the medical colleges, bearing in mind that most of the medical colleges have 150 admissions and some have 100 admissions, the number of beds in tertiary care facilities attached to these colleges established by the private sector would aggregate to 18,000 beds. Further due to mushrooming of institutions and irregular distribution of medical colleges in various states, a minimum of 30% of the bed facilities of the private sector becomes virtually an unutilised reserve. It is also necessary to realise that this reserve in the private medical colleges comes along with established expensive infrastructure and trained manpower. However in mass casualty events, the mechanism for their active participation during disasters is a major area that needs immediate attention.

2.1.4 Other Non-Governmental Organisations

A) Red Cross

The Red Cross was initiated as a movement in 1863 to provide succor to the war affected soldiers and it gradually emerged as the world's leading humanitarian organisation, operating in 185 countries. The Indian Red Cross Society (IRCS) was formed under an Act of Parliament (Act XV, 1920). It is one of the largest and oldest indigenous humanitarian organisations in the country. It is actively involved in disaster response, relief, preparedness and health care in the community. The Indian Red Cross has 700 branches located at state, district and sub-district levels with 12 million volunteers, members and field workers throughout the country. The national headquarter of the IRCS is located in Delhi. It participates actively in community welfare programmes in the pre-disaster, disaster and post-disaster phases and takes initiatives like relief work, promotion of voluntary blood donation, HIV-AIDS prevention programme, hospital services, ambulance services, nursing services and junior/ youth Red Cross. It has been running the largest voluntary blood banks in India since 1962 and is at present contributing 10% of the total blood collection through its 108 blood bank centres across the country. Blood and blood products are issued free of cost to thalassaemic and haemophilic patients, and to government hospitals.

The Indian Red Cross has 500 medical care establishments across the country providing community health care through its general hospitals, maternity and child welfare centres, clinics, medical mobile units and medical camps in remote parts of the country. These facilities can provide assistance in times of disasters. In addition, welfare services for sick and wounded soldiers in the armed forces hospitals are being provided by a cadre of 30 Welfare Officers. The Indian Red Cross also maintains general

amenity stores, libraries and help in organising fund raising campaigns.

The Indian Red Cross has strengthened its capacity in the field of disaster preparedness and disaster response to all natural and man-made disasters, such as floods, cyclones, earthquakes, communal riots etc. It has resulted in improved cooperation with the government and other stakeholders and is gradually emerging as a leading DM agency. It is equipped with the best of disaster response tools and has a backup of national, state and district disaster response team members who immediately reach the disaster affected areas and start their rescue and relief operations with the support of local volunteers. These members are trained and specialised in different sectors and are deployed under a team leader in the event of any major disaster in the country for coordination and management at the incident site.

Another effective disaster response tool of the Indian Red Cross are its water sanitation units which when needed, are installed in the disaster affected areas. These units provide 5,000 to 10,000 litres of clean drinking water every hour, which would suffice to the needs of about 10,000 beneficiaries per day. The Indian Red Cross has six large regional warehouses (each measuring 7-12 acres) situated at strategic locations, which stores relief items that can be distributed to the states within 24 to 48 hours. At present, relief stocks catering to nearly 80,000 families are pre-positioned. The Indian Red Cross has an experience of more than eight decades in the field of disaster relief. It plays a significant role in community level preparedness activities like cyclone shelters, raised tube wells for flood mitigation and community radios. All these have been identified and recognised as replicable models in disaster preparedness. Video conferencing facilities linking the national headquarters with the state branches and warehouses are being established for facilitating disaster response.

Recently, the Indian Red Cross (national headquarters) has initiated a university affiliated one-year part time, Postgraduate Diploma Course in Disaster Preparedness and Rehabilitation to develop a cadre of disaster managers. This course aims at increasing the capacity of the managers in government and private sectors for effective disaster response and rehabilitation.

St. Johns Ambulance is the training and ambulance wing of the Indian Red Cross. It has more than 650 centres, which organise training classes in first aid, home nursing, hygiene and sanitation, mother craft and child welfare, etc. It also has a fleet of ambulances.

The Indian Red Cross is also a part of the International Federation of Red Cross and Red Crescent Societies at the global front. The capabilities of the Indian Red Cross are enormous and its utility has been proved in the past, although there is a requirement for augmentation in the newly evolving institutional mechanism for mass casualty management. It contributes towards the creation of a better society where vulnerable people and communities can lead a life of social and economic security and human dignity.

B) Lifeline Express

The Lifeline Express (Jeevan Rekha) is the world's first full-fledged hospital on a train, developed by Impact India Foundation in collaboration with the MoR and MoH&FW. It has brought the benefits of modern medicine free of cost to millions of poor villagers in rural India. Over 4,50,000 Indians have so far benefited through 92 five-week projects in coordination with district/state administrations, NGOs, corporate entities, Public Sector Undertakings (PSUs) etc., over the past 16 years.

The Lifeline Express consists of five coaches built by the Integral Coach Factory of Indian

Railways at Perambur, Chennai. It has two sophisticated OTs with five operation tables, modern surgical equipment and accessories, sterilisation equipment, a six-bed post operative ward, in addition to a medical store, kitchen, restrooms, x-ray room, audiometry/ophthalmic room and an office. One of the coaches can also be detached from the train and rushed separately to the disaster site, as it is completely self-sufficient in terms of mechanical, medical and surgical inventory. It also has an auditorium and training facilities for 50 medical personnel. Thus, it is able to provide on the spot diagnostic, medical and advanced surgical treatment for preventive and curative interventions for the handicapped, using the Indian Railways network, which is the largest in the world comprising about 63,500 kilometers of track.

The framework in which an NGO in cooperation with government/local organisations, corporations and other NGOs is able to provide community based health care services without any government funds or without financial support from United Nations (UN) agencies, in a sustainable manner is worth emulation and replication.

C) Emergency Management and Research Institute (EMRI) in Andhra Pradesh

The EMRI provides emergency ambulance services with a dedicated toll free number—108, which is accessible from both—fixed line and mobile phones. It is used to report any of three kinds of emergencies—medical, police or fire. Computer Telephony Integration (CTI) methodology has been used so that any call received while all the telephones of the call centre are busy will be recorded and no lapse of any emergency information will occur. The advanced life-saving ambulances are equipped with advanced medical equipment like defibrillators and ventilators to aid the patient even during transportation to a hospital. The ambulances are spread out through

the state and placed strategically so as reach the emergency victim as soon as possible. In case of police or fire emergencies the local office of the state police or fire department is immediately notified with full details.

Each ambulance is accompanied by a trained Emergency Medical Technician (EMT) who is responsible for pre-hospital care while transporting the patient to the appropriate hospital for stabilisation. If required, the EMT can be in conference via cell phone with an in-house Emergency Response Care Physician (ERCP) who is a certified medical practitioner and available 24x7 to support the EMT in case of a question or further guidance. The ambulances are equipped with most common medications and equipment to aid the EMT in pre-hospital care. It is an important example of a PPP providing regular emergency management services.

D) 1298 Ambulance Services

'1298 Dial for Ambulance' is an ambulance access for an initiative to provide a network of fully equipped, advanced and basic life-support ambulances in the city of Mumbai. In case of a medical emergency, any Mumbai resident may dial 1298 for accessing a fully equipped ALS ambulance within the shortest possible time. 1298 Dial for Ambulance has divided Mumbai city into 10 zones and the service has been launched with one ambulance stationed in each zone. On receiving a call for ambulance, the control room which works 24 hours'x 7 days, immediately locates the area to be reached on a Global Positioning System (GPS) enabled map. The nearest ambulance available is dispatched immediately and tracked on Real Time Tracking System to ensure that the ambulance reaches the patient/victim as quickly as possible.

The state-of-the-art ALS ambulances are equipped with all the advanced equipment. The ambulance has air-conditioning, mild

soundproofing and silicon sealing in joints. It also has on board a collapsible trolley stretcher and a stair. The ambulance crew usually consists of a medical consultant, driver and helper.

E) Heli-Ambulance

Helicopters are used for prompt evacuation of casualties from a remote area or an urbanised highly populated zone. The concept of using heli-ambulances is very common in developed countries. The advantages of using heli-ambulances include evacuation from inaccessible terrains, ability to land on rooftops of high rise buildings thereby saving time and reducing the toll rate. Presently, In India, heli-ambulances are available with government organisations, PSUs and NGOs. In addition, heli-ambulances can be used as flying OTs fitted with all advanced life-support equipment. The practical usage of these ambulances in the present context is limited to a certain part of the population due to lack of networking and being few in number. In view of the ever increasing incidences of man-made and natural disasters, there is a need to develop this sector in the PPP mode.

2.2 International Initiatives

In the 1980s, many developed countries have initiated strategies and plans for effective Mass Casualty Management (MCM). The scoop and run approach for MCM has been replaced with a more scientific Mass Casualty Management System approach which envisages a pre-established operational framework, structure, coordinating mechanism and procedure for resource mobilisation, field management and hospital management. There is also a paradigm shift from a response-centric approach to that of prevention, risk reduction, mitigation, preparedness, response, recovery and rehabilitation. The planning process has also shifted focus from a contingency based planning to functional planning.

2.2.1 Global Initiatives by the World Health Organization

Whenever any major disaster like the tsunami in south India or the earthquake in Gujarat strikes the country, in line with customary practices during disasters, the UN system provides immediate support to the affected areas. Under the UN systems umbrella, the WHO together with other UN agencies, initiate numerous activities in the public health area. Some of the immediate interventions include immunisation of children against measles, establishment of disease surveillance units, distribution of chloroscopes to monitor the quality of drinking water, etc. The driving principle in all interventions has been to equip the community at the grass-root level and build the system to make it sustainable.

For the tsunami affected areas, a WHO coordination unit was established in Chennai to coordinate relief and recovery activities. Later, government approved external assistance from multilateral agencies like the World Bank (WB), Asian Development Bank (ADB) and UN agencies for long-term rehabilitation and reconstruction of the tsunami affected areas was initiated. The WHO and other relevant UN agencies participated in the Joint UN Assessment Mission under the UN Recovery Framework.

The WHO's work in the tsunami affected regions covered wide areas of public health such as disease surveillance, psychosocial support, health promotion through environmental sanitation, setting up resource centres and information hubs, and strengthening services to mothers, newborns and children. These activities were carried out in collaboration with various WHO Collaborating Centres, academic institutions and NGOs.

Detailed guidelines for early warning, alert verification and response to disease outbreaks in displaced camps were prepared and disseminated

to affected areas. The WHO model for environmental health, water quality monitoring and surveillance activities was adopted by all NGOs.

Some prominent activities taken up by the WHO country office were the gearing up of services at Government Hospital, Nagapattinam, development of new guidelines for the management of newborn and childhood illnesses during emergencies, sustaining a high immunisation coverage and improving outreach services for women and children, besides training nurses in managing health conditions in emergencies. A web based reporting system was also established connecting all the Comprehensive Emergency and Obstetric Newborn Care centres and selected hospitals across the state of Tamil Nadu.

A new paradigm for psychosocial support was introduced to ensure sustained support to the community through trained personnel in the community itself. The model worked and a substantial number of people have been helped. The modus operandi was varied in different settings and offered an opportunity to assess the models. Based on the feedback and from the lessons learnt, a generic model for Psychosocial Support (PSS) has been suggested. The trainers were selected from local teachers, health workers, nursing students, self-help groups, NGOs, community based organisations, social work students, youth groups and Integrated Child Development Services functionaries at the community level.

The WHO India Country Office initiated environmental sanitation interventions with active community participation. The aim was to provide safe water, sanitation facilities, solid waste management and vector control measures within the temporary shelters to minimise environmental health problems. The basic approach was to monitor drinking water quality, rebuild toilets, improve drainage facilities and train the community to take up their upkeep.

A need was felt for a unified system of data flow to provide administrators and health staff accurate information regarding the morbidity and functional data available from various departments and institutions. A data resource centre has been developed in Chennai for better compilation and fast retrieval of health related guidelines and documents so that the system is better prepared to deal with emergencies.

The Government of Tamil Nadu in partnership with the WHO is also trying to provide a safety net of health insurance schemes to the poorest sections of society to protect them against medical expenditure. The WHO in collaboration with other agencies and the Government of Tamil Nadu have initiated the process for development of an accreditation system for public district hospitals across 10 districts in the state on a pilot basis.

The WHO is providing technical support for the following:

- Preparation of the National Health Sector Disaster Contingency Plan. The draft plan is ready and awaiting approval.
- A draft training module on district-level mass casualty management is awaiting approval.
- Training is being provided on Hospital Preparedness and Emergency Response (HOPE). USAID has supported a basic course and training of instructors course for HOPE. Five countries in the region have adopted this course for developing human resource. USAID also supports the 'Program for Enhancement of Emergency Response' (PEER) which apart from the HOPE component also runs a Master Training Programme for MFRs. It is under the PEER project.
- Training is also being provided on the Multi-user System for Emergency

Response for health professionals, fire brigade, police and municipality workers.

- The Emergency Control Room with the MoH&FW is being strengthened.

Among other major activities, the WHO liaises with the MoH&FW for their emergency management programmes. It provides technical support for the development of a model state-level health sector management plan. Technical support is also being provided to strengthen capacity for emergency preparedness and response in the area of:

- Injury surveillance.
- Establishing linkages with IDSP.
- District health resource mapping.

The WHO will provide support to the government in the following areas:

- Strengthen health sector emergency preparedness.
- Strengthen inter-sectoral action for risk and vulnerability reduction within the framework of the International Strategy on Disaster Reduction, and respond to the health needs including nutrition as well as water and sanitation in emergencies and crises.
- Support a global alert and response system for public health emergencies.

The WHO, Pan American Health Organisation, USAID and ADPC have undertaken substantial initiatives in the area of capacity building also. In the South-East Asian Region, the WHO supports the ADPC in training human resource at various levels (policy, planning and implementation) for public health emergencies including mass casualty events. An international guideline document on minimum standards for food, water and sanitation—'Sphere', is also available.

2.2.4 International Health Regulations

The International Health Regulations (IHR) consist of a comprehensive and tested set of rules and procedures which will help to make the world more secure from global health threats. This was agreed by the World Health Assembly in 2005 and represents a major step forward in international public health security. The revised IHR (2005) were enforced on 15 June 2007. First constituted in 1969 (www.who.int/csr/ihr/ihr1969.pdf), India is a signatory to IHR (2005), the salient features of which are as follows:

- i) The regulations adopted in 1969, were applicable to only three infectious diseases—cholera, plague and yellow fever. After the global spread of Severe Acute Respiratory Syndrome (SARS), it extended the scope of application to any disease caused due to a new or unknown cause, irrespective of origin or source, that presents significant harm to human beings. The member country has to improve its public health capabilities to prevent and control the spread of any such disease within the country and prevent it from going outside its borders.
- ii) The regulations establish an agreed framework of commitments and responsibilities for states and for the WHO to invest in limiting the international spread of epidemics and other public health emergencies while minimising disruption to travel, trade and economics.
- iii) Under IHR (2005), states will be required to report all events that could result in public health emergencies of international concern, including those caused by chemical agents, radioactive materials and contaminated food.
- iv) The regulations build on the recent experience of the WHO and its partners in responding to and containing disease outbreaks. Recent experience shows that addressing public health threats at their source is the most effective way to reduce their potential to spread internationally.
- v) The regulations will help to ensure that outbreaks and other public health emergencies of international concern are detected and investigated more rapidly and that collective international action is taken to support affected states to contain the emergency, save lives and prevent its spread.
- vi) It provides a framework for mobilising support from governments and donors and for responding to an influenza pandemic.
- vii) The WHO has been mandated to provide technical assistance to member states and will also mobilise the necessary resources required for this purpose.
- viii) The member country has to designate or establish a National Focal Point as per IHR which should be a national centre which is accessible at all times; communicate with WHO concerning IHR implementation, including consultation, notification, verification and assessment, public health response; and also coordinate with other ministries/sectors within the country.
- ix) The requests furnished by the WHO for verification of information (including unofficial reports) regarding public health risk will be responded to by the member countries.
- x) All the events that may constitute a public health emergency of international concern will be required to be immediately notified to the WHO within 24 hours of assessment as per the enumerated procedures in the IHR.

- xi) The member state is required to improve its capacity for detection, reporting and assessment of and response to public health events to meet the minimum core capacity requirements under IHR (2005).
- xii) Provisions for routine inspections and control activities at designated international airports, ports and ground crossings to prevent the international spread of disease.
- xiii) The member country has access to privileged information gathered by the WHO about public health threats in other countries that might affect the member country.
- xiv) A list of responsibilities for the WHO in strengthening the ability of member countries to fulfil the obligations framed by IHR (2005) have also been laid down.
- xv) The WHO has already developed and built an improved event management system to manage potential public health emergencies. The WHO has also built strategic operations centres at its Geneva headquarters and regional offices around the world, which are available round-the-clock to manage emergencies. The WHO has also been working with its partners to strengthen the Global Outbreak Alert and Response Network (GOARN), which brings together experts from around the world to respond to disease outbreaks.

In a nutshell, the effective implementation of these regulations can be achieved with the collective action of member states and as individual countries their national legislation should be compatible with the IHR (2005). The necessary information for its implementation and frequently asked questions is available at <http://www.who.int/csr/ihr/en/>.

2.3 Initiatives for Specialised Facilities for Medical Preparedness and Mass Casualty Management

2.3.1 CBRN Casualty Management Facilities

- i) DRDO has developed expertise and facilities for CBRN casualties (like radiation monitoring vans, detection equipment, protective suits and radio protectors). Bhabha Atomic Research Centre (BARC) has also got facilities for detection and decontamination. In each constituent unit of the Department of Atomic Energy (DAE) a few identified doctors have got the necessary training in medical management of radiation emergencies. All Nuclear Power Corporation of India Limited (NPCIL) units and BARC have Personnel Decontamination Centres and the necessary stock of specific decorporation agents for typical radioisotopes and are also equipped with radiation monitoring equipment. Some doctors from the armed forces medical centres have been trained by the response centres of DAE/BARC in medical management of nuclear emergencies. A few training programmes have been conducted for doctors from the armed forces on radiation hazards and their management at the Institute of Nuclear Medicine and Allied Sciences (INMAS), DRDO Delhi. Some of the doctors at civil hospitals in Mumbai such as KEM Hospital at Parel, Sion Hospital at Sion and Nair Hospital at Bombay Central have been given training in medical management of nuclear emergencies.
- ii) Defence Research Development Establishment (DRDE), Gwalior has developed diagnostic kits for some biological agents. Facilities for chemical detection, protection, decontamination,

detection equipment like chemical agent monitors, AP2C, 3 colour detector papers, portable gas chromatographs, residual vapour detection kits, Personal Decontamination Kit (PDK), and portable decontamination apparatus are also available with DRDE, Gwalior.

- iii) Protective suits along with gloves and boots are being developed by Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur.
- iv) Face masks, canisters, CBRN filter fitted casualty evacuation bags are being developed by Defence Bioengineering and Electro-medical Laboratory (DEBEL), Bangalore.
- v) Some initiatives have been taken up by the National Institute of Communicable Diseases (NICD) through integrated diseases surveillance systems for detection of any unusual microbial agents used for bio-terrorism. It also has an institutionalised mechanism for management of biological disasters including epidemics.
- vi) Three Hazardous Material (HAZMAT) vehicles are available with the Delhi Fire Service which can be used for protection, detection, decontamination and sample collection in addition to rescue of victims.
- vii) There are two national poison information centres: one at AIIMS, Delhi and the other at Environment Centre, Chennai. In addition, there are five Emergency Response Centres (ERCs) located in different parts of the country.

2.3.2 DNA Fingerprinting Laboratory

Identification of the dead is performed by various methodologies including basic

medical examination to the sophisticated DNA fingerprinting methodology. There are few DNA fingerprinting laboratories, among which CDFD is a national referral laboratory. There are many laboratories in scientific and academic institutions which have the capability of carrying out DNA analysis. But their capabilities will have to surge in case they are required to help in identification of dead in a mass casualty event. A list of potential-laboratories is given in Annexure-F.

2.3.3 Blood Transfusion Services in India

Blood transfusion services constitute a crucial component in managing mass casualty events. There are 2,177 licensed blood banks. To assure quality, NACO has been running a Blood Safety Programme since 1992. The Drugs and Cosmetics Act has been amended to permit the establishment of blood storage centres at sub-district levels. Voluntary donations which used to be around 20% a decade earlier have reached 50%. Some of the better performing states have even recorded 80%. The Indian Red Cross Society is a major player. Private commercial blood banks are also emerging. Component separation facilities are also being expanded.

2.4 Recent National Developments

Enactment of the DM Act, 2005

In view of the large losses of life and property by natural calamities and the devastating potential of man-made disasters, the Union Government decided to institutionalise disaster management and focus on prevention, enhanced level of preparedness, prompt and effective response and capacity building. The DM Act, 2005 was enacted on 23 December 2005. The Act seeks to institutionalise the mechanism for effective DM at the national, state and district levels to plan, prepare and ensure a swift response to both natural calamities and man-made disasters/accidents.

The Act, *inter alia* mandates:

- (a) the formation of a national apex body, the NDMA with the Prime Minister of India as the ex-officio Chairperson,
- (b) the state governments to establish the State Disaster Management Authority (SDMA), and also create district and local authorities.

Powers and functions of the NDMA:

The NDMA constituted under Section 3 of the DM Act, 2005, has the responsibility of laying down the policies, plans and guidelines for disaster management. NDMA is responsible to:

- i) lay down policies on DM;
- ii) approve the national plan;
- iii) approve plans prepared by the ministries or departments of the Gol in accordance with the national plan;
- iv) lay down guidelines to be followed by state authorities in drawing up the state plan;
- v) lay down guidelines to be followed by the different ministries or departments of the Gol for the purpose of integrating the measures for prevention of disasters or the mitigation of their effects in the development plans and projects;
- vi) coordinate the enforcement and implementation of the policy and plans for DM;
- vii) recommend provision of funds for the purpose of mitigation;
- viii) provide such support to other countries affected by major disasters as may be determined by the central government;
- ix) take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or disaster as it may consider necessary;

- x) lay down broad policies and guidelines for the functioning of National Institute of Disaster Management (NIDM).

The NDMA will be assisted by its executive committee, the National Executive Committee (NEC). The NEC has the responsibility for implementing the policies and plans of the NDMA. The NEC will act as the coordinating and monitoring body for DM for the implementation of the national plan.

The NDMA is, *inter alia*, responsible for coordinating and ensuring implementation of the government's policies and plans for disaster reduction/mitigation and ensuring adequate preparedness at all levels; coordinating response to a disaster when it strikes, and post-disaster relief and rehabilitation; and coordination of rescue, relief, rehabilitation, and reconstruction efforts at all levels. At the national level, the Gol has taken the initiative to create NDRF units with MFRs to deal with natural and man-made disasters.

The NDMA will help maintain, build and strengthen the existing machinery, structure and mechanism. The nodal ministry will continue to be responsible for DM, and based on the guidelines issued by NDMA, will prepare the detailed action plan for DM. Similarly, all ministries/departments of state governments and UTs will prepare comprehensive action plans that will address all phases of the DM cycle in a coordinated manner. The plans will finally be approved by the NDMA which will coordinate and ensure their implementation with the help of all concerned agencies.

2.5 Genesis of the National Disaster Management Guidelines—Medical Preparedness and Mass Casualty Management (NDMG—MPMCM)

As per the DM Act, 2005, the NDMA is required to prepare the national guidelines, based on which, the nodal ministry will prepare

a detailed action plan in consultation with states and other stakeholders for better and effective medical management of all disasters.

A national workshop was held on 22 and 23 August 2006 to discuss the important issues of medical preparedness and mass casualty management. During this meeting, after the deliberations on the present status of medical preparedness by various national experts including regulatory bodies i.e., the MoH&FW and line ministries like the MoR, MoD, MoL&E (represented by ESIC) and DGHS at the centre and in various states; various professional and research institutions including IHBAS, ICMR, CDFD, NICD, PGIMER; academia and NGOs like Lifeline Express etc., a future course of action was set. It was decided to articulate the MPMCM guidelines through a national document called the National Disaster Management Guidelines—Medical Preparedness and Mass Casualty Management (NDMG—MPMCM). A core group of experts from various fields of hospital and health management, medical education, mental health and psychosocial services, trauma care, representatives from the nodal ministry MoH&FW and line ministries including DGAFMS, MoD and MoR; academic institutions like PGIMER, Chandigarh and experts from NICD, Delhi, state hospitals and private hospitals related to MPMCM was constituted under the chairmanship of Lt. Gen. (Dr.) J.R. Bhardwaj, PVSM, AVSM, VSM, PHS (Retd), Hon'ble Member, NDMA to assist NDMA in preparing the National Guidelines on MPMCM. Several meetings of the core group were held to review the draft versions of the document.

2.6 Approaches to Mass Casualty Management

In India the most common approach followed is 'scoop and run' which does not require specific technical ability from the rescuers. This often results in the transfer of the problem from

the incident site to the hospital, overwhelming and disrupting its medical care capacity.

The 'classical care approach' to mass casualty management juxtaposes two organisations that are working independently with only weak linkages: The field organisation (often involving non-health sector responders), and the receiving hospital which is often isolated from the pre-hospital problem. The search and rescue and MFRs and the action undertaken by hospital units follows this approach. The mass casualty management system approach envisages pre-established procedures for resource mobilisation, field management and hospital reception. In the new framework, a need of a well-established framework between various stakeholders has been realised.

The major pillars that need to be strengthened include:

- i) Epidemiological surveillance.
- ii) Public health measures for containment of disease outbreaks.
- iii) Concept of pre-hospital care at the disaster site.
- iv) A unified incident command system.
- v) Community participation.
- vi) Harmonisation of the concept of triage.
- vii) Communication network.
- viii) Transportation of mass casualties during disasters.
- ix) Capacity development of various linkages and supporting functions.
- x) Updating of the medical set-up to handle mass casualties.
- xi) Networking of critical care facilities at earmarked hospitals and trauma care—with referral linkages.
- xii) Rehabilitation including psychosocial care.

- xiii) Specialised incident-site and hospital capabilities to handle CBRN casualties.
- xiv) Human resource development by training manpower.
- xv) Resource mobilisation based upon the nature of disaster.
- xvi) Adoption of new technologies used worldwide for effective mass casualty management.
- xvii) Network of blood transfusion services, bio-safety laboratories, poison centres and other facilities.
- xviii) Network of different detection and testing laboratories for different kinds of samples.
- xix) Mechanism and capacity development to deal with public emergencies.
- xx) Material logistics.
- xxi) Simple and concise documentation for the victims requiring medical care.
- xxii) Identification of deceased by modern technologies.
- xxiii) PPP—development of regional consortiums for critical care.

The approach needs to be proactive at the stakeholders level and should be community-centric so that the system thus evolved will be self-sustaining and update itself continuously in the coming years.

Introduction

Health care facilities in India are growing at a rapid rate, though the growth is mainly restricted to urban areas and there is an urban-rural divide. Only 10.3% of the total hospital beds available in the country cater to the rural population which comprise 70% of the total population. In 1961 the Mudaliar Committee recommended one bed per 1,000 of population that has not yet been achieved. According to an estimate in the World Health Report, the increasing requirement of 80,000 beds every year for the next five years can only be fulfilled with the proactive involvement of private players in the medical field. In view of the requirement of medical preparedness for disasters, it is essential to develop emergency medical response, trauma care, preventive measures for epidemics, hospital preparedness, training, education and other specialised facilities as an integral component of the presently growing health sector. A new dimension of CBRN disasters due to the threat posed by accidental and terrorist sabotage activities needs immediate redressal. Such measures are required to be attained in a time-bound manner.

3.1 Preventive Measures

India has vast experience in tackling the public health burden of communicable diseases hence the country is well placed to manage public health emergencies of mass casualty potential. Experienced Quick Response Medical Teams (QRMTs), rapid field investigations, supported by a network of bio-safety laboratories of appropriate levels

and centres of excellence such as NICD and institutions under ICMR have the expertise to prevent/contain any such outbreaks. In spite of such efficient systems, there are some important areas that need improvement:

- i) The number and quality of bio-safety laboratories needs augmentation.
- ii) Continuous research at the national level is needed to develop capabilities against newly emerging biological agents and other toxicants.
- iii) Existing public health laboratories are required to be fully equipped and functional.
- iv) The IDSP is yet to be operationalised in all the districts with a major component of computer aided information dissemination that would be in a position to detect early warning signals for instituting appropriate public health measures.

3.2 Preparedness for Emergency Medical Response

3.2.1 Incident Command System

The indigenous version of the ICS, which will be suitable for our own specific needs and in consonance with the DM Act, 2005, is being evolved and firmed in. Presently, one such model is already under trial and will be further refined after the trial. The administrators will be required to be trained thoroughly for its proper implementation. Once in place, it would address many of the deficiencies prevailing in the present system especially those

concerning coordination in planning, operations and logistic management. Pre-hospital care will be established with operationalisation of the medical task force. The incident medical post needs to be defined regarding the composition and capacity, based upon a need assessment analysis. A more active involvement of medical personnel in the ICS is needed. A unique and toll free emergency telephone number needs to be created at the national level to call for medical help from any part of the country.

3.2.2 On-Site Mass Casualty Management

- i) The concept of pre-hospital care and mass casualty management in the field is not yet fully developed.
- ii) SOPs for on-site mass casualty management of victims are not available.
- iii) In the hospital setting, the concept of triage is followed informally depending upon the clinical acumen of the attending doctor. Triage concepts are required to be developed and followed meticulously.
- iv) SOPs regarding specialised care for CBRN casualties, including the usage of antidotes are lacking.
- v) There are an inadequate number of mobile hospitals and mobile teams.
- vi) There is lack of on-site planning in district disaster management plans.
- vii) The medical inventory categorised for natural, man-made and CBRN disasters is also inadequate. No stockpile of medical supplies exists for surge capacity. Proper standardised protocol for emergency procurement and relay, and the concept of supply chain management need to be further developed.
- viii) There are an inadequate number of trained paramedics.

3.2.3 Transportation

All modes of transport are used in mass casualty incident settings—personal vehicles, trucks, tractors, tempos and even bullock carts. The major gaps existing in this area include:

- i) Ambulances are conspicuous by their absence. Presently, the basic life-support facilities are grossly inadequate. There is also a lack of coordination between the various agencies possessing ambulances, thus a major part of the community is not benefited.
- ii) There are also very few advanced life-support ambulances. There is no accreditation system for ambulance services in India.
- iii) Floating hospitals are already being used in Assam, however, the concept of heli and ship ambulances is yet to be developed in other parts of the country.
- iv) Need to develop a mechanism for evacuation services with special attention to vulnerable groups. Private players are also not utilised properly for development of this sector.
- v) Lack of coordination and integration amongst various first responders including the fire services and police department.
- vi) The mechanism to evacuate the population to pre-identified sites in safer zones is lacking in district disaster management plans.
- vii) Lack of designated air ambulances and absence of mechanism to prioritise the landing of medical flights.
- viii) Absence of landing facilities for heli-ambulances.
- ix) Stern traffic rules and policies are needed for smooth movement of ambulances specifically for surface ambulances.

- x) Public awareness needs to be created regarding ambulance services, helpline numbers and their appropriate usage during emergencies.

3.2.4 Communication

An efficient communication system is one of the most essential elements in managing MCE. At times, disruption of infrastructure as an aftermath of disaster can affect the terrestrial/wired communication system and affects all sectors including health care delivery. State-of-the-art communication systems are available in the country though their utilisation in the health delivery system is grossly inadequate.

- i) At present, the communication network between hospitals is inadequate to manage mass casualties.
- ii) There is lack of intra-communication facilities in most of the district/sub-district level hospitals.
- iii) No direct communication network exists between hospitals and police/fire services. Some district/taluka/CHC hospitals are provided with only a single telephone as a measure for external connectivity.

3.2.5 Capacity Development

Capacity development in the health sector is a priority area. Disasters can only be tackled in an appropriate way if there is an adequate availability of skilled manpower supported by essential material logistics and infrastructure. Although initiatives have been undertaken to improve basic health care facilities all across the country, more efforts are required.

A) Human Resource

- i) In hospitals there is shortfall of anaesthetists, neurosurgeons, psychiatrists,

orthopaedic surgeons, doctors, nurses, paramedics and technicians. This is more so in government hospitals. Gaps in human resource are much more profound in district/taluka/and community health care hospitals.

- ii) For mass casualty management, mobilisation of human resource from neighboring districts/states/centre, depending upon the magnitude, is the preferred strategy. Although such mobilisation can be achieved within 24 hours, follow-up on patient care suffers after withdrawal of these teams.
- iii) The number of doctors with specialised capabilities to tackle CBRN casualties is inadequate even in the tertiary care hospitals.
- iv) District level quick response teams are lacking.
- v) Highly skilled paramedics known as emergency medical technicians are required for handling medical emergencies.

B) Material Logistics

State run hospitals have limited medical supplies and there is no stockpile for surge capacity. The procurement procedures are tedious and time consuming. Some of the states have well-established material procurement systems which are useful in disaster settings. In most of the states there are no standardised protocols for emergency procurement and they rely substantially on central supplies or donations from various agencies. Despite sufficient availability of medical stores in the country, there are some areas that need immediate attention:

- i) There is a need to strengthen medical inventory and supply chain management.
- ii) Web/computer based network of medical stores does not exist.

- iii) The national medical resource inventory needs to be networked with various state medical inventories.
- iv) Newly created districts need appropriate health care facilities.
- v) The health care facilities at the district levels need upgradation.

C) Training and Education

There have been some efforts to train hospital managers in mass casualty management from 1996 onwards through WHO projects. The emphasis was on the district hospitals to have their own disaster management plans. However, these efforts were a drop in the ocean considering the enormous training load. The glaring gaps that need redressal include:

- i) Need to evolve the training module and education curriculum for updation of mass casualty management skills for doctors, nurses, paramedics at district/sub-district levels, on basic and advanced life-support systems for managing mass casualty events.
- ii) Need to evolve standardised training modules for different medical responders/ community members at the disaster site.
- iii) The training required for designing mock drills/exercises is not available.
- iv) Education about the basic medical practices for management of mass casualties is required to be developed at the school and college level.
- v) Identification/development of training institutions for 'emergency medicine'.
- vi) Regular mock exercises are required to be conducted at the hospitals a minimum of twice a year.

D) Community Preparedness

Community members are usually the first responders, though, their effectiveness becomes limited during disaster situations due to lack of knowledge in first aid. The areas which need to be considered are:

- i) Community education and awareness about various disasters and list of Dos and Don'ts.
- ii) NGOs and Private Voluntary Organisations (PVOs) need to be involved in community education and sensitisation.
- iii) Conducting regular mock exercises for developing resilience in the community.

3.3 Hospital Disaster Preparedness

Hospitals are an important unit for the management of mass casualties. Hospital preparedness in the pre-disaster phase enhances the effectiveness of their coordinated response during disaster situations. In India, there are different hospitals under different administrative setups. The availability and quality of medical facilities differ drastically from urban to rural and from private to governmental hospitals. Thus, preparedness calls for hospital disaster management planning at the hospital level, its development and upgradation, planning at district/state level and overall regional plans for effective management.

- i) Government/medical college hospitals in major cities and state capitals have, on an average, more than 500 beds. Even in these hospitals emergency department/critical care facilities are inadequate. However, surge capacity may exist to some extent to manage mass casualty events arising due to conventional disasters.

- ii) Most of the district level hospitals, taluka hospitals and CHCs are not equipped to handle mass casualty events. In many states, 30-50% of their hospital beds are in rural areas. Emergency support systems including critical care support in these hospitals are grossly inadequate. Most of them do not have alternate sources of electricity, water, gas supply, fire extinguishing devices or evacuation plans.
- iii) Areas and sites to receive and manage mass casualties are not earmarked and properly prepared in most of the hospitals.
- iv) The rate of quality accreditation is slow and needs immediate attention for encouragement of quality care at all levels.
- v) Registration and accreditation policy should make it mandatory to have a hospital DM plan and administrative policy to define the role of hospitals in disaster management.
- vi) The urban-rural distribution of medical assets is grossly imbalanced.
- vii) Although the number of private hospitals are increasing, they are not appropriately planned to manage MCE. Firm administrative policy should be in place for developing such plans at the hospital level.
- viii) Absence of networking between public and private hospitals.
- ix) The hospital buildings are not constructed according to Bureau of Indian Standards (BIS) codes in the seismic zones.

3.3.1 Critical Care

India has about 8,000 intensive care beds whereas the minimum projected requirement is 50,000. There are few beds available for critical care at the district hospitals. The existing facilities are already overwhelmed with

routine emergency requirements and very few hospitals in rural or urban settings have surge capacity to accommodate additional patients requiring ventilatory support.

3.3.2 Blood Transfusion Services and Blood Safety

- i) There are still some districts with no blood transfusion facilities.
- ii) Blood storage and transportation facilities are not adequate in most of the regional blood transfusion centres to handle disaster situations.
- iii) Private commercial blood banks are also emerging, though they are not integrated into the system.
- iv) Component separation facilities are not enough for dealing with mass casualties.
- v) There is no provision for additional funding of state Regional Blood Transfusion Centres to tackle disasters.
- vi) The inventory maintained by most of the blood banks in the country is inadequate.
- vii) There is total reliance on people's sentiments to come forward and donate blood during disasters. This needs to be supplemented with appropriate blood preparedness measures.

3.3.3 Specialised Facilities for CBRN Casualties, Trauma and Burns

- i) CBRN disasters require specialised training and facilities such as decontamination systems, Personal Protective Equipment (PPE), detection equipment, decorporation agents, antidotes, critical care support, identification and management of CBRN contaminated dead bodies. These facilities are grossly lacking even in our tertiary care institutions.

- ii) Training programmes for doctors, nurses and paramedics on CBRN management are inadequate. Training of civil defence, Red Cross and NGOs on first aid, resuscitation, wound management etc., in a CBRN environment is also lacking.
- iii) A database of health facilities, medical, nursing and paramedical professionals in the field for CBRN casualty management is not available.
- iv) Facilities for bone marrow transplant are very limited.
- v) Facilities for environmental sampling to facilitate identification of biological agents are also needed.
- vi) Genetically modified antibiotic resistant strains of microorganisms are likely to be used as biological agents, therefore genome detection by employing DNA probes are very essential which are lacking at the moment.
- vii) New poison centres are required to be established along with upgrading of existing facilities.
- viii) Burn management needs trained manpower and infrastructure support in terms of burn intensive care and plastic surgery facilities. Currently these facilities are very few and not available even in the major tertiary care institutions. The burn centres are not sufficient in number to handle mass casualty events.
- ix) The concept of trauma care is lacking.
- x) Rehabilitation services for trauma cases also need to be built up in major tertiary care institutions.

3.3.4 Identification of Dead Bodies and Mortuary Services

Identification of dead bodies and their disposal is an important activity in mass casualty

events with its legal, psychosocial and ethical perspectives. It is a highly specialised scientific discipline involving molecular, genetic and computer aided technologies. The technologies are available within the country but their application in disaster settings require operational research, refinement, development of cost-effective technology, capacity building and use of standard protocols. The major gaps include:

- i) Inadequate storage facilities in mortuaries. The mortuaries of even the secondary care institutions are not adequately equipped.
- ii) Poor maintenance of existing mortuaries.
- iii) Standard protocols need to be developed which are scientifically validated and suitable to our environment, for setting up temporary mortuaries in increased demand situations during disasters.
- iv) There is a need to enhance the capacity of mortuaries in the highly vulnerable areas.

3.4 Post-Disaster Phase

The post-disaster phase is a critical period and the aim will be to bring back normalcy in the shortest possible time. Medical professionals have an important responsibility in long-term management in the aftermath of disasters. The major areas that require upgrading are discussed in the ensuing paragraphs.

3.4.1 Rehabilitation, Reconstruction and Recovery

There is no specific mechanism existing for management of various activities during the rehabilitation, reconstruction and recovery phase in the aftermath of disaster. Immediate emphasis must be focused on physical health problems and acute psychosocial trauma. Simultaneously, attention is required for prevention of impending epidemics in the post-disaster phase. Moreover, the activities

facilitating recovery and rehabilitation tend to dwindle or reduce in different ways, especially after the first 6 to 12 months. At present there is a lack of adequate facilities for long-term rehabilitation and mental health care for disaster victims. The major areas of concern for meaningful and comprehensive rehabilitation, reconstruction and recovery are:

- i) Lack or absence of a comprehensive, inter-sectoral approach.
- ii) Inadequate emphasis on resource mobilisation, and relevant economic policies like employment generation schemes.
- iii) Lack of long-term plans and programmes, for rehabilitation and reconstruction.
- iv) Inadequate understanding and emphasis on the psychological aspects of rehabilitation and recovery.
- v) Lack of adequate focused programmes for the rehabilitation and recovery of the vulnerable groups.
- vi) Inadequate community participation and involvement in the planning and execution of the rehabilitation and recovery programmes.

3.4.2 Psychosocial Support and Mental Health Services

Disasters leave a trail of human agony, which requires psychosocial intervention apart from logistic and material help. Our country possesses rich experience and adequate expertise in providing mental health services and psychosocial care. Successful models of mental health delivery and psychosocial care are also available. The National Mental Health Programme (NMHP) of India through its District Mental Health Programme (DMHP) in coordination with the primary health care system is a potential resource for delivery of such services especially

during and in the aftermath of disasters. Despite huge resource potential, there are some critical deficiencies in the available systems, as briefly summarised here.

- i) The training of medical undergraduates, nurses and health workers in mental health services is grossly inadequate. There is virtually no emphasis on mental health aspects of disasters even in the postgraduate training in psychiatry or other mental health disciplines. There is a need for coordinated training, services and monitoring at the district and state level.
- ii) Although adequate mental health services are made available during the early phases after disaster, these are usually withdrawn within six months. The mental health services need to be planned for a minimum of two-five years, sometimes extending beyond five years.
- iii) Quality control mechanism is required to ensure the appropriateness and relevance of the interventions for psychosocial care.
- iv) The coordination among various agencies involved in mental health delivery and disaster relief work has often not been satisfactory resulting in suboptimal use of resources.
- v) A large gap exists between knowledge acquired from the vast amount of research and service delivery experience, and the actual implementation (transformation into action) and integration of this knowledge in disaster relief measures.
- vi) There is a need for an inter-sectoral approach beyond the field of health in providing a spectrum of care that is integrated rather than a stand alone vertical programme on mental health.

- vii) There is a need for formulation and implementation of suitable micro- and macro-level economic policies for rehabilitation and reconstruction.

3.4.3 Research and Documentation

The areas of basic and applied research and documentation that need to be considered are:

- i) Inadequate documentation of disasters and their scientific analysis. Standardised protocols for scientific analysis and drawing lessons are also not existing.
- ii) Research pertaining to development of new treatment modalities, specific biomarkers, advanced robotic tools etc., needs an overall upgrading to meet global standards.
- iii) Documentation process will be made more simple and concise.

3.4.4 Roles of Other Stakeholders in Medical Management of Mass Casualties

The effectiveness of DM depends upon the adoption of efficient management practices including the division of work among the different stakeholders. The roles identified for different stakeholders need to be clearly defined and practiced using mock drills.

3.5 Finance

Adequate financing for disaster prevention, preparedness and management at state and national levels has not been addressed properly. The authorities concerned need to regularly earmark funds for activities to strengthen MPMCM. These issues are required to be addressed on priority basis so that long-term planning for flow of funds is organised. Health Insurance and social security systems have not been implemented at the grass-root level.

3.6 Disaster Management Plans

- i) There is a need to develop a standardised model for development of medical plans based upon the 'all hazard' concept.
- ii) Urban population is composed of slum 'areas and affluent classes, both having varied health problems. These are generally compounded by dense population, industrialisation and large scale migrations. It can lead to different types of events of mass casualty including biological disasters and rapid spread of communicable diseases. Such concerns need to be included in city disaster management plans.
- iii) PPP for mass casualty management has not been taken up in the magnitude required for medical preparedness.

4

Guidelines for Mass Casualty Management—Preparedness

A mass casualty event includes all the incidences that are beyond the coping capacity of the local administration. In mass casualty events, a large number of people and livestock get affected resulting in a high degree of morbidity and mortality. The arrangements for the management of livestock including the disposal of carcasses will be addressed. A number of measures are required during the preparedness phase so that the impact of the disaster can be reduced. These measures when implemented fully can restore normalcy at the earliest.

4.1 Legislative and Regulatory Framework

The central and state health departments are responsible for health care delivery. Legislation and regulatory framework at each level is responsible for proper implementation of their programmes. Therefore, it is important to reassess the existing regulations and if needed, modified or new acts/ rules/regulations be enacted. These should address the problems faced in the past during the management of mass casualties.

One of the important issues is to devise a legal framework for the active involvement of the private/ corporate sector in the health care management system.

The DM Act, 2005, provides for institutional mechanism for the effective management of disasters and for matters connected or incidental thereto. This institutional mechanism

comprises creation of the national, state and district disaster management authorities. Their responsibilities include laying down policies, plans and guidelines, with active involvement of all concerned government institutions, Panchayati Raj Institutions (PRIs)/local bodies/statutory bodies and NGOs. At the district level, the district collector/magistrate has been empowered by the DM Act, 2005, to act as the chairperson of the DDMA and will be responsible for the management of a crisis. The medical management aspects will be taken care of by the Chief Medical Officer (CMO) of the district under the directions of the chairperson. The various nodal health managers identified in the pre-disaster phase will follow the directions of the CMO for the coordinated management of a mass casualty event. It is necessary to dovetail all the relevant acts/rules in harmony with the DM Act, 2005.

The NDMA is assisted by the NEC in coordinating the enforcement and implementation of the policy, plans and guidelines for disaster reduction/mitigation. They will also ensure adequate preparedness, coordinate response, post-disaster recovery and rehabilitation. The various guidelines for medical preparedness are discussed in the ensuing paragraphs.

4.2 Preventive Measures

To develop effective preventive strategies, the epidemiological programmes will be designed to foresee the problems that will demand interventions, before the disasters. The major recommendations for prevention of disasters include:

- i) Proper implementation of immunisation programmes. Special campaigns for immunisation will be conducted in high risk, vulnerable areas prior to impending disasters to prevent post-disaster epidemics.
- ii) The IDSP will be fully operationalised in all the districts shortly with the help of computer-aided information. It will enable detection of early warning signals for "instituting appropriate public health measures. The major indicators will include morbidity indices, existing factors and deficiencies amongst vulnerable groups of society. The surveillance team will monitor and investigate the probable sources, modes of spread and environmental effects of the epidemics. The surveillance programme will also integrate all laboratories including those in the private sector.
- iii) The Early Warning System (EWS) is a variant of the surveillance system designed to anticipate a disaster and limit its effects. Such a system assists in predicting disasters using mathematical tools (Annexure-G). The model of epidemiological surveys include initial assessment; organisation of surveillance and development of the EWS that would be further integrated with other communication systems to develop an effective EWS. Further it is also necessary to develop disaster-specific models of the EWS and ensure integration with the medical response plans of the districts.
- iv) A defined reporting and simple feedback mechanism of surveillance data in a standardised manner will be developed. The system of compulsory reporting including filing of 'nil reports' will also be made mandatory.
- v) Surveillance systems should identify the various spots from where the samples need to be collected, like food and water sources and sanitation systems including toilets.
- vi) Dedicated communication systems within states and a standardised system of reporting from district to state and national level will be strengthened.

4.3 Preparedness

Medical preparedness relates to activities for management of diseases and trauma, emergency medical response, quick evacuation of casualties, well-rehearsed hospital disaster management plans, training of doctors, paramedics and upgrading of medical infrastructure at various levels which will reduce morbidity and mortality. The important components of medical preparedness are given in succeeding paragraphs.

4.3.1 Emergency Medical Response (EMR)

One of the major aspects of preparedness for emergency medical response includes prompt establishment of medical posts at the incident command site in the safe zone near the actual emergency site. Medical teams will be fully trained and equipped to handle all kinds of emergencies resulting from natural or man-made disasters. The 'golden hour' is a critical period between injury and life/limb saving surgery that decides the patient's outcome. Within one hour of injury, treatment should commence by providing basic life-support to reduce morbidity and mortality. Important components of preparedness for effective EMR planning at the incident site are as follows:

- i) Development of infrastructure including EOCs, GPS based control rooms and other networks, training of specialised responders and their interaction with MFRs, equipping them with the latest state-of-the-art equipment.

- ii) Indicators for providing prompt warning for activation of the medical system, selection of the IC site and other emergency locations and switch over procedures for calling backup medical services.
- iii) The concept of triage in trauma and other types of disaster victims will be promoted. SOPs for carrying out activities like triage, resuscitation and treatment at the incident site and preparedness/mitigation plans will be developed.
- iv) The standards for detection, decontamination and decorporation, BLS (Air way maintenance, ventilation support, control of hemorrhage, anti-shock treatment and preparation for transportation) will be laid down.
- v) Various treatment profiles for the management of the victims of natural and man-made disasters will be developed.
- vi) EMR plans will be integrated with the public health system of the district under the single unified command and control of the CMO.
- vii) The mechanism for checking the status of coordination in planning, operations and logistic management will be developed.
- viii) A list of all resources and emergency risk medical inventory including drugs, equipment etc., will be prepared and made available online and integrated with the IDRN network.
- ix) An inter-services communication system will be developed and dovetailed into the emergency functioning.
- x) There will be periodic mock drills for checking the response timings and reducing them to the bare minimum. Periodic training and retraining schedules will also be prepared. Drill will be conducted at least twice a year at each

hospital to test their DM preparedness and integration with other emergency functionaries for prompt and effective medical response.

All these modalities will be integrated into the 'all hazard' plan for the effective management of victims at the incident site.

4.3.2 Transportation and Evacuation of Casualties (EOC)

Emergency medical evacuations by definition are unplanned, unexpected and urgent. The ideal evacuation time should be in minutes so that patients can be treated in the 'golden hour'. The major recommendations for evacuation services are:

- i) The transportation and evacuation of casualties will be organised using a multi-sectoral approach including PPP. The district disaster management plan will have an evacuation plan with identified routes, types of ambulances that are to be used during different levels of disaster and a resource inventory of paramedics, doctors, QRMTs and drivers.
- ii) There will be an Integrated Ambulance Network (IAN). These units will be responsible for the maintenance of all evacuation services during disasters. They will maintain the minimum response time keeping the 'golden hour' concept in mind. In the initial phase, the IAN will be established in the metro cities followed by different districts based upon their multi-hazard status. Each ambulance should have basic medical equipment for resuscitation, essential drugs, stretchers and two-way communication. The support staff of the ambulance should be well-versed in the use of the equipment it is carrying. The minimum standards for equipping surface ambulance will be worked out and states will ensure their availability

- so as to achieve the requisites of BLS. The list of drugs with its expiry date and equipment serviceability should be checked regularly. The authorities will ensure availability of specialised ambulances fitted with special equipment to carry CBRN disaster casualties.
- iii) SOPs for regular maintenance of the ambulance and its medical equipment will be laid down.
 - iv) The ambulance network developed will be integrated into the other emergency networks of the districts including police/ fire/State Disaster Response Force (SDRF).
 - v) Designated air ambulances and adequate mechanism to prioritise the modalities for aerial evacuation will be developed.
 - vi) Adequate number of helipads will be made for heli-ambulances. Such landing facilities in the cities may include rooftops and side line spaces along national and state highways. Open spaces available in highly populated sectors will also be identified.
 - vii) Strict implementation of the existing traffic rules and policies will be done to prevent casualties due to delays on congested roads.
 - viii) Public awareness, campaigns will be undertaken in regard to ambulance services of the city, helpline numbers and their appropriate usage during emergencies.
 - ix) Train Based Casualty Transport and Evacuation System:
 - a. Self-Propelled ARMVs of the railways located at seven strategically located locations in India (Northern, Central, Western, Eastern, South-Central, Southern and North-East) will be moved to render immediate medical relief during disasters as part of the Integrated Disaster Management Plan for Medical Relief and Mass Casualty Management. The currently available ARMVs will be suitably modified to accommodate indoor bed facilities for at least 50 persons.
 - b. These ARMVs will be equipped with full Trauma Care Management including life-saving surgery.
 - c. In MCE, more than one ARMV may be required at the disaster site or nearest available railway station.
 - d. These ambulances having a two hour response time will be integrated into the state DM plan.
 - e. These ARMVs are required to be manned by trained personnel who are ready to move at short notice. For this, during the pre-disaster periods these ARMVs will be utilised to provide community based health care services in conjunction with the district and state health administration. This will also ensure that all the equipment in the ARMVs is properly maintained and in actual use at all times.
 - f. The facilities of NGOs like the Lifeline Express are useful models for mobilisation of medical help to the incident site. This will be replicated in other places along with a focus on community awareness.
 - g. The railway disaster plan will provide crucial support to the community and local administration during mass casualty emergencies. This plan will include accidents involving transportation of hazardous materials.
 - x) Depending upon the multi-hazard vulnerability status of various states, critical distances, condition of casualties, remoteness of the area etc., an aerial ambulance network will be planned. States will be encouraged to

make necessary arrangements so that air evacuation is available in times of need.

- x) Casualties may need to be evacuated by waterways. Disaster medical management plans will consider the availability of medical ships/boats for evacuation of disaster affected casualties.
- xii) ESI ambulance network will be integrated into the district disaster management plans.
- xiii) The inter-district evacuation services network will also be developed and practiced during state-level mock drills.
- xiv) There will be an inventory of all the patient evacuation services, emergency medical personnel and paramedics.

4.3.3 Mobile Hospitals and Mobile Teams

- i) Full-fledged containerised mobile hospitals will be acquired and attached with hospital earmarked by centre/states/districts. The scale of authorisation will be decided by the centre/states based upon the need assessment analysis.
- ii) Mobile hospitals will be located at strategic locations earmarked by states/districts and will be attached to designated hospitals. These will be made available at the disaster sites involving MCE. These full-fledged containerised hospitals will also be used for training of medical teams and will be deployed for large congregations of people like religious and cultural fairs. The important features of mobile hospitals are given in Annexure-H. Such hospitals can be moved at the time of disaster or threatening disaster situation to treat a large number of casualties at the site.
- iii) The role of mobile teams/QRMTs is to provide on-site emergency

medical treatment to casualties. The teams will have a medical officer, nurse, paramedics and driver who could help in first aid and loading/unloading of casualties. The teams will be equipped with emergency medical equipment to provide BLS. Necessary logistics, including medical stores, etc., will be made available to these teams. The teams will also make a complete assessment of the situation and transmit information for additional requirements of medical teams and ambulances. Designated mobile teams will participate in the regular disaster management mock drills.

- iv) The stocking of emergency medical stores will be done by the state governments. 'Bricks' of medical stocks capable of treating 25/50/100 casualties will be kept ready to go with the QRMTs at short notice.

4.3.4 Communication and Networking

Communication is a vital component of DM. In addition, communication systems are also vulnerable to failure during disasters, thus it is important to develop strategies to protect these systems and to make them more disaster resilient.

- i) All hospitals will be connected with the Integrated Ambulance Network, QRMTs/ MFRs and various emergency functionaries of ICS through a dedicated communication network. All hospitals will have an intra-/ inter-hospital horizontal network. Dedicated telephone numbers will be made available to hospitals. The network will also be integrated with police, fire and other helpline services.
- ii) A specialised communication network will also include tele-medicine. The

Indian Space Research Organisation (ISRO) has established two-way video conferencing facility using specific satellite bandwidth at both sides i.e., provider and user end at some places. The Village Resource Centre (VRC) of ISRO will also be utilised. BSNL is also expanding its broadband connectivity to taluka level. These communication systems will be utilised for tele-medicine during disasters.

- iii) Mobile tele-health is another concept of tele-medicine that can be used for disasters by putting diagnostic equipment and Information Communication Technology (ICT) together on a vehicle to get connectivity between the disaster site and advanced medical institutes where such connectivity already exists. Such systems may be placed in known disaster prone areas or could be moved at the onset of disasters. Such systems will be developed at regional levels.
- iv) The development of GIS-based statistical data, population indices and demographic data by ground level documentation and data management during mass casualty events. This data will be made available to the surveillance teams.
- v) A single emergency toll-free telephone number will be introduced for the entire country.
- vi) Mechanism to check the redundancy of data, voice communication and security of the communication network will be developed.
- vii) Radio-frequency based systems to locate and manage resources and inventory will be allocated at specific locations.
- viii) All the communication systems within the medical set-up will be linked to the national communication network.

4.4 Capacity Development

Capacity development requires all round development of human resource and infrastructure for establishment of a well-focused and functional DM medical system. This will be developed by pooling the resources available with MoD, MoR, MoH&FW, MoL&E and NGOs. It will include training of all stakeholders including doctors, nurses, paramedics and other resource persons as well as pooling of other identified resources for DM. State/ district authorities will ensure the development of basic infrastructure and other supporting facilities. Emphasis will be given to the following areas:

- i) State/district authorities will ensure the availability of specialists in DM in accordance to disaster risks of the particular region.
- ii) MFRs will be trained in triage and BLS. Ambulance services will be developed at all levels to evacuate casualties from the site of disaster.
- iii) ICS will be adopted and rehearsed for coordination at the district and state level.
- iv) A communication network will be developed to integrate all agencies handling disasters.
- v) Updating of medical stores will be done periodically on the basis of the risk analysis of the region.
- vi) Necessary mechanism will be developed for emergency purchases of drugs and other medical equipment by the CMO.
- vii) Facilities for storage of dead bodies will be in place and the system for rapid identification and disposal as per religious norms will be strengthened.
- viii) Mechanism to store rare blood groups for prompt availability during disasters will be developed. Mechanism to

- develop a cold chain for storage and transportation of blood and its components.
- ix) A resource directory will be prepared by various hospitals at centre, state and district levels specific for disaster management.
 - x) The concept of crisis expansion of beds will be dovetailed into the existing medical system.
 - xi) Arrangements between various private hospitals and the government will be developed for treating casualties during disasters and cost sharing factors will be worked out in the pre-disaster phase.
 - xii) Hospitals on national highways passing through disaster prone areas, will have specialised care facilities. An ambulance for trauma care supported by trained manpower and equipment will be placed every 50 km and a trauma centre at every 100 km under a national highway trauma care project.
 - xiii) The infrastructure and facilities under the NRHM will be utilised for increasing community participation.
 - xiv) The civil defence, home guards, Nehru Yuva Kendra (NYK) and community will be trained in first aid and will be able to provide public health services.
 - xv) Training of the fire and emergency services for management of CBRN disasters will be strengthened.
 - xvi) The medical and paramedical staff will be trained in management of mass casualty events including CBRN disasters.
 - xvii) The concept of supply chain management with minimum standards for all essential items like food, water, drugs, fluids, blood, etc., will be developed in collaboration with the corporate sector.
 - xviii) During the pre-disaster phase, the ARMVs of the railways will be utilised for providing community based health care services in conjunction with the state and district health administration.
 - xix) The assets available under the NRHM will be integrated with DM plans to make use of these resources during a crisis.

4.4.1 Training and Education

Disaster related medical training will be provided to medical officers, nurses, emergency medical technicians, paramedics and MFRs to handle disasters including CBRN and other types of MCE. The important recommendations are as follows:

- i) Paramedics, nurses, emergency medical technicians, ambulance drivers, QRMTs, the National Disaster Response Force (NDRF) and MFRs will be trained in various aspects of disaster medicine starting from BLS to specialised care including CBRN medical management as a part of the medical preparedness plan. Refresher training will be conducted for all stakeholders at regular intervals. An adequate number of specialists for CBRN management will be trained at various levels.
- ii) All medical professionals will be trained to perform Cardio Pulmonary Resuscitation (CPR). There is also a need to train other emergency responders to perform CPR properly and promptly until emergency medical help arrives. Necessary amendments are suggested to include BLS, pre-hospital trauma life-support, ALS and advanced trauma life-support in various curricula. Refresher courses on the different aspects of the medical management of casualties for all medical officers, specialists and medical students will also be conducted from time to time.

- iii) Selected hospitals will develop training modules and standard clinical protocols for specialised care including CBRN management and will train other hospitals in these programmes. Table top exercises using different simulations for training will be used at different levels followed by full-scale mock drills twice a year.
- iv) There is a shortage of various specialists/super specialists/mental health service providers. Condensed specialised courses for developing specialised human resource in DM will be held for medical officers.
- v) DM related topics will be covered in the various CME programmes and workshops by educational institutions in the form of symposia, exhibition, demonstration, medical preparedness weeks, etc. Dos and Don'ts for various natural and man-made disasters will be developed as a part of the community education programme. The duration of such programmes will be short, repeated periodically and also long-term including field exercises. The VRC model being developed by ISRO may be adopted by all 241 multi-hazard districts with appropriate modalities suitable to local requirements in 21 states for imparting education and training to the community. This may be suitably modified by the state to suit their specific needs/environment. Education of the community in first aid will be strengthened. Community education on various aspects of psychosocial care, public health issues and vulnerability of women, children, old and chronically ill patients will be encouraged.
- vi) Disaster medicine related education will be given in different vernacular languages through simple exercise models in course curriculum and through awareness programmes. Disaster related education already incorporated by CBSE, will be replicated by other national and state-level boards.
- vii) Disaster plans will be rehearsed as a part of training every six months.
- viii) Training modules for first responders will be made available in all regional languages.
- ix) First aid training will be given to all school students at appropriate levels.

4.5 Community Preparedness

The community will be trained to deal with disasters during the pre-disaster phase. This will be done by identification of task forces constituted from different community groups like resident welfare associations, vyapar mandals, PRIs, NGOs, local health care providers and others, for varied tasks of DM. The roles of these groups will be incorporated in DM plans and rehearsed periodically. The community groups will be involved in performing the following activities:

- i) Defining predisposing existing factors, endemicity of diseases, and various morbidity and mortality indices. The availability of such data will help in planning and executing response plans.
- ii) Providing support to public health services, sanitation in the area of disaster, disposal of the dead and preventive measures for controlling the possibility of epidemics will be mediated through various resident welfare associations and PRIs.
- iii) Providing social support and psychosocial care to the vulnerable groups.
- iv) Supporting activities like street shows, posters, distribution of reading material, school exhibitions, electronic media and publicity etc.

4.6 Hospital Preparedness

Hospital care is an important stage of medical management in a mass casualty event. The mortality and morbidity is inversely proportional to the level of preparedness at the hospital level. The demand made on the hospitals during a severe disaster may disturb any arrangement, but only the hospitals that are ready with plans to tackle them can meet the unpredictable challenges of disasters. The major issues under consideration are:

- i) Hospital planning will include both internal hospital planning and be a part of the regional plan for disasters and mass casualties. Hospital disaster planning will consider the possibility that a hospital might have to evacuate, quarantine, or divert patients to other health care facilities. The plan will be 'all hazard', simple to read and understand, easily adaptable with normal medical practices and flexible to tackle different levels and types of disasters. The plan will include capacity development, infrastructural development over a period of time and identify resources for expansion of beds during a crisis. The plan will be based upon need assessment analysis of mass casualty events. The quality of medical treatment of serious/critical patients will not be compromised. The development plan will aim at survival and recuperation of as many patients as possible. Hospitals will acquire sufficient number of personnel, including doctors and paramedical staff to meet emergency care needs. Emergency services provided will be integrated with the other departments of the hospital. It is essential that all hospital disaster plans have the primary feature of defining the command structure in the hospital, and to extrapolate it to the disaster scenario with clear-cut job definitions once the disaster alert is sounded.
- ii) Based on need assessment studies, the hospitals will submit data on their capabilities and additional requirements to district authorities.
- iii) Mechanism will be evolved to surge the capacity with the help of the district administration and resources from the government and private sector.
- iv) There is no universal hospital disaster management plan which can be implemented in all hospitals in all situations. Based on the risk assessment, each hospital will develop the disaster plan specific for their hospital. The plan will be available with the district administrations and will be tested twice a year by mock drills for updation (Annexure-I).
- v) A hospital disaster management plan should plan for the increased requirements of beds, ambulances, medical officers, paramedics, and mobile medical teams. The additional requirement of disease related medical equipment and disaster related stockpiling and inventory of emergency medicines, etc., will also be catered to in the hospital DM plan.
- vi) New hospital buildings will be made disaster resistant. Structural safety of the existing tertiary and secondary health care facilities will be evaluated to withstand high intensity earthquakes and at least one government hospital in each district will be retrofitted, if found necessary.
- vii) The Biomedical Waste (Management and Handling) Rules 1998 [BMW (M&H)] as amended will be enforced and all the biomedical waste generators will strictly comply with the rules at the hospital and incident site. Specific provisions include:

- a. The Biomedical Waste (BMW) will be handled carefully and will be treated and disposed off in a scientific manner.
- b. All BMW generators will create treatment and disposal facilities in accordance with the BMW (M&H) rules or will become a member of a common BMW treatment storage disposal facility if available in that area and send the BMW to this facility and maintain proper records.

4.7 Specialised Health Care and Laboratory Facilities

Specialised health care is required for different types of disasters. The needs and priorities for specific disasters are being covered in the guidelines for various disasters. However there are numerous specialised facilities which are required for most of the mass casualty events. Some such facilities are indicated below:

4.7.1 Trauma Centres

On the basis of need assessment analysis or trauma risk profile, the various district, zonal or apex trauma centres will be developed to strengthen the existing facilities within the hospitals. In view of the widespread area, special attention will be paid to develop regional trauma services in the country, including national highways. It is also recommended to develop selected trauma centres with CBRN management facilities. Helipads may be provided for major trauma centres and regional centres in unapproachable remote areas for prompt evacuation. The trauma centres at various levels will be developed on the following basis:

Apex Trauma Centre — At the state level, there will be an Apex Trauma Centre (ATC) with independent departments of orthopaedics, surgery, neurosurgery, cardiac surgery, urology

and replantation medicine etc. Out of the total bed strength which the state hospital has i.e., approximately 600 beds, 100 beds will be designated specifically for trauma victims during disasters. There will be two dedicated OTs. The ATC must ensure definitive care to the majority of the state's major trauma case load through primary triage or following secondary transfer. It will facilitate the development of a core group of surgeons who will be able to manage a large number of casualties and will provide support to the trauma system in the state.

Zonal Trauma Centre — The zonal trauma centre will have 25 beds. It will provide resuscitation and stabilisation. It will establish early consultation with the ATC and undertake early transfer of casualties to the ATC if required. It will have a state-of-the-art OT with all the facilities. The centre will have at least one general surgeon, orthopaedic surgeon, neurosurgeon and radiologist. There will be at least four dedicated paramedics and eight nurses.

Regional Trauma Centre — The regional trauma centre will have a capacity of 10-15 beds with appropriate infrastructure and manpower in far flung areas with difficult terrains. They will also be evenly located along national highways. These will have linkages with the ATC or zonal trauma centres. The facilities and infrastructure will be at par with the zonal hospital.

District Trauma Centre—The district hospital should have at least 10 beds for trauma patients. It will have at least one general surgeon, orthopaedic surgeon, anaesthetist and radiologist. Arrangements will be made for the availability of a neurosurgeon from the private sector, zonal hospital or ATC. There will be a dedicated OT other than the one used by the gynaecologist/general surgeon. There will be standard triage and transport protocols.

SOPs including 30 minutes bypass protocol, pre-hospital major trauma protocol, training of

paramedics and emergency medical technicians, nurses and doctors will be developed and integrated into the state disaster management plan.

Trauma centres will cover all the accidents on highways, nearby rail tracks and natural and man-made disasters. States which are vulnerable to earthquakes of magnitude six and above on the Richter scale and other types of disasters will ensure the development of all these centres.

4.7.2 Burn Centres

Burn centres are a prerequisite for the management of all disasters. The recommendations for different levels of medical organisations are as follows:

Each state will develop an appropriate number of burn facilities to tackle MCE. The burn centres will have trained doctors and supporting medical staff capable of treating chemical burn emergencies also.

- i) All medical colleges will have a burn centre with at least 30 beds.
- ii) All the tertiary care hospitals having 200 surgical beds and above will create 30-bed burn centres. The states will ensure that their capacity to handle burn cases will be in accordance with the need based analysis of the region.
- iii) The nodal burn centres will be developed with 30 beds in the districts having more than 10 Major Accident Hazard (MAH) units with burn risks.

4.7.3 Blood Banks and their Networking

Blood banks play a very important role in the management of mass casualties especially those of trauma requiring resuscitation measures and treatment of shock. Blood banks are responsible for collection, grouping and cross-matching, storage and distribution of screened human blood or its components from

selected human donors. Effective coordination between blood banks and various health agencies is necessary to ensure adequate and timely provision of blood products to decrease morbidity and mortality. All blood banks have to procure a license before they start functioning as per the provisions of the Drugs and Cosmetics Act. The major guidelines for blood bank services are as follows:

- i) Establishment of blood bank facilities in districts where presently not existing.
- ii) Based upon the need assessment analysis, all major blood banks in the country will have a plan to raise the required number of 'units' through volunteer donation and mobilisation from other blood banks of non-affected areas for DM.
- iii) Each blood bank will ensure supply of safe blood. All the blood units will be tested for infections as laid down in the guidelines for safe blood. Cold chain supply management of blood will be established at all levels.
- iv) The National Blood Bank transfusion services will be networked with regional, zonal, district, state and central facilities for blood collection, separation of components, and storage. The networking will also be integrated with private players like the Lions Club, NGOs like the Indian Red Cross Society and as a backup, with the armed forces, etc. Online dissemination of information will be encouraged.
- v) All blood banks will maintain a resource inventory of rare blood groups. The service network will be prepared for a seven-day backup system for tackling any MCE.
- vi) The blood banks/hospitals will cater for other infusion fluids in sufficient quantities. These may be used as an emergency measure to combat shock till such time blood or its components are available.

- vii) There should be a plan to surge the capacity for providing blood to remote incident sites at short notice. The plan should indicate the number of casualties it can support in particular time periods. The plan should include indicators for usage of multi-stocks available at different locations.
- viii) Mechanism for priority based transportation for blood and its components through various modes including road, railways, or air will be worked out.

Blood transfusion is an important therapeutic component of disaster and trauma care. Aggressive volume resuscitation and swift replacement of blood loss is crucial for saving life. Blood preparedness and coordination at all levels and immediate response to disaster situations can save the life of the patient.

4.7.4 Laboratory Network for Management of MCE

The laboratories play an important role in all phases of disasters including pre-, during- and post-disaster phases. The major epidemic diseases include acute diarrhoea (including dysentery and cholera), acute jaundice syndrome, acute respiratory infections, malaria, typhoid, dengue, measles, acute pyogenic meningitis/encephalitis and leptospirosis. The laboratories will investigate and monitor epidemic outbreaks, perform environmental monitoring and help in identification of disaster victims by the DNA method and provide for special diagnostic facilities for CBRN disasters.

The major guidelines for laboratories are given below:

- i) The existing laboratory facilities and their staff will be assessed and mapped. Networking between these laboratories will be established. A focal laboratory at the district level to coordinate the activities of all the laboratories in the

district will be identified. The district laboratory should be able to carry out routine haematological and microbial investigations. These laboratories will also be able to collect and transport biological and chemical samples to the state referral laboratory.

- ii) The laboratories at the hospitals and medical colleges will be upgraded in accordance with the requirement of the particular area. Referral laboratories having technology for rapid detection of a large number of samples will be identified and upgraded.
- iii) A network of bio-safety laboratories level-II and III will be established in the country. The requirements of such laboratories will be planned by the nodal ministry, line ministry and state governments. A few Bio-safety Level-IV laboratories will also be established at earmarked institutions.
- iv) The national laboratories including laboratory networks of ICMR, NICD, Council of Scientific and Industrial Research (CSIR), DRDO, Department of Science and Technology (DST), Department of Biotechnology (DBT) will be developed as the central decision making laboratories of the National Laboratory Network. The list of important National Referral Laboratories is given in Annexure-J.
- v) Public health laboratories performing complete analysis of food and water, etc., will also be integrated with the other laboratory networks.
- vi) The role of private laboratories will also be defined in the epidemiological preparedness plan.
- vii) The list of tests to be performed at each level of laboratories for priority diseases, determined by the local situation will be defined. Rapid tests that require minimal expertise and have high sensitivity will be used. Guidelines for standardised

formats for samples collection and standardised testing procedures will be prepared. Appropriate bio-safety and waste management measures will be advised. All laboratories will have an internal and external quality assurance system. Each laboratory will have an inbuilt research component.

- viii) Flow of information between the laboratories and other medical facilities and emergency functionaries will be streamlined. The results, trends and unusual findings (early warning signals) will be closely monitored. Rapid communication and regular reporting of results to the epidemiologists for initiating action will be ensured.
- ix) The supplies for collection, transport and storage of clinical samples will be ensured. Epidemic outbreak investigation kits will be made available to the Rapid Response Teams (RRTs) and constantly replenished and restocked (Annexure-K).
- x) Laboratory support for DNA identification of the dead will be strengthened.
- xi) Laboratory support for CBRN management will be developed. The major recommendations are:
 - a. Laboratories for radiobiosimetry will be established at specified hospitals and research centres to assess the effect of radiation exposure to an individual.
 - b. Mobile laboratories will be developed for monitoring CBRN agents. State government will also take the help of DRDO, BARC, NICD and PIC in establishment of these laboratories.
 - c. Specialised laboratories will be developed at earmarked hospitals

for studying the immediate and long term effects of CBRN agents.

4.8 Role of Alternative Systems of Medicine

In our country, alternative systems of medicine like Ayurveda, Unani and Homeopathy are also practised. Many remedies may be useful in management of injuries and illness during disasters. Evidence based well proven treatment modalities may be practised under the supervision of competent and qualified medical practitioners.

There are a large number of 'traditional best practices' for day-to-day ailments. Traditionally, these are adopted at the household level and are considered to be useful to treat minor ailments. Such traditionally useful and time tested procedures may be adopted in support of existing health care systems.

4.9 Preservation and Identification of the Dead

All major natural/man-made disasters have the potential to convert into MCE accompanied with high degree of mortality. Hence, in the aftermath, there is urgency for proper collection, preservation and storage of dead bodies. The recommendations include:

- i) At the district level, all hospitals including private hospitals will develop adequate mortuary facilities.
- ii) Each hospital will make plans to surge their capacity by developing a temporary facility in a pre-identified zone.

Proper identification of the dead is an important ethical and legal issue. Administrative authorities at the district level have the responsibility of identifying and certifying the cause of death. Therefore, there is a need to identify certain laboratories which will help

in exact and early identification. There are a number of methodologies used in identification of the dead:

A) Forensic anthropology: Trained forensic anthropologists are expected to assist in the recovery, analysis and identification using biological characteristics including age, sex, stature (skeletal fragments) and anomalies, if any. This is based upon the relative state of preservation and degree of fragmentation of the remains.

B) DNA fingerprinting analysis: The ready availability of DNA technology is capable of meeting many complexities presented by MCE whereby severe victim destruction/fragmentation has taken place. DNA analysis for MCE requires special resources related to specimen tracking, data management, and interpretation of results. The testing laboratories will be expected to use specialised software to facilitate the interpretation of a large number of DNA profiles in the tracking, searching and identification process involved in this methodology. DNA analysis will require valid reference samples to identify human remains accurately. The important considerations for collection of DNA samples for identification of the dead are given in Annexure-L.

C) Identification of human remains is also possible using the methodology of fingerprints, odontology (forensic dentistry), radiology, ante-mortem data collection that will be used wherever DNA fingerprinting facility is not available.

Each state will define and develop a few laboratories which will be upgraded in a phased manner so that they can be of help in case of any major disaster. Such laboratories will also be networked with the chain of other laboratories. These laboratories will be used for testing and training at the regional level. The important recommendations for training include:

- i) Specialised training will be given for collection of samples, reference samples, DNA testing, data management, specimen tracking and interpretation of results.
- ii) CDFD, Hyderabad will be encouraged to train the required staff of other laboratories. The state authorities can earmark certain laboratories to train the skilled personnel available with the DDMA.

The following operational capabilities will be developed at the district level:

- i) The system of appointment of medical examiner/coroner in the pre-disaster phase under whom all the mass casualty matters concerned thereof will be carried out.
- ii) SOPs for identification and disposal of the dead should be clearly defined.
- ii) All district laboratories will have the capability to collect samples. The laboratory staff will be trained and provided with sampling kits.
- iv) The roles and responsibilities of various stakeholders in accordance with the different modes for identification of the dead will be laid down.
- v) At the disaster site, the chemical and biological samples have to be collected after properly documenting the number, date, time and description into a logbook or database and after appropriately labelling the specimen containers (e.g., test tube, bag, etc.). SOPs will be laid down for all these procedures.
- vi) The type of samples to be collected include blood, soft tissue (deep red skeletal muscle, organ tissue, skin) and hard tissue (bones and teeth), for the use of DNA extraction or other identification procedures. The priority for collection of samples is based upon the ease of collection and the time up

to which it can be preserved with least decaying possibility. Such indicators will be laid down for effective decision making.

- vii) Establishment of mobile laboratories and mobile teams for collecting human remains and biological samples for identification.
- viii) Definite and clear-cut procedures for issuing of death certificates, disposal of remains, return of personal effects and development of records keeping legal, cultural and operational concerns are already there, though the practical aspects of these procedures in MCE will be tested regularly.
- ix) The photographs of all the unidentified dead will be put on the website and other prominent places.

A few developed countries have Disaster Victim Identification Cells (DVICs), established at a few places which are prone to disasters. Such models will be taken up as a pilot project and adopted if found suitable.

4.10 Psychosocial Support and Mental Health Services

The three principles for psychosocial preparedness to be adopted are: a) preparedness of the communities to meet their psychological needs during the disaster planning phase; b) providing the required psychosocial services to the affected population after the disaster; and c) integration of these services—not only with the health services but also with the general relief, recovery and rehabilitation activities. This integration is necessary for the effectiveness of the mental health services and psychosocial support provided. The major guidelines include:

- i) Psychosocial support and mental health services will be an integral component

of general health and relief services. This will be imparted through simple techniques by personnel at the grass-root level. The services will be planned and delivered in the local socio-cultural context, maximising on the strengths, and with considerable attention to cultural and language sensitivity. Services of external agencies will be utilised by linking these with the local teams/professionals and agencies/administrative systems.

- ii) Appropriate training in psychosocial support and mental health services will be given to the identified target groups such as primary health care workers, medical doctors, nurses, anganwadi workers, social workers, administrators, police, fire, local youth organisations, PRIs, resident welfare associations, school teachers, national cadet corps, community volunteers and local community organisations, students, and staff of the departments of social work/ psychology. Training of trainers will be given to the medical officers, NGO leaders and health administrators, who will act as trainers for primary level care providers. Appropriate training material will be prepared and made available, in local languages with cultural sensitivity.
- iii) CLWs will be trained to help in the management of patients with psychosocial disorders. CLWs will be helpful in establishing communication with different emergency functionaries and integration of psychosocial support with relief, rehabilitation and rebuilding efforts, creating counselling groups, defining vulnerable groups, and taking care of cultural and religious sensitivities during the post-disaster phase.
- iv) Advance planning should take place at the state and district levels for provision of mental health services and psychosocial support.

- v) Special care for vulnerable groups like women, children, elderly, and disabled people will get due consideration while planning mental health services in disaster affected areas.
- vi) Adequate funds should be made available for training activities for psychosocial preparedness.
- vii) Convergence of relief, rehabilitation and psychosocial support to the affected people will be managed to avoid duplication and facilitate coordination.

Detailed guidelines on the aspects of psychosocial support and mental health services are being prepared and will be issued separately.

4.11 Research and Development (R&D)

R&D will be the backbone for adoption of newer technologies. Research studies conducted during and after the MCE provide valuable information about the various areas that need attention. These studies include aspects of epidemiological, behavioral or health care research inclusive of emergency and long-term management aspects. The major recommendations include:

- i) Major hospitals and institutions will have an R&D unit at the back end to fulfil the gaps identified in the subject area.
- ii) R&D will focus on testing different models and table top exercises at each level for quick response and decision making.
- iii) Development of PPE, diagnostic and treatment modalities for CBRN and upgrading of technology. Research activities involving development of CBRN sensors, detectors, specific CBRN biomarkers, biological dosimeters, genetic mapping, special equipment and drugs required for effective management of CBRN disasters will be encouraged.

- iv) Model mitigation projects including specific CBRN ward development, mobile hospitals, mobile and fixed decontamination facilities, tele-medicine services and ambulances will be developed.
- v) The old and existing technologies will be reviewed from time to time and new technologies suitable for the Indian environment will be developed to replace the obsolete ones. The Indian industries will be encouraged for developing high-quality and low-cost indigenous alternatives e.g., mobile chemical neutralisation units, etc.
- vi) The mechanism for technology sharing and transfer in relation to globally acceptable equipment and methodologies will be encouraged.
- vii) Studies of random and long-term effects of CBRN agents including teratogenic effects, carcinogenicity and effects on reproductive and other vital organ systems will be undertaken to mitigate these effects. Studies will be carried out to develop comparative models to compare directly or indirectly exposed individuals, immediate family members and the various responders.
- viii) Studies to evaluate the ill effects of drug therapies and other medical management practices and measures to mitigate them.
- ix) In addition, numerous pilot projects will be undertaken to solve practical problems in the medical management of mass casualties. Some of the examples are mentioned below:
 - a. Epidemiologic study of the environment and behavioral factors associated with injury.

- b. To compare transport facilities available for the victims of two nearby districts using multi-variant analysis.
- c. Comparing the modes of long-term community recovery after MCE and evaluation of ideal sequel pattern.
- d. Need assessment study of the community using different models of cluster sampling or simple demographic studies to guide the relief work during the disaster phase.
- e. To develop indicators exhibiting the pattern of aggravation for situations based upon the comparison of available medical services and medical needs of the community. The study will also focus on the factors leading to nonavailability of medical facilities to the patients not affected by the disasters. It will also include suggested alternatives.
- f. Evaluation of the disturbed behavior of individuals and various escalation factors that hamper the rate of evacuation. The expected outcome of such a study is 'experimentally tested measures that are useful in inducing the state of relaxation' and thereby enhancing the evacuation rate.
- g. Proper documentation and research database management will be done.
- h. Complete documentation will be performed by specific authorities at the state and district level. The lessons derived from them will be used to develop scientific recommendations for improving future models.

Various research models and associated standard documentation procedures will be developed through the pilot project to convert our capabilities into capacities.

5

Guidelines for Response, Rehabilitation and Recovery

Adequate medical preparedness will ensure a prompt and effective response which will also be extended to the rehabilitation and recovery phase, so as to mitigate the short- and long-term hazardous effects of disaster. Special care to the vulnerable groups of society, participation of the community at large and psychosocial support will be the priority areas during the post-disaster phase.

5.1 Response

Prompt and effective medical response in the 'golden hour' decreases morbidity and mortality during an emergency situation. An 'all hazard' plan will be based upon various disaster specific risk factors identified at various levels. The plans include roles and responsibilities of stakeholders, responders and service providers including the private sector; factors governing the identification of sites of ICR relief centres, medical units and hospital care; and various coordination protocols. The plan will enumerate the functioning of the command and control structure. The medical response plan will integrate all aspects of emergency medical management at the incident site, medical care facilities during transportation and evacuation, adequate ambulance services with defined evacuation routes, and their communication linkages and coordination with other identified agencies. The medical response plan will be prepared by the CMO of the district as a part of the DDMP under the supervision of the district collector. Some of the medical responses are as follows:

5.1.1 Alert/Warning System

The medical response plan will have an adequate mechanism for proper planning, coordination with different responders/service providers, and operation and logistics management. In addition, a well-rehearsed alert/warning system will also be established. It will activate the medical response system by using indicators for:

- i) Notification of an event,
- ii) Pre-defined and well-practised triggering mechanism for initiating EMR at different levels; and
- iii) To switch over to a higher level of crisis as and when required depending upon the following levels: Level 0 — preparedness phase; Level 1 — district-level response; Level 2 — state-level response; and Level 3 — national-level response.

Response plans will be prepared in accordance with the level of disaster, which will be coordinated from the medical post at the incident site. SOPs will be laid down for all emergency support functions.

5.1.2 Incident Command Site

The IC site will be identified on the basis of the multi-hazard status of the district; weather and other micro-meteorological conditions; and micro-level risk zonation. The medical post

forms an integral part of ICP. It will work under a nodal medical officer appointed by the CMO and under the overall direction of the incident commander. Communication backups such as—wireless-/ satellite-based or other modes of communication will always be available with the hospitals and administrative authorities.

5.1.3 Pre-Hospital Care

Pre-hospital care provided at the medical post will reduce morbidity and mortality. The medical posts will provide the following services:

- i) Evacuation services.
- ii) Medical and trauma services.
- iii) Decontamination facilities.
- iv) Specialised CBRN care.
- v) Provision of food, water, shelter, sanitation, etc.
- vi) Coordination with functionaries involved in search, rescue, helplines and information dissemination, transport, communication, water and power supply, and law and order.

It will initiate and monitor activities like:

- i) Mobilisation of QRMTs/MFRs.
- ii) Usage of triage, by well established, rehearsed and recognised triage systems, resuscitation and pre-hospital care of the victims.
- iii) Prioritisation for evacuation and transportation.
- iv) Availability of medical relief material, search and rescue, additional medical teams and an integrated approach like having the inventory of all emergency logistics available on the internet.

A well established system of triage for classification of trauma patients will be practised

by the QRMTs. The basic approach of triage is based upon the following prioritisation criterion:

P-I (Red): Require Immediate Life-Saving Measures.

P-II (Yellow): Do not Require Life-Saving Measures but require treatment for injuries or medical ailments.

P-III (Green): Require observation and follow up.

However the system may be modified as per the assessed requirement of the local conditions.

5.1.4 Planning for Safe Translocation of the Population

Specific plans will be prepared for safe translocation of the population if the intensity of disaster needs complete evacuation. While preparing these plans, care will be exercised to maintain a balance between the probability of occurrence of panic and promptness in response.

5.1.5 Role of Specialised Forces (NDRF, SDRF)

The NDRF is a specialist force that has been raised exclusively to tackle DM related issues in the country. It comprises eight Battalions (Bns) of 18 teams each. 12.5% of the total personnel in the NDRF are technical staff who deal with specialised issues, most importantly emergency medical services. NDRF Bns are stationed at nine strategically identified locations across the country with their specific areas of responsibility. In addition to NDRF, SDRF will also be established and trained in EMR. Major functional aspects of these specialised forces in EMR include:

- i) All personnel are expected to be trained in MFR techniques with a basic knowledge of life-saving techniques at various central and state training institutes.

- ii) For robust medical preparedness to deal with MCE every Bn will have 36 trained paramedics and 18 doctors equipped with state-of-the-art medical and life-saving devices.
 - iii) Specialised training to deal with all kinds of disasters to which our country is vulnerable i.e., earthquakes, cyclones, floods, landslides, tsunami and CBRN. Bearing in mind the current CBRN global threat scenario, the NDRF will have four Bns specially trained for CBRN emergency response.
 - iv) Use of NDRF personnel for community capacity development and public awareness programmes in their respective allotted regions during the pre-disaster phase.
- and trained manpower by inter-agency coordination and networking.
 - v) Coordination with other hospitals for effective management of mass casualties.
 - vi) The various nodes of the hospital communication system will be dovetailed with emergency services of the district. An inter-hospital and inter-services communication network will be established at all levels.
 - vii) Inclusion of security and safety provisions.
 - viii) Use of public address systems for situation reporting and dissemination of relevant information.
 - ix) Specific requirements for management of CBRN disasters will also be highlighted in the medical response plans both for the incident site and care at the hospital.
 - x) Testing of medical response plans will be done by mock drills on the basis of pre-calculated response times in the DM plan. The drills will be carried out to check the following parameters:
 - a. Response procedures of authorities/team members.
 - b. Organised response at the incident site and at the hospital with different multi-hazard scenarios.
 - c. It will also define the participatory role of the community.

5.1.6 Hospital Care

Hospital care will be initiated by activation of the hospital DM plan on receipt of specific information about the occurrence of a disaster. The staff will be briefed about the expected number of casualties and advised to prepare the available medical-aid resources in an appropriate way before the arrival of the first casualty. The major activities undertaken are as follows:

- i) Activation of emergency measures based upon the hospital DM plan.
- ii) Critical care to the severely injured victims.
- iii) Hospitals will have various life-support functions like—oxygen support, ventilator system, dialysis, blood transfusion and other specialised facilities, trauma centres and laboratory networks. Long-term management of the patients will also be included in the plans.
- iv) The hospital DM plans will also include continuous monitoring procedures, hospital emergency services, provisions to have additional beds, pooling of resources

5.1.7 Integration of Print and Electronic Media

The role of the print and electronic media also needs to be integrated for:

- i) Proper dissemination of information about the dead and injured.
- ii) Helping in development of an effective alert system.

- iii) Informing the community about various evacuation routes, public guidance, etc.
- iv) Dissemination of disaster-related specific information to avoid unnecessary panic.

5.1.8 Medical Services in the Aftermath of Disasters

The medical response plan will include identification and disposal of the dead, containment of infection and psychosocial support. These responsibilities will be dovetailed into the duties of various responders/service providers. The facilities for mortuary services, embalming, DNA fingerprinting techniques and public health laboratories will be developed based upon the need assessment analysis. The mechanism for maintenance of accurate morbidity and mortality data will be included in the plan.

5.1.9 Minimum Standards for Food, Water, Shelter, Environmental Sanitation and Personal Hygiene

The availability of food, proper nutrition, adequate water supply, and proper facilities for hygiene and sanitation are the basic requirements for all human beings. In many disaster prone areas in which there is a frequent movement/displacement of the population, the status of nutrition and availability of the above parameters may not be adequate in the pre-disaster phase. Population existing in such regions are already subjected to negative factors pre-existing in the region. It is essential to provide food with proper nutrition and adequate calories for all sections of society. Hence it is essential to lay down minimum standards for food, nutrition, water, sanitation, hygiene and shelter. Based upon the Humanitarian Charter and Minimum Standards in Disaster Response, the 'SPHERE' project was first launched in 1997 to develop universal minimum standards in disaster response. This document brings out minimum standards for food, water, sanitation, hygiene, shelter and health services.

These recommendations can be adopted with some modifications till the complete guidelines are issued by the National Authority. The guidelines will include:

- i) Consideration of weather and climatic conditions, nutritional status, age and gender based calorific and nutrient requirements and also special reference to vulnerable groups.
- ii) Based on the national standards, each state will work out their own minimum standards which should not be less than the national standards.
- iii) On the basis of age and gender, the basic requirement will be worked out. The basic rations should furnish the minimum estimated energy requirement with 10-12% of total energy provided by protein, 17% by fat and the rest by carbohydrates. Additional food will be given to selected, nutritionally vulnerable individuals to compensate for specific deficiencies in energy, protein, vitamins and minerals—in the food otherwise available to them. The nature of the food should be such that it is palatable to the local community.
- iv) Ideally 15-20 litres of water per day per person is required in emergency situations for cooking, drinking water and personal hygiene.
- v) 3.5 m² area of space per person should be provided in the shelters.
- vi) Special requirements for children/elderly, pregnant women, or the disabled will also be addressed.
- vii) Adequate arrangements for disposal of garbage, human and cattle excreta will be made.
- viii) Water points and personal convenience services should be located far apart to prevent drinking water contamination.

- ix) Dead cattle and animals should be disposed off away from human inhabitation. It is also recommended to use adequate recycling and waste management practices.
 - x) Adequate provisions for controlling the spread of vector borne diseases will be made. These provisions will include defining risks and indicators for effectiveness of general vector control programmes. The general modalities for protection include:
 - a. Mosquito control.
 - b. Airing and exposure to sunlight of bedding and clothing.
 - c. Protection of food from external contaminants.
 - d. Usage of appropriate environment and chemical protection measures.
 - e. Adoption of chemical safety measures as per international protocols and norms to prevent the over use of toxic chemicals that burden the ecosystem in the longer run.
- In major disasters, achievement of the above minimum standards may not be feasible in the immediate phase. However, necessary care will be taken by the district authorities to fulfil the urgent requirements in the response phase.
- ### 5.1.10 Community Participation
- The community itself plays a vital role in the overall management of MCE usually as the first responder as it is the biggest human resource available in the aftermath. It is essential to make best use of this vast resource. The effectiveness of the services provided by the community groups depends upon their level of awareness and training. Community based DM plans should be made at the local and district levels and they should include:
- i) Awareness campaigns to provide knowledge and awareness to the community of:
 - a. Risks prevailing in the local area.
 - b. Dos and Don'ts.
 - c. Information about various inventories including medical, rescue and relief.
 - ii) The sensitisation of the community about various collection sites, important contact/ helpline numbers, evacuation routes and modes of transportation available for orderly evacuation from the incident zone, as identified in the district DM plan. These plans will be rehearsed at the community level during mock drills.
 - iii) Training of the community involves:
 - a. Identification of community leaders or community social workers.
 - b. Development of different groups and sub-groups for different tasks to be performed in the post-disaster phase.
 - c. Training and conducting mock drills to develop community resilience.
 - d. The identified groups will be trained in triage, psychosocial support services, relief work such as food and water distribution, and post-disaster documentation.
 - e. Some younger groups will be trained in rescue services.
 - f. Identification and training of women groups who usually have better acceptance in the local community.
 - iv) The plan should clearly define the details of food and water that should be made available and also means of cooking raw food stuff. Establishment of 'community kitchens' for providing cooked food in disaster affected regions is more

practical and palatable to the community as precooked food often gets spoiled and is wasted during transportation. Such activity will be planned under the coordination of CLWs.

- v) CLWs will also help in maintaining law and order and traffic flow. Trained community groups will be put in use to control unlawful acts like theft, aggression and violence arising from panic reactions. These activities will reduce the possibility of the occurrence of secondary disasters or domino effect.
- vi) Community based psychosocial care is a success story in the post-tsunami phase of our country. The DDMA's will encourage such activities in their areas.
- vii) Relief work is a complex and difficult process as its dynamics and activity index changes with time in the aftermath of disasters. This can be further streamlined with the proactive participation of the community.
- viii) Optimal utilisation of women groups for taking care of orphans, the disabled and other vulnerable groups.

Community based practices in our country play a very important healing activity for the affected population in the post-disaster phase. Strong community feelings and social binding can prove very fruitful in the management of disasters, provided these activities are carried out in a coordinated manner under the supervision of an elected representative or an elderly person who commands respect.

5.1.11 Special Care to Vulnerable Groups

Vulnerable groups in the community are those, which are at a greater risk by virtue of age, sex, disability or poor health. They require special care even in the normal course. It is essential to develop the tools, mechanism

and modes for providing specific care to these groups in the aftermath of a crisis. The recommendations to achieve a high level of preparedness to address this important issue include:

- i) Identification of the vulnerable groups on the basis of pre-defined parameters. The database of the groups will be made online and should be updated regularly. This database will be very useful for mobilising resources and providing medical care to these groups.
- ii) Provisions for providing special care will be made for children especially orphans. Special care will also be provided to pregnant women and those suffering with chronic disabilities or diseases like HIV/ AIDS.
- iii) Relief and compensation will be ensured especially to families where the head of the family has perished in the disaster. The natural principle of equality will be the guiding factor in the distribution of relief.
- iv) Special attention will be paid to the health care workers who provide psychosocial support and mental health services to disaster victims.

5.1.12 Mental Health Services and Psychosocial Support

The guidelines for mental health services and psychosocial support also need to be followed in the response and recovery phases after the disaster. Some of the important guidelines include:

- i) Appropriate interventions for mental health and psychosocial support be planned and implemented in a phased manner.
- ii) Emotional first aid along with mobilisation of community support systems should form the basis of activities in the first few weeks following a disaster.

- iii) Trained counsellors and CLWs, with a backup of specialised mental health services as and when required, will be made available for a minimum follow-up period of two years.
- iv) Mental health services and psychosocial care integrated with the local delivery systems will be made available and accessible for at least up to five years.
- v) Specific activities and programmes for the psychological well-being and care of the rescue and relief workers, as well as the CLWs and counsellors will be made available.
- vi) Material for training of counsellors and CLWs, as well as training of trainers will be made available, and uniformly implemented.
- vii) Awareness material about the common psychological and behavioral reactions to disasters will be made available and widely distributed.

5.2 Public-Private Partnership

The various guidelines to harmonise the action of PPP in medical management of MCE include:

- i) PPP will be effectively achieved by developing necessary instruments/Memorandum of Understanding (MoU) between the government and various private stakeholders. The financial strategy will be worked out in advance during the pre-disaster phase depending upon the vulnerability status of the nodal district.
- ii) The insurance sector will also be involved so that mutual trust between the various stakeholders can be developed. Suitable legislation, rules and regulations, or

appropriate modifications in the existing regulations will be made to accommodate all the fair demands posed by victims of MCE. These modifications will be done with a community-centric and mutually acceptable approach.

- iii) In addition, various PPP models involving the private sector and public sector will be encouraged. These models will include training and community preparedness for DM. Private health care providers and deemed medical universities will be used in the capacity building of the community with regard to disaster preparedness, first aid and Basic Trauma Life Support (BTLS) training through organised campaigns.
- iv) NGO task forces will be developed at the district level to be used for different operations and functions during emergency medical response. Registered NGOs will play a positive role by actively participating in disaster situations. The major roles include—education of the community, helping and organising mock drill exercises for testing local or district level medical DM plans, training of community level workers in first aid, community awareness, and monitoring and reporting tools.
- v) The Gol and state governments have been encouraging the participation of the private health care sector by providing them with incentives like land at concessional/ government rates for construction of hospitals in major cities. In turn, the corporate hospitals are obliged to provide health care to the common people in a mutually agreed manner at subsidised rates. Such practices may be encouraged if found workable and may also be improved to enhance the contribution of the private sector in disaster response.

5.3 Rehabilitation and Recovery

A multi-pronged inter-sectoral approach along with community involvement and participation is necessary for complete rehabilitation and recovery.

- i) State district authorities will make adequate provisions of relief to affected people— based on the assessment of loss of life and damage to property. In the pre-disaster phase, it is recommended to develop criterion of relief with due diligence of all stakeholders. States/district authorities will make available the requisite funds identified in the DM Act, 2005, for implementation of all relief measures.
- ii) Mechanism for rehabilitation will be developed for disaster victims who are staying in temporary dwellings. The reconstruction and restoration of basic infrastructure will be achieved at the earliest. The restoration of normal day-to-day functioning and bringing life back to normalcy will be implemented through appropriate strategies.
- iii) The DM plan will include medical rehabilitation as an important area, with special attention to—psychosocial care, special care for the disabled due to trauma, long-term medical care for vulnerable groups and vocational rehabilitation. The district administration will identify the target groups that need such special care and provisions will be made to achieve these long-term goals with a mission mode approach. Senior medical officers will also be involved in the decision-making process of post-disaster rehabilitation.
- iv) Rehabilitation and recovery will also be part of the hospital DM plan. The plan will have specific indicators and standards for 'follow up'.

5.4 Post-Disaster Documentation

- i) Medical documentation will begin at the site. During triage the victims will be given an identification number. This reference number will be retained while transferring the patient to tertiary care, diagnostic reports, follow-up medical treatment, monitoring of long-term effects, counselling, and legal compensation by insurance and relief components.
- ii) A concise report of the different casualties along with relevant documents will be sent to the relief management team of the district for taking necessary action. It will also include those who don't require hospitalisation but are suffering from psychosocial trauma so as to ensure availability of relief for them.
- iii) The DDMA will ensure proper documentation activity-wise, through the appointed agency during the period of response, rehabilitation and recovery.
- iv) The evaluation of data includes various variables like statistical data of mortality and morbidity indices, number and types of cases, age, general occupation of the victims, clinical profiles of cohort group with same or similar medical problems, specific cases observed during long-term management etc. These are required to evolve standardised procedures.
- v) Documentation on post-disaster surveillance and epidemiological studies so as to assess the consequences of disasters, identify initiators and promoters of mortality with respect to time variables and comparative analysis with clinical capability to achieve total recovery in the stipulated time period. Such documentation will help in updating the developmental and DM plans.

This documentation will help in drawing valuable lessons from various case study reports for future management. Certain research projects will be worked out on the basis of such lessons that will be taken up to re-engineer the overall management processes.

5.5 Media Management

Media, both electronic and print plays a proactive, important and crucial role in disseminating information to the public. The public relies on the media for information, and media reports often shape public opinion. As this role is crucial in the pre-, during- and post-disaster phases, the media plan should be part of the overall action plan at all levels. It will clearly specify the focal point for media communications, the process by which information would be disseminated, the level of approval, its frequency and time, etc. Vital information can be provided by the media, such as—the names of injured and dead persons, requirement of blood especially the rare blood groups, mobilisation of resources, do and don'ts for public awareness, etc. Information dissemination should be optimised by taking a proactive approach to public information and by understanding the informational needs of the media. The major guidelines for media management include:

- i) The media plan will be worked out in coordination with different district, state and national authorities. There should be earmarked personnel at all levels who will interact with the media. A proactive approach will be followed for fast information dissemination via press releases, press conferences and through relevant internet sites. An honest and transparent approach in providing clear, accurate, timely and concise information would ensure that the media reciprocates in the same way.
- ii) The press release will give the gist of the message with clarity. The press release

should include information about the source and necessary details of the MCE.

- iii) The medical authority will make use of the media in providing information about the patients. The medical officer so identified should be aware of the informational needs of the media. The approach adopted by the medical authority should be based on good relations and mutual trust. All information provided to the media should ideally be approved by the medical authority.
- iv) The EOCs or call centre earmarked for such a purpose can disseminate information to media and public 24x7.

5.6 Important Medical Management Aspects of the District Disaster Management Plan (DDMP)

The DM Act, 2005, envisaged the creation of the DDMP with a dedicated head and adequate legal provisions for the management of disasters. The district is a well organised, structured unit, having complete independent administrative control under the district collector. All districts will develop their DDMP based upon the guidelines issued by the national/state authorities with medical management as an integral component. In India, there are over 600 districts having different topological and meteorological conditions, seismic zones, rivers, dams, hazardous industries and overall economic status which governs the multi-hazard status of the districts. The medical management district plan will include the following facets:

- i) DDMPs will pool all the medical resources available in their jurisdiction including those of the armed forces, MoR, ESI hospitals and the public and private sectors with mutually agreed, predetermined arrangements for sharing costs, etc.

- ii) The plan will be community-centric and also define the active participation of the community in DM.
- iii) Mechanism for check listing and reporting at fixed intervals will be introduced to determine 100% availability of all medical equipment, hardware and other facilities at all times at the various nodal places.
- iv) Vulnerability analysis of the areas followed by assessment of medical needs of the areas will be done to identify high, medium and low risk zones. This is crucial to plan the medical resources and risk inventory at these nodal points. Disease surveillance as such should be strengthened for both communicable and non-communicable diseases under IDSP by actively involving private doctors and laboratories at the micro-level.
- v) Resource inventory of all hospitals (government and private), which will define their stockpile and capacity to surge for DM.
- vi) Provisions for usage of aerial surveys for fast analysis of the situation on the ground will be made in the district DM plans.
- vii) The assessment will also include the occupational hazards of the district and the corresponding vulnerable population, endemic diseases of the area and the new diseases emerging in the area. All these are required for the development of early warning systems as a part of IDSP.
- viii) The mechanism for fulfillment of the assessed requirement in terms of manpower, equipment, vaccines, antidotes, ventilators, personal protective equipment, water filtration units, disaster-specific medicine bricks etc., will be worked out in development plans and the immediate requirement through mitigation project mode.
- ix) Infrastructural development, planning of integrated ambulance services, safe evacuation system, supply of safe food and water will be carried out under the overall supervision of the medical officer in the district.
- x) Specific protocols for rapid evacuation of victims from the incident site will be prepared. Identification of landing strips and helipads will be carried out for prompt aerial evacuation. The Airport Authority is to be included in the plans.
- xi) The training and health education programmes for community leaders and task forces in first aid, basic dos and don'ts and the ways by which the community response can be fine-tuned will also be elaborated in the district DM plans.
- xii) Specific orientation of the responders/ service providers towards handling injured children, or extrication of geriatric patients will be carried out in the pre-disaster phase.
- xiii) The linkages of medical systems to all other emergency functionaries through designated officers of earmarked hospitals who are required to be in direct contact with the district administration for two-way information dissemination. The salient features and important contents of the hospital disaster management plans of all the hospitals in the district, will be annexed along with the list of NGOs with their contact numbers.
- xiv) The SOPs for medical response mechanism using different simulation models of worst case scenarios of different types of disasters and their domino effects will be prepared.
- xv) The locations of relief camps, incident command posts, earmarked hospitals,

- nursing homes, primary health care centres with their responsibilities and command control centre will be prepared in tabulated form for ready reference for decision making during MCE.
- xvi) Medical inventory, its continuous updating and the ready availability of the specific equipment or medicine in the nearby district will be listed and laid down in the DM plan. State/district will make specialised provisions for cold chain system of transportation of blood and its components, essential drugs, medicines and vaccines requiring low temperature conditions.
 - xvii) Adequate communication systems will be developed.
 - xviii) Directory of all the medical officers, paramedics, nursing staff, ambulance drivers, and medical inventory will be prepared for ready reference. This should be available in electronic mode and should supplement the information available on the IDR database.
 - xix) Indicators for identifying the level of disaster in the district, state and national level will be standardised.
 - xx) A checking and reporting mechanism, and regular audits to check the efficacy of hospital DM plans and the district medical management plans.
 - xxi) Adequate number of trained professionals to deal with the general and specific aspects of DM will be specified and listed in the DM plan.
 - xxii) Mechanism for emergency financing and human resource allocation will also be worked out in these plans. Adequate financial powers should be allocated to the hospital administration for procurement of emergency medical stores.
 - xxiii) Mechanism for involvement of private players will be clearly outlined with designated responsibilities of different stakeholders for effective preparedness and response.
 - xxiv) Additional beds and their equipment will be stocked in identified district hospitals in highly disaster prone districts. Indoor bed surge capacity should be strengthened by combining public and private medical sectors while planning in the pre-disaster phase.
 - xxv) Provisions for adoption of global best practices, and usage of alternative medicines in providing care to the victims will also be laid down in DDMPs.
 - xxvi) On the lines of the NDRF, districts will create district disaster response teams, and states will build SDRFs that will act as specialised responders during mass casualty emergencies.
 - xxvii) At the state level, buffer stocks of medicines and vaccines will be stockpiled on the basis of the vulnerabilities of all the districts in the state.
 - xxviii) Disaster-specific modules will also be developed in the plans.
 - xxix) CBRN specific module, based on threat perception will earmark the underground shelters for collective protection. Comprehensive medical management to combat CBRN agents will be delivered by specific tertiary health care facilities fitted with CBRN filters and power backups with the provision to deal with enhanced

requirement of beds. In addition, personal protective equipment and decontamination facilities are imperative in these hospitals. The ambulances should be fitted with CBRN filters and positive pressure facility to prevent further contamination in transit. With the backdrop of the loss of health care facilities in the affected district, satellite and other towns will be identified and provisioned concurrently to meet the challenge. The list of chemical industries operating in the district will enumerate the plausible industrial products/by-products which can be generated including toxic industrial chemical agents with their antidotes. This module will also specify the safe food and water supply.

xxx) Earthquake specific module will earmark the retrofitting of the major health care facilities, enhanced requirement for trauma care, injuries and measures to prevent the occurrence of epidemics due to loss of sanitation facilities. The earthquake DM plan will cater to worst case scenarios where there are a large number of casualties due to the earthquake.

xxxii) Cyclone, tsunami and flood specific modules will earmark the

health care facilities, roles of local medical professionals, mechanism for prevention of prevailing zoonotic, water-borne diseases and epidemics in the area, community professionals trained in psychosocial care and medical support linkages with other districts away from the rivers/coast line.

xxxiii) Landslide and avalanche prone areas are vulnerable to cold burn injuries in addition to trauma. The medical system will be supplemented with enhanced supplies of woollen clothes, evacuation routes and medical professionals trained to deal with such patients. Specialised treatment facilities will be created in earmarked hospitals.

xxxiiii) Mechanism for providing care and management for psychosocial trauma for all types of disasters will be laid down.

Disaster-specific plans are based upon the risk assessment studies of the area. Since most of the areas in the country are prone to multiple hazards, defining basic medical care for management of every type of disaster is crucial for medical management of mass casualties.

6

Medical Preparedness for CBRN Management

Medical preparedness for CBRN management will analyse the effects of CBRN agents and focus on their management—injuries, burns, illness, psychosocial trauma and public health problems that emerge in the aftermath of CBRN accidents/ terrorist attacks. In principle, the medical management aspects remain the same as for any other disaster but they need specialised provisions for emergency planning at the incident site during evacuation and crisis management at the hospitals. The special provisions include the necessity of planning, practice and exercises involving protection for rescue workers and victims, logistics, immediate and accurate detection measures, decontamination and decorporation, antidote administration, iodine prophylaxis and bio-dosimetry, etc. All the specialised measures will be adopted by the nodal/ line ministries and state/district level administration. Training and scientific advice will be made available at DRDO, MoD and BARC. The medical preparedness plans will include problem-solving exercises based upon the past-experience of disasters and will become an integral part of the 'all hazard' DM plan at the national, state and district level. Medical preparedness activities will encompass all ministries/departments delivering health care services including those in public and corporate sectors. The prevention and preparedness aspects are given in the succeeding paragraphs.

6.1 Prevention of CBRN Emergencies

The development of various instruments and mechanisms are required in the non-disaster phase at all levels, for the prevention of CBRN emergencies, which will eventually establish a comprehensive risk reduction framework. The

issues related to safety, security and associated apprehensions for the possible misuse of CBRN agents in terrorist acts are discussed in detail in the respective guidelines on Chemical, Biological and Nuclear disaster management. The salient aspects are discussed briefly in the succeeding paragraphs.

A) Radiological and Nuclear Emergencies

Nuclear Medicine is a branch of medicine and medical imaging that uses radioisotopes in diagnostic and therapeutic measures. Nuclear energy has numerous widespread applications in the field of industry, medicine, agriculture and research. Because of these widespread applications, the availability of radioactive sources has become easy. While their radioactive strength is in itself a deterrent to pilferage, they do have the potential of being stolen and used in a Radiological Dispersal Device (ROD) or Improvised Nuclear Device (IND).

In diagnosis, radioactive substances are administered to patients and the radiation emitted is measured. The sources used in Positron Emitted Tomography (PET), which is a diagnostic tool in nuclear medicine, are all positron emitters which are produced at the time of diagnosis and have half-lives of only a few hours and they emit positrons of low energy only. These sources are not of any value to terrorists as they do not produce any significant damage on the human system biologically.

In therapy, radionuclides are administered to treat disease. For example, administration of Iodine-131 is often used for the treatment of thyrotoxicosis and thyroid cancer. In the field of nuclear medicine

for diagnostic purposes, radioisotopes (like Iodine-131 and Technetium-99m etc.) used are of very low half-life ranging from a few hours to a few days. Even if such material is stolen or pilfered for use as ROD by a terrorist organisation, these sources do not have any damage potential.

In case of cancer treatment wherein teletherapy machines use high strength and long half-life sources like Co-60, the source is fixed into the machine by the user facility itself after clearance from the regulatory authority. This source is supplied by a radiological facility within the country and not by the supplier of the machine. Once the source is fixed, it can neither be accessed nor removed by unauthorised personnel. After the useful life of the radioisotopes, the source is returned to the radiological facility for disposal.

B) Chemical Emergencies

Chemical emergencies can arise either due to the misuse of chemical warfare agents as source materials or industrial toxicants, dual use chemicals, poisons and hazardous wastes as targets as well as sources by terrorist groups. Accordingly, development of proper safety measures and physical security systems at all administrative levels are to be kept in place. Some of the major recommendations for prevention of such emergencies, *inter alia*, include:

- i. The Chemical Weapon Convention is a universal non-discriminatory, multilateral, disarmament treaty that bans the development, production, acquisition, transfer, use and stockpile of all chemical weapons. It also regulates the prevention of misuse of dual use chemicals. India being a signatory, the strict implementation of the provisions of this treaty is to be ensured at all levels.
- ii. The various safety aspects for chemical industries, that have been given in the *National Disaster Management Guidelines—Chemical (Industrial) Disaster Management*, are to be implemented with strict compliance.
- iii. The security aspects at the installations, storages and during transportation of industrial chemicals will be laid down in the respective disaster management plans at all levels.
- iv. The security of MAH units against sabotage activity by terrorist groups, is to be planned carefully and implemented on a priority basis.

C) Biological Emergencies

Biological disasters and bioterrorism are of great concern due to the technological advancement for production of mutant variations of microorganisms, including those available in routine micro-biology laboratories and those used for production of vaccines and numerous other industrial applications including bioremediation.

Biological agents can multiply only in a 'living host' and till today, there is no definite sensor available to detect these agents. Genetically modified biological agents cannot be detected without adopting molecular biology techniques. Such agents can be identified only at the community level and not at the individual level. In fact, the hospital is the main source from where the first information about a biological emergency can be received. The bio-safety and bio-security aspects are, therefore, of utmost importance to prevent any biological emergency. Some of the major recommendations for the prevention of such emergencies include:

- i. The bio-security aspects for protection of 'high consequence—microbial agents and toxins' against diversion for their misuse, including cyber security of critical information on development of such microorganisms or mutant variations thereof must be assigned the highest priority in all laboratories handling such biological agents.
- ii The bio-safety plan, with proper checks and balances inbuilt, will be developed by each facility for the preventive aspects related to accidental release and exposure.

While on the subject, it may be observed that the IDSP has already been initiated in the country which is developing local capacities to trigger alarms of impending outbreaks leading to biological disasters.

Finally, an integrated multidisciplinary programme on capacity development through education, training and critical infrastructure development, needs further impetus on a priority basis to mitigate the devastating effects of any such CBRN emergency.

6.2 Education

Education of CBRN management is necessary for all health care workers and other stakeholders. CBRN related topics will be included in the curriculum at various levels for medical officers and paramedics. The major recommendations include:

- i) All medical and paramedical staff will be made aware about the types of illnesses, injuries, burns and other health problems caused by CBRN agents and their preventive and therapeutic measures.
- ii) Medical, paramedical staff and all other health care workers will be educated about the signs and symptoms produced by CBRN agents.

- iii) Education at each level will be imparted using symposia, CME, workshops, or refresher courses.

6.3 Training

Specialised training of doctors, medical first responders (MFRs), team of specialists and paramedical staff will be based upon competence based training, which will include:

- i) Development of training of trainer modules for CBRN management for MFRs/QRMTs and other emergency functionaries.
- ii) MFRs and health care providers will be trained on the following facets for management of CBRN casualties:
 - a. Effects of CBRN agents and factors which aggravate/reduce the effects thereof.
 - b. Decontamination along with resuscitation measures is an essential component of the medical response emergency plan and for emergency transportation. It is important to know that treatment of CBRN casualties should not be compromised for activities like decontamination.
 - c. Emphasis will be given on prophylactic protection measures like radiation protection, prophylactic antidotes for selected Chemical Warfare (CW) agents and symptomatic or specific treatment in the aftermath of exposure.
 - d. Defining roles and responsibilities to be performed at the incident site for each member of the specialised QRMTs/MFRs.

Such competence based training schedules will be tested with on-site mock drills to build the confidence levels of the responders. These

mock exercises/drills will be carried out to train them in effective usage of CBRN detection and protection equipment, based upon the SOPs.

Skill based training include the following facets:

- i) Usage of radiation surveys meters/ personal dosimeters.
- ii) Procedure of decontamination.
- iii) Indicators to assess the situation in the aftermath of exposure in the lowest possible time.
- iv) Establishment of mobile decontamination facilities.
- v) Usage of field detectors and software for real time monitoring to give a clear picture of the changing dynamics of the disaster situation.
- vi) Technical backup teams deployed at the incident site or at the control room to support the working teams.
- vii) Selected CLWs, medical practitioners and other health care workers will be trained in providing psychosocial support to the survivors.
- viii) Specialised MFRs of the NDRF and the SDRF will be trained and kept ready to supplement the paramedical teams of the DDMA and other stakeholders responsible for medical management of CBRN casualties.
- ix) All earmarked hospitals for CBRN management having teams of super specialists in the disciplines of haematology, gastroenterology, neurology, respiratory medicine, dermatology, oncology and ophthalmology will be provided regular training in managing the effects of CBRN agents.
- x) Training in clean up actions and environmental issues will also be undertaken.

6.4 Community Awareness

- i) Knowledge of the effects of CBRN agents with basic emergency precautions and preventive measures will be imparted to the community.
- ii) The basic knowledge of CBRN agents and their effect will be imparted to all the responders including police, fire, rescue workers and other service providers.
- iii) Programmes to promote proper community awareness will be encouraged on the following aspects:
 - a. Dos and Don'ts regarding CBRN agents.
 - b. Provisions for effective sanitation and hygiene including safe food and purified water in a CBRN contaminated environment.

6.5 Research and Development

The areas of applied research for the development of clinical facilities for the management of CBRN casualties will be identified. There is need for a national institute for CBRN management. Certain research programmes/projects will be taken up in mission mode by specialised technical organisations like DRDO, Armed Forces M-medical Services and Department of Atomic Energy (DAE) in the following areas:

- i) Establishment of the Acute Radiation Injury Treatment Centre' as a model facility.
- ii) Creation of a CBRN Simulation Modelling Facility for training and mock exercises.
- iii) Upgradation of PPE for adults, children and infants.
- iv) Development of mobile CBRN decontamination facilities and systems.
- v) Development of detectors for CBRN agents.

- vi) Development and production of vaccines and prophylactic modalities for CBRN management to meet surge requirements.

6.6 CBRN Casualty Management at the Incident Site

Management at the incident site needs situational assessment by trained survey teams, fully equipped with personal protective equipment, field detectors and other necessary accessories. Based upon the assessed situation, the safe zone will be identified. At least one mobile radiological laboratory unit will be made available in each district and minimum of two units in each metropolis to support the functions of detection, protection and decontamination. The assessment team will observe the micro-meteorological conditions which are prevalent at the time of incidence, since these conditions have bearing on the management of casualties. Important areas that require attention are:

A) Personal Protective Equipment (PPE)

Personal protection is the foremost and most important element of CBRN management. All the responders will be given PPE in addition to the buffer stock for enhanced requirement. Urgent control measures must be instituted to limit the exposure of MFRs by the use of protective clothing, respirators and by limiting the time of exposure at the incident site. The major protective measures include:

- i) Protective masks will be provided depending upon the requirement of MFRs.
- ii) Protective equipment must be provided to teams and first responders to give them full protection against particulate aerosols.
- iii) Plastic wraps to cover contaminated material, disposable shoe covering, paper flooring covers are some of the protective equipment required for on-site management.

B) Decontamination

The aim of decontamination is to rapidly and effectively remove all the external and internal CBRN contaminants, from both—person and equipment. This is time consuming and requires adequate resources to be deployed at the incident site. The factors that decide the type of decontamination procedure include—nature of the CBRN agent, form (solid, liquid or gas) and period of exposure. Wherever the period of exposure of victims is high, internal decontamination becomes necessary by usage of specific decorporation agents. The important points that should be kept in mind during decontamination at the site are as follows:

- i) Decontamination facilities will be created as a part of the on-site plan.
- ii) Mobile CBRN decontamination facilities will also be created by the DDMA so that they are readily moveable to the site of incidence. Respiratory protection must be ensured by using proper face masks during the whole decontamination process.
- iii) Decontamination of the casualty will be carried out first at the incident site, outside the risk area. Usually, the rescue service is responsible for decontamination at the incident site. Medical staff may be required to help the rescue teams.
- iv) Contamination caused by liquid chemical agents requires dry decontamination procedures.
- v) Ambulances and hospitals may become contaminated and unserviceable for a long time if contaminated persons are transported and treated in hospitals.
- vi) All casualties must be checked for the level of decontamination prior to their evacuation to the hospital in specialised ambulances fitted with CBRN filters. Personal scanners should be used for checking the level of decontamination

by holding the scanner one inch away from the body and moving it at the rate of two inches per second starting from the face downwards.

- vii) All other soiled clothing and material will be decontaminated and stored in suitable containers (non-leaking bags) for proper disposal.
 - viii) All personnel, ambulances and equipment including protective clothing, gloves, caps and masks should also be decontaminated.
 - ix) The dead will be decontaminated, if required and put in double-sealing casualty bags before disposing them by deep burial procedures.
 - x) Universal safety precautions will be practiced during the handling of victims.
 - xi) Sufficient training will be imparted to all first responders by conducting regular mock exercises.
- C) Special provisions for CBRN Casualty Evacuation
- i) Specialised ambulances will be made available for evacuation of CBRN casualties. These ambulances are fitted with CBRN filters and will be equipped with life-saving resuscitative equipment and other necessary equipment to manage CBRN casualties (Annexure-M). SOPs will also be laid down for treating such casualties.
 - ii) After decontamination, each casualty should be placed—preferably in a casualty evacuation bag fitted with CBRN filter. If these are not available, the patients will be provided with PPE.
 - iii) Paramedical staff and driver who are accompanying the patients in the ambulance will be trained in the management of acute health effects of CBRN agents and BLS measures.

6.7 Hospital Disaster Management Plan

The state disaster management plan will identify and earmark certain hospitals for development of specialised facilities for the management of CBRN casualties. Dedicated staff of all these hospitals will be trained to use PPE and other universal safety precautions laid down in the plan. CBRN management will begin with decontamination and decorporation followed by immediate and long-term medical treatment of casualties. These hospitals will create the following specialised facilities as identified in the hospital disaster management plans:

i) Detection

The detection facilities will have radiation dosimeters, Geiger Muller counters and chemical agent monitors to check the level of radiation and chemical contaminants. These facilities are necessary to monitor and prevent the contamination of the hospital itself.

ii) Decontamination

All the persons transported to hospitals from an accident scene should already have been decontaminated but it must be expected that many will make their way to the hospital on their own and will still be contaminated. Prior to admission at the hospital any person exposed to CBRN agents should be decontaminated. Fixed decontamination facilities will be developed which are able to decontaminate a large number of patients. SOPs will be developed accordingly for the effective management of CBRN effects as follows:

- a. The decontamination room must be located at the entry of the hospital and should be sealed off from the rest of the hospital and have a separate ventilation system.

- b. Whole body decontamination will be done after removal of all clothing.
 - c. Personal decontamination powder will be used for decontamination of the whole body surface including wounds, burn injuries etc., and then transferred to 'the clean side'.
- iii) Decorporation
- Decorporation will be initiated as soon as possible. Prior administration of potassium iodide prevents damage to the thyroid from radiation. Gastric lavage, emetics, purgatives, laxatives and enemas can also be used to eliminate radioactive material from the body. Decorporation agents DTPA and Prussian blue eliminate radio nuclides from the body thus reducing internal contamination. Decorporation agents act as diluting, blocking, mobilising and chelating agents.
- iv) Treatment
- Earmarked hospitals will have specialised CBRN treatment centres with trained specialists and paramedics for management of CBRN casualties. The main components of CBRN management centres are given in Annexure-N. At the time of hospital admission, baseline measures of complete blood counts will be taken which will later help in evaluation of the effects of acute radiation syndrome or effects of CBRN agents. Some of the advanced care and diagnostic facilities for CBRN casualty management are as follows:
- a. Radiation injury treatment centre.
 - b. Advanced blood bank facility: some of the important facilities include, blood component separation apheresis, stem cell harvesting, immuno-haematological, infection markers screening, leucodepletion and gamma irradiation. The cold chain system also needs to be created (Annexure-O). Adequate storage unit including deep freezer (-33°C); ultra deep freezer (-83°C); platelet agitator-cum-incubator (+22°C); and adequate blood transportation boxes will be created.
 - c. Advanced laboratory facility: This facility will have a genetic and molecular laboratory and other specialised diagnostic facilities for CBRN management.
 - d. Burn Centre.
 - e. Selected hospitals will develop bone marrow transplantation facilities.
 - f. The hospitals will appoint a hospital infection control committee headed by a microbiologist/pathologist.
 - g. The various aspects of epidemic management caused by biological agents include: A multi-sectoral approach is recommended to deal with any outbreak of infectious diseases resulting, either from a natural epidemic or due to bioterrorism activities. A national biological disaster response plan will be evolved with due participation of health officials, doctors, various private and government hospitals and the public. The plan should be implementable at the first indication of a national level health threat. There is a need for strengthening the public health system for managing outbreaks of infectious diseases, either occurring naturally or due to an act of biological terrorism. In the context of a large number of people vulnerable to infectious disease across the country, there is need to establish regional/state institutes for

rapid epidemiological investigation and control of threatening epidemics due to bioterrorism.

Separate guidelines on the aspects of biological disaster management including bioterrorism are being prepared and will be issued separately.

h. Special provisions for management of chemical casualties are given below:

- i) A list of all the toxicants and their hazardous effects on health and environment must be prepared at all levels for medical management plans as identified in on-site and off-site plans of industries and districts respectively.
- ii) This data on chemicals being used in the local area will give directions for developing the inventories of antidotes and essential medicines for resuscitation and symptomatic care. Gudel airways are also one of the essential components. Other prophylactic/therapeutic measures and medical equipment will also be prepared and stocked at the hospitals. Stocking and turnover of antidotes and other drugs will also be maintained.
- iii) All the identified hospital would have adequate stock of PPE including respirators.
- iv) The mobile laboratory concept will be introduced so that the type of toxicants and their by-products can be identified at the site itself. Imparting knowledge of the exact nature of the chemical will facilitate proper antidote administration and effective treatment for early recovery.
- v) National poison centres and other chemical laboratories for different chemical agents will be developed

and strengthened at national and regional levels.

Treatment modalities including immediate and long-term management will be undertaken and continuous research and development programmes will be promoted to develop advanced treatment modalities corresponding to worldwide best practices. The medical management aspects of chemical casualties due to industrial toxicants have already been addressed in the National Disaster Management Guidelines—Chemical Disaster Management. Separate guidelines on the aspects of chemical (terrorism) disaster management involving management of chemical warfare agents are being prepared and will be issued separately.

CBRN Stores

Specified hospitals for CBRN treatment will stock all the drugs, decorporation agents and other specialised items for treatment of CBRN casualties. They will include:

- i) Growth factors, colony stimulating factors, and other radiation recovery agents are very useful for restitution of the immune system.
- ii) Antidotes are required to be procured to neutralise chemical effects. Antidotes required for nerve agents are physostigmine, obidoxime, atropine, and pyridostigmine. Vesicants may require dimercaprol, sodium thiosulphate while cyanide-based agents may require dicobalt edetate.
- iii) Biological agents require antibiotics and vaccines. Recombinant protective antigen vaccine and anthrax immunoglobulin for anthrax, recombinant F1-V antigen vaccine for plague and vaccines for Q fever, tularemia, botulism, viral hemorrhagic fever and small pox will be catered. The various kits for treating CBRN casualties are given in Annexure-M.

- iv) Mechanism must be established for meeting the enhanced requirement of drugs, antidotes and vaccines by augmenting the production of manufacturing units during threatening disaster situations or actual disasters.

6.8 Critical Infrastructural Development

Potential targets:

- i) Metros, state capitals and major cities of the country are potential targets for nuclear attack. In such a situation, the hospitals will not be in a position to treat radiation casualties. Hence, the tertiary care hospitals will be identified and progressively upgraded for CBRN management in satellite and nearby towns based on the vulnerability analysis.
- ii) Utilisation of underground metro stations: In case of nuclear attack, underground metro stations can be utilised as a shelter for victims and to provide medical treatment facilities for first aid and emergency medical care, if needed. In such a situation:
 - a. Both ends of the underground metro station will be cordoned off by a shutter fitted with CBRN filters.
 - b. Provisions of safe water supply, stocking of food, drugs, medical equipment, power backup will be planned.
 - c. Interlinking of metro stations to the satellite town via an underground route can be planned in the development of such a facility.

6.9 Psychosocial Support and Mental Health Services

- i) The psychological effects of CBRN accident/attack include uncertainty, fear and terror. Acute behavioral syndrome

and anxiety are other problems. In addition, the feeling of vulnerability, lack of control and consciousness, with fear and terror among the care providers cause aggravation of the situation.

- ii) There are three major categories of victims which include:
 - a. Distressed (sadness, fear, anger, difficulty in sleeping, impaired ability to concentrate and disbelief).
 - b. Behavioral changes (decreasing travel, staying home, refusing to send children to school and increasing substance use and abuse).
 - c. Psychic illness.
 - d. In addition, Post-Traumatic Stress Disorder (PTSD) and Acute Stress Disorder (ASD) are also common. The degree of effect varies between those directly exposed, those having prior history of mental illness and those who suffered loss of resources and disruption of their social support after the event.
- iii) The past global experiences on CBRN events have highlighted that one out of four persons suffer from severe psychological stress disorder though they may not have actually been exposed to CBRN agents. The major steps in giving psychosocial support include:
 - a. Triage and initial disposition, b. Early psychological interventions.
 - c. Evaluation and diagnosis of the specific disorders.
 - d. Education to the patients.
 - e. Special education and counselling to pregnant women and care to children.
 - f. Continuous psychosocial support and mental health services to the community to enhance their morale,

cohesiveness and realisation of their social responsibility.

- g. Effective relief and confidence building measures to reduce the anger of the community and inhibit any process that promotes social divide.
 - h. Linking these services to the recovery and rehabilitation process as a long-term management of CBRN events.
- iv) Absenteeism, flight, refusal to attend to patients and dereliction of responsibility are generally observed in health care providers during emergencies. Thus, it is important to take care of the care providers. This requires:
- a. Provision of care to the families of care providers.
 - b. Continuous communication between the care providers and their families.

6.10 Medical Response to CBRN Disasters

Activation of MFRs will be carried out by an inbuilt triggering mechanism for prompt emergency medical response at the site, during evacuation and treatment of casualties at the hospital. The steps taken in the first few minutes will determine the effectiveness of mitigation. Medical response in the aftermath of CBRN incidents includes:

- i) Emergency medical care at the incident site:
 - a. On receipt of the alert signal QRMTs/ MFRs will reach the disaster site immediately along with their PPE, detection, decontamination and requisite medical management equipment and essential drugs.
 - b. Trained MFRs will carry out triage, BLS and resuscitative procedures. Decontamination facilities will be

established and then evacuation will be carried out as per laid down SOPs. Triage refers to sorting of the patients for allocation of treatments according to the system of priorities designed to decrease mortality and morbidity. The process is highly complex in case of a CBRN scenario.

- c. The process of triage, resuscitation and decontamination will go hand-in-hand followed by prompt evacuation with BLS which is a necessary element of incident-site management.
 - d. Establishment of a casualty collection centre so that all the casualties can be directed towards the health care facilities depending upon the severity of disaster.
 - e. After resuscitation and decontamination, the casualty will be placed in the casualty evacuation bag fitted with CBRN filter for evacuation.
- ii) Emergency medical care during evacuation:
- a. Proper SOPs for care of the CBRN casualties must be available to the trained paramedics.
 - b. Adequate supply of air/oxygen and life-support system will be provided in the ambulance.
- iii) Medical management at the hospital:
- a. On arrival at the earmarked hospitals, the patients will again be triaged and decontaminated. At no stage will the emergency medical care be compromised during decontamination or change to protective clothing.
 - b. Necessary blood samples will be collected for standardising the baseline haematological and biochemical data about the level of contamination.

- c. The patient will be transferred to the CBRN ward after monitoring of contamination as per laid down procedures and indicators.
- d. The knowledge management of long-term effects of CBRN agents on the exposed population will be dovetailed into the mechanism of CBRN management.
- e. Regular follow-up with periodical medical checkups for continuous monitoring of the delayed effect of CBRN agents is required to detect and treat long-term health effects like interstitial lung fibrosis, chromosomal aberrations, damage to eyes and genetic neurological abnormalities and carcinogenic effects.
- f. Special care will be taken for immediate and delayed psychosocial effects during and in the aftermath of crisis.
- g. Long-term effects of CBRN agents on environmental factors will also be monitored.
- h. Care should also be taken to prevent the consumption of contaminated food and water at all levels.

6.11 Prevention and Control of Panic Reaction

CBRN terrorism, specifically a dirty bomb scenario may not have radiation levels which are likely to cause any physical damage. However, it will spread great panic in the public, aggravating the situation. The first responders equipped with radiation monitors must ascertain the level of exposure and reassure the public about the same. The public can be reassured by announcements made on public address systems carried by the first responders, local community leaders and electronic media. In case the radiation level is beyond the safe limits then necessary evacuation must be carried out to safer zones at the earliest.

7

Approach to Implementation of the Guidelines

The national guidelines on medical preparedness and mass casualty management have been formulated as a part of an integrated national all hazard approach for the management of disasters. It is ensured that all aspects of preparedness are covered for quick and efficient medical response including measures pertaining to relief, rehabilitation and recovery. The objective is to develop a national community that is well informed, resilient and prepared to face disasters with minimal loss of life while ensuring adequate care for the survivors. Therefore, it will be the endeavour of the central and state governments and local authorities to ensure its implementation in an efficient, coordinated and focused manner. This can be achieved by forging mutually reciprocal relationships as envisaged by the institutional mechanism set up through the DM Act, 2005, viz., the NDMA, SDMAs and DDMAAs.

The primary responsibility of initial medical response will continue to remain with the state and district authorities. Further capacity enhancement and reinforcement of the system, will be provided by central and state governments based on the enhanced requirements. Initiatives like public-private partnership will be encouraged for further revamping of the system. The following factors are considered vital for ensuring a seamless and harmonious management of mass casualties:

- i) Identifying stakeholders/agencies/institutions with well-defined roles and responsibilities.
- ii) Specifying a clear chain of command and work relationships of administrative and medical groups.

- iii) Rationalisation and augmentation of the existing regulatory framework and infrastructure.
- iv) Institutionalisation of the programmes and activities at the ministerial/department levels.
- v) Increased inter-ministerial and inter-agency communication and networking.
- vi) Commensurate infrastructure and capacity development for medical preparedness.

MoH&FW as the nodal ministry will ensure the implementation of the Guidelines at the national level. The other stakeholders in medical emergency management are the MoD, MoR, MoL&E at the central level, ministries/departments of health in the states/UTs, scientific and technical institutions, academic institutions in the medical and paramedical field, professional bodies, corporate sector, NGOs and communities.

Implementation of the Guidelines will begin with formulation of a medical preparedness plan as part of the all hazard DM plan in all districts and states/UTs. The enabling phase will be used to build necessary capacity, taking into consideration the existing elements such as legislation, emergency plans, stakeholder initiatives, gaps and priorities based on vulnerability and risk assessment. The existing DM plans at various levels will be further revamped/strengthened to address medical preparedness. The central ministries/departments, states/UTs and districts will prepare and implement DM plans at all levels that address the strategic, operational and administrative aspects through

an institutional, legal and operational framework. Integral to this plan would be coordination within and between all the stakeholders at all levels.

These Guidelines have set modest goals and objectives of medical preparedness to be achieved by mobilising all stakeholders through an inclusive and participative approach. All concerned ministries of the GoI, the state governments, UT administrations and district authorities will allocate appropriate financial and other resources including dedicated manpower and targeted capacity development for successful implementation of the Guidelines.

7.1 Implementation of the Guidelines

7.1.1 Preparation of the Action Plan

The MoH&FW will prepare an action plan (involving programmes and activities) that will promote coherence among different medical management practices and strengthen mass casualty management capacities at various levels. The plan will be based on realistic and achievable timelines. Other ministries like MoD, MoR, MoL&E (through ESIC) will also prepare their respective medical preparedness plans as a part of the all hazard DM plans. In view of the expected role of these important line ministries in management of mass casualties in the event of national calamities, they should also cater for developing additional capacities besides meeting their own requirements in their medical preparedness plans.

The sssplan will be simple, realistic, functional, flexible, concise and comprehensive, encompassing networking of pre-hospital, hospital and public health components. The plan would lay special emphasis on the most vulnerable groups/communities to enable and empower them to respond and recover from the effects of disasters.

The national plan will include:

- i) Measures to be taken for minimisation/reduction of medical emergencies or mitigation of their effects (leading to avoidable morbidity and mortality).
- ii) Measures to be taken for integration of mitigation procedures in the development plans.
- iii) Measures to be taken for preparedness and capacity development to effectively respond to any threatening mass casualty situation.
- iv) Roles and responsibilities of the nodal ministry, different ministries or departments of the GoI, institutions, communities and NGOs in respect of measures specified in clauses (i), (ii) and (iii) above.

The action plan will spell out detailed work areas, activities and agencies responsible, and indicate targets and time-frames for implementation and be continually reviewed and updated. The identified tasks, to the extent possible would be standardised to have SOPs and resource inventory, etc. The action plan should have an inbuilt mechanism to coordinate with other ministries and the NEC. The plan prepared will also specify indicators of progress to enable their monitoring and review within the ministry and to the National Authority. The plan would be sent to the NDMA through the NEC for approval.

The ministries/agencies concerned, in turn, will:

- i) Issue guidance on implementation of the plans to all stakeholders.
- ii) Obtain periodic reports from the stakeholders on the progress of the implementation of the DM plans.
- iii) Evaluate the progress in implementation of the plans against the time-frames and take corrective action, wherever needed.

- iv) Disseminate the status of progress and issue further guidance on implementation of the plans to stakeholders.
- v) Report the progress in implementation of the plans to the nodal ministry.

The MoH&FW will keep the National Authority apprised of the progress on a regular basis. Similarly, concerned state authorities/departments will develop their state level DM plans and dovetail it with the national plan keeping the National Authority and SDMAs informed. The state departments/authorities concerned will implement and review the execution of the DM plans at the district and local levels along the above lines.

7.1.2 Implementation and Coordination at the National Level

Planning, executing, monitoring and evaluating are four facets of the comprehensive implementation of the Guidelines. If desired, the nodal ministry can co-opt an expert nominated by the National Authority during the planning stage so that the desired results are achieved through the action plan. The consultative approach increases the ownership of stakeholders in the solution process by bringing clarity to the roles and responsibilities in regard to various medical preparedness activities. Detailed documentation to elaborate the monitoring mechanism to be employed for undertaking a transparent, objective and independent review of NDMG—MPMCM activities will be worked out. A separate group of experts may be earmarked for evaluation so as to get an objective third party feedback on the effectiveness of activities based upon the Guidelines.

The important issues while preparing the action plan include:

- i) Adopting a single window approach for conducting and documenting activities outlined in the Guidelines in all the

- stakeholder ministries, departments, state governments, agencies and organisations.
- ii) Laying down the roles and responsibilities of all stakeholders at state and district level for managing MCE and to assist them in terms of required resources.
- iii) Developing detailed documents on how to ensure implementation of each of the activities envisaged in the Guidelines so as to attain a synergy among various activities and achieve coordination.
- iv) Ascertaining medical preparedness measures including capacity development for effective response to MCE.
- v) Incorporating measures for the prevention of medical emergencies, or the mitigation of their effects by integration of the mitigation measures in development plans.
- vi) Coordinating with line ministries such as railways, civil aviation, defence and ESIC networks for maintaining their resources to ensure that these are available during MCE.
- vii) Ensuring that professional expertise for the dissemination, monitoring, and successful and sustainable implementation of the various plans is available at all levels and for all the tasks.
- viii) Making sure that the skills and expertise of professionals are periodically updated, corresponding to best practices the world over as per the spirit of the emergency medical management framework.

The national plans would lay emphasis on identified critical gaps in managing mass casualties and would strengthen the government hospitals as also ensure assistance to the states in putting up requisite infrastructure including specialised capabilities for managing mass casualties arising out of CBRN disasters. This may include self-

contained mobile hospitals that can be airlifted or transported by road or rail to the disaster affected area especially if the health facilities at local levels are affected. A coordinated and synergistic partnership with the private sector, NGOs and Red Cross will result in provision of critical resources during response operations, and assist in restoring essential services.

7.1.3 Institutional Mechanism and Coordination at State and District Levels

The state governments may adopt in their plan the measures indicated in para 7.1.2 above, as applicable. The respective state/UT/district authorities will develop their medical preparedness plans as part of the all hazard disaster management plan based upon the MPMCM guidelines. The measures indicated at the national level may be adopted to ensure effective implementation by regular monitoring at the state level by the concerned authorities. The state will also allocate resources and provide necessary finances for efficient implementation of the plans. Since most activities under NDMG—MPMCM are community-centric and require association of professional experts for planning, implementation and monitoring, the SDMAs will formulate a suitable mechanism for their active involvement at various levels.

The India Disaster Resource Network database needs to be strengthened by the states (by continual updating and enhancement) and integrated with their DM plans. The activities are to be taken up in project mode with a specifically earmarked budget (both plan and non-plan) for each activity. The approach followed will emphasise medical preparedness and disaster-specific risk reduction measures including technical and non-technical mitigation measures that are environment and technology friendly, and sensitive to the special requirements of the vulnerable groups and communities.

7.1.4 District Level to Community Level Preparedness Plan and Appropriate Linkages with State Support Systems

A number of weaknesses have been identified with regard to awareness generation, response time and actions like evacuation, medical assistance and other activities in the area of medical preparedness and mass casualty management. This is observed specially in the district DM plans and it has been found to be a weak link in emergency management. The central and state governments need to evolve mechanism through mock drills, awareness programmes, training programmes, etc., with a view to sensitise and prepare officers concerned for initiating prompt and effective response.

The CMO of the district will be the overall in-charge of medical management of both government and private set-up in the pre-, during- and post-disaster phases. Prior arrangements will be worked out with the private sector to ensure that all these resources can be adopted in disaster situations. The CMO will be responsible for preparing the district medical preparedness plan as part of the DDMP based on the MPMCM guidelines.

Disaster resilience is the ability of the community to anticipate disasters and react quickly and effectively when they strike. The process of building resilience will be made through awareness generation, organising health and sanitation fairs, involving the community in mock drills, PPR and development of local capacities through education and training programmes.

7.2 Financial Resources for Implementation

After any disaster, central and state governments provide funds for immediate relief and rehabilitation to address the immediate needs of the affected population in terms of

food, water, shelter and medicine. This process does not adequately cover the requirements for reconstruction of damaged structures, especially those that are privately owned. The different disasters in the past have revealed that expenditure on response, relief, rehabilitation and recovery far exceeds the expenditure on prevention, mitigation and preparedness. With the paradigm shift in the government's focus on activities during the pre-disaster phase, adequate funds need to be allocated for prevention, mitigation, preparedness and capacity development rather than concentrating only on management at the time of disaster. The basic principle of Return on Investment (RoI) may not be applicable in the immediate context but the long-term impact would be highly beneficial, especially in terms of social cost-benefit imperatives. Thus, financial strategies will be worked out so that necessary finances are in place and flow of funds is organised on a priority basis by identification of necessary functions, in all the phases of preparedness, prevention, mitigation, response, relief, rehabilitation and recovery. Important activities include:

- i) Central ministries/departments and the state governments will mainstream DM efforts in their development plans.
- ii) Specific allocations will be made in the annual and development plans for carrying out disaster preparedness and mitigation measures.
- iii) On the basis of the multi-hazard vulnerability status of a particular area, the all hazard DM plan will have requisite inbuilt mitigation mechanism including earthquake resistant structures etc., for hospital buildings and other health care management institutions in the government and private sectors.
- iv) The developmental plans will have suitable techno-financial measures for establishing an effective health care system for the incident site and for the

hospitals to ensure medical preparedness and management of mass casualties.

- v) Concerned ministries/department will initiate mitigation projects for upgrading existing infrastructure to meet the enhanced requirement of risk reduction and risk management.
- vi) Private stakeholders will allocate sufficient funds for the purpose of disaster-specific prevention/mitigation and medical preparedness measures.
- vii) Wherever necessary and feasible, the central ministries and departments, and Urban Local Bodies (ULBs) in the states may initiate discussions with corporate sector undertakings to support disaster-specific risk reduction practices and establishment of a medical set-up to deal with all disasters as a part of PPP and Corporate Social Responsibility (CSR).

Central and state governments will facilitate the development and design of appropriate risk avoidance, risk sharing and risk transfer mechanism in consultation with financial institutions, insurance companies and reinsurance agencies. The insurance sector will be encouraged to promote medical insurance mechanism in the future. A national strategy for risk transfer through insurance, using the experiences of micro-level initiatives in some states and global best practices will be developed to reduce financial burden on the governments. Detailed mechanism for insurance needs to be evolved for the response, relief and rehabilitation phases.

7.3 Implementation Model

The institutional and operational framework including hospital infrastructure available with the state and district health authorities in the government sector needs further revamping and

strengthening. The private sector health care institutions should also form an important medical resource for the management of mass casualties during disasters. As on date, none of the major hospitals in the government/private sector are fully equipped/geared for managing mass casualties, particularly the victims of natural and man-made disasters. The implementation plan has to be drawn up at each level setting targets in terms of timelines and yearly reviews at every level to evaluate the degree of achievement, reasons for shortfall and corrective action for timely implementation. The experience gained in the initial phase of the implementation is of immense value, to be utilised not only to make mid-term corrections but also to make long-term policy and guidelines after comprehensive review of the effectiveness of DM plans undertaken in the short term.

7.3.1 Suggested Timeframe for the Implementation of NDMG—MPMCM Guidelines

All identified activities under the medical preparedness action plan will be planned as listed below for their implementation. The timelines proposed for the implementation of various activities in the guidelines are considered both desirable and feasible, especially in cases where financial and technical constraints are not limiting factors. Precise schedules will, however, be evolved in the disaster management plans that will follow at the central ministries/state level.

A) Phase-I (0-3 Years)

i) Regulatory framework:

- a. Dovetailing of existing acts, rules and regulations with the DM Act, 2005.
- b. Enactment/amendment of any act, rule and regulation, if necessary for better implementation of all DM health programmes across the country.

ii) Prevention:

- a. Integrated surveillance systems based on epidemiological surveys, detection and investigations of disease outbreaks.
- b. Establishment of early warning system.
- c. Rapid health assessment and provision of laboratory support.
- d. Institution of public health measures.

iii) Preparedness:

- a. Mechanism for emergency medical care at the incident site.
- b. Equipping MFRs/QRMTs with all material logistics and backup support.
- c. Provision for prompt evacuation using road/railways/aerial/water routes— development of integrated ambulance network.
- d. Development of containerised mobile hospitals.
- e. Provision of detection, protection, decontamination and decorporation facilities at the incident site and during evacuation.
- f. Communication and networking system with appropriate intra-hospital and inter-linkages with state ambulance/transport services, state police departments and other emergency services including fire.
- g. Mobile tele-health services.

iv) Capacity development:

- a. Knowledge management:
 - Sensitise and define the role of public, private and corporate sectors for their active participation.
- b. Human resource development:
 - Strengthening of the NDRF, MFRs, medical professionals,

- paramedics and other emergency responders.
 - Evolve mechanism for providing short and long-term psychosocial support and mental health services.
 - Human resource for monitoring and management of delayed health effects.
 - c. Education and training:
 - Inclusion of mass casualty management in the present curriculum of medical undergraduates.
 - Initiation of postgraduate courses.
 - Inclusion of training programmes in the area of emergency medicine to hospital administrators, specialists, medical officers and paramedics for mass casualty management.
 - Proper education and training (including CME) of the personnel using information networking systems.
 - d. Community preparedness:
 - Community awareness programme for first aid and triage.
 - Dos and Don'ts to mitigate the effects of medical emergencies.
 - Define roles as a part of community based disaster management plans.
 - e. Hospital Preparedness:
 - Hospital disaster management plans.
 - Surging capacities to respond to any MCE.
 - Identifying, stockpiling, supply chain and inventory management
 - of drugs, equipment and consumables including vaccines, antidotes, and other agents.
 - f. Specialised health care and laboratory facilities:
 - Trauma centres at regional levels.
 - Strengthening of poison centres.
 - Blood banks.
 - Laboratory services network.
 - Specialised facilities including CBRN regional centres for protection, detection, decontamination and decorporation.
 - g. Scientific and technical institutions for applied research and training:
 - Post-disaster medical documentation procedures and epidemiological surveys.
 - Regular updating on certain issues by adopting activities in R&D mode initially by pilot studies.
 - v) Development of radiation injury treatment centre, CBRN simulation model facility, mobile CBRN decontamination facility and detectors for CBRN agents.
 - vi) Upgradation of PPE and production of vaccines and prophylactic modalities for CBRN management.
- B) Phase-11 (0-5 Years)
- i) Prevention:
 - a. Strengthening of integrated surveillance systems and EWS at regional levels.
 - b. Incorporation of disaster specific risk reduction measures.

- ii) Preparedness:
 - a. Institutionalisation of advanced EMR system (networking ambulance services with hospitals) and containerised hospitals.
 - b. Upgrading containerised mobile hospitals for CBRN management.
- iii) Capacity development:
 - a. Strengthening of scientific and technical institutions for knowledge management and applied research and training in CBRN.
 - b. Continuation and updation of human resource development activities.
 - c. Developing community resilience,
- iv) Hospital Preparedness:
 - a. Testing of various elements of the emergency plan through table top exercises and mock drills.
 - b. Specialised health care and laboratory facilities.
 - c. Trauma centres at district levels.
 - d. Poison centres at various vulnerable areas.
- v) R&D activities identified in phase-I will be intensified and newer facilities will be developed at vulnerable locations.

C) Phase-III (0-8 Years)

The long-term action plan will intensify the areas identified in phase-I and phase -II along with the following important issues:

- i) All hospitals and laboratories will be accredited to address the issue of quality medical care.
- ii) Integration of the concept of mock drills, training and refresher training schedules, monitoring the mechanism of human resource development, and critical infrastructure at all levels to tackle natural and man-made disasters.
- iii) Based upon the need assessment analysis, facilities like mobile hospitals, QRMTs, network of laboratories, burn centres, radiation injury treatment centres and blood banks will be developed.
- iv) Institutionalising a continuous upgrading mechanism based upon the gaps identified in various activities performed in phase-I and phase-II.
- v) Modes to integrate various community practices in the institutionalised framework of MPMCM.
- vi) Identification of gaps based on the R&D activity in phase-I and phase-II that need further research and intervention.

To conclude, the present system of medical preparedness and arrangement for mass casualty management is required to function in a more proactive and coordinated manner. MoH&FW, state governments/district administrations will enhance their capacities with the help of the private sector. The existing DM plans at various levels will be further revisited and strengthened to address the management of mass casualties.

Annexures

Annexure-A
Refers to Chapter 1, Page 1

Damage Caused by Mass Casualty Events due to Natural Disasters in India

<i>Year</i>	<i>People affected (Lakh)</i>	<i>Houses & buildings, partially or totally, damaged</i>	<i>Amount of property damage/loss (Rs Crore)</i>
1985	595.6	2,449,878	40.06
1986	550.0	2,049,277	30.74
1987	483.4	2,919,380	20.57
1988	101.5	242,533	40.63
1989	30.1	782,340	20.41
1990	31.7	1,019,930	10.71
1991	342.7	1,190,109	10.90
1992	190.9	570,969	20.05
1993	262.4	1,529,916	50.80
1994	235.3	1,051,233	10.83
1995	543.5	2,088,355	40.73
1996	549.9	2,376,693	50.43
1997	443.8	1,103,549	n.a.
1998	521.7	1,563,405	0.72
1999	501.7	39 104,064	1020.97
2000	594.34	2,736,355	800.00
2001	788.19	846,878	12000

Disaster Management Status Report, 2004, NDM Division, Ministry of Agriculture

Complex Socio-Economic Environmental Problems in Mass Casualty Events and Public Health Emergencies with Mass Casualty Potential

A) Social Effects

- i) Loss of human life
- ii) Health related long-term effects
- iii) Increase in psychosocial pathologies in the community
- iv) Lack of education to the affected community
- v) Temporary and permanent migration
- vi) Law and order problems/social disruption
- vii) Loss of livestock

B) Economic Effects

- i) Loss of housing
- ii) Damage to infrastructure
- iii) Disruption to communications and power
- iv) Disruption in transport facilities
- v) Loss of industrial production
- vi) Loss of agricultural produce
- vii) Disrupted markets and public distribution system
- viii) Loss of commerce

C) Environmental Contamination: Air/Water/Land and Standing Crops

D) Destruction of Health Infrastructure

- i) Hospitals, clinics, PHCs, CHCs buildings
- ii) Equipment and supplies

E) Enhanced Requirement of Health Care Providers

F) Concerns of Epidemics

- i) Disrupted potable water supply
- ii) Poor sanitation
- iii) Overcrowding in relief camps
- iv) Water/food contamination
- v) Vector proliferation

G) Enhanced Health Care Needs of Vulnerable Groups

H) Disruption of Ongoing Community Health Programmes

I) Increase in Mental Health Problems (PTSD etc.)

Public Health Emergencies with Mass Casualty Potential:

- i) Vector-borne diseases: Enabling environment for mosquito breeding due to water collection leading to increase in malaria/dengue/Japanese encephalitis cases.
- ii) Water-borne diseases: Contaminated water and poor sanitation. Increase in possibilities of cholera/enteric fever/shigellosis/rota-viral diarrhea/hepatitis epidemics.
- iii) Increase in zoonotic diseases: Due to displacement of animals from their habitats.
- iv) Droplet infections: Due to adverse living conditions, overcrowding in temporary shelters (measles, influenza, meningitis, scrub typhus, TB).
- v) Contact diseases: Lack of personal hygiene and overcrowding especially in relief camps/ temporary shelters.
- vi) Bioterrorism can cause mass casualties leading to public health emergencies.

Preventive Measures:

A) Water Supply

- i) Safe and sufficient drinking water
- ii) Protect existing water source from contamination
- iii) Chlorine tablets sanitation

B) Provision of Latrines and Toilets

C) Waste Disposal

D) Adequate Supply of Food and Nutrients

E) Proper Disposal of Dead Bodies and Carcasses

F) Vector Control

- i) Spraying of shelters with residual insecticides
- ii) Provision of insecticide treated mosquito nets
- iii) Use of larvicidals

G) Health Education

- i) Promote hygienic practices e.g., hand-washing and use of soap, latrines for defecation
- ii) Use of safe water e.g., boil/add chlorine tablets to water
- iii) Safe food
 - Properly cooked food
 - Safe food handlers

Important Health Legislation

A) To Improve and Maintain High Standards of Medical Education and Services:

- The Indian Medical Council Act, 1956 and Regulations, 2002
- The Indian Nursing Council Act, 1947
- The Dentist's Act, 1948 (amended in 1993)
- The Pharmacy Act, 1948
- The Rehabilitation Council of India Act, 1992
- The Indian Medicine Central Council of India Act, 1970
- The Homeopathy Central Council Act, 1973
- The Consumer Protection Act (CPA), 1986

B) Public Registration to Assess Mortality and Enumeration of Population

- The Registration of Births and Deaths Act, 1969
- The Census Act, 1948

C) To Prevent Public Health Problems:

- The Epidemic Diseases Act, 1897 (amended time to time)
- The Delhi Antismoking and Nonsmoking Health Protection Act, 1996
- The Transplantation of Human Organs Act, 1994
- The Prevention of Food Adulteration Act, 1954
- The Aircraft Act, 1934 and Indian Air Craft (Public Health) Rules, 1954 (amended in 1969)
- Public Liability Insurance Act, 1991
- Essential Commodities Act, 1955
- The International Health Regulation, 2005

D) To Achieve Maternal Health and to Empower the Women:

- The Medical Termination of Pregnancy (MTP) Act, 1971
- The Maternity Benefit Act, 1961
- The Dowry Prohibition Act, 1961
- The Dowry Prohibition (Maintenance of list of Presents to the Bride and Bridegroom) Rules, 1985
- The Immoral Traffic (Prevention) Act, 1956

- The Prenatal Diagnostic Techniques (Regulation and Prevention of Misuse) Act, 1994
- The Hindu Succession Act, 1956
- The Indecent Representation of Women (Prohibition) Act, 1986
- The Commission of Sati (Prevention) Act, 1987

E) To Safeguard Children and Young:

- The Infant Milk Substitutes, Feeding Bottles and Infant Foods (Regulation of Production, Supply and Distribution) Act, 1992
- The Juvenile Justice Act, 1986
- The Child Labour (Prohibition and Regulation) Act, 1986
- The Child Marriage Restraint Act, 1929
- The Hindu Adoption and Maintenance Act, 1956

F) To Rehabilitate and Provide Equal Opportunity to the Disabled and Disadvantaged Groups:

- The Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995
- The Mental Health Act, 1987
- The Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Act, 1989

G) To Prevent Drugs Addiction and Substance Abuse and Safe Manufacturing of Drugs, Distribution and Storage:

- The Narcotic Drugs and Psychotropic Substances Act, 1985
- The Drugs and Cosmetics Act, 1940
- The Drugs (Control) Act, 1948
- The Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954

H) To Protect Workers and to Provide Social Security:

- The Minimum Wages Act, 1948
- The Dangerous Machines (Regulation) Act, 1983
- The Plantations Labour Act, 1951
- The Factories Act, 1952
- The Mines Act, 1948
- The Employees' State Insurance (ESI) Act, 1948
- The Workmen's Compensation Act, 1923
- The Bonded Labour System (Abolition) Act, 1976
- The Trade Union Act, 1926

- The Dock Workers (Safety, Health and Welfare) Act, 1986
- The Mines Labour Welfare Fund Act, 1972
- The Bidi Workers' Welfare Fund Act, 1972
- The Beedi and Cigar Workers (Conditions of Employment) Act, 1966
- The Contract Labour (Regulation and Abolition) Act, 1970
- The Boiler Act, 1923
- The Payment of Wages Act, 1936
- The Payment of Bonus Act, 1965
- The Weekly Holidays Act, 1942

I) Environmental Legislation:

- The Environment (Protection) Act, 1986
- The Biomedical Waste (Management and Handling) Rules, 1998
- The Municipal Solid Waste (Management and Handling) Rules, 2000
- The Hazardous Waste (Management and Handling) Rules, 1989
- The National Environment Tribunal Act, 1995
- The Air (Prevention and Control of Pollution) Act, 1981
- The Water (Prevention and Control of Pollution) Act, 1974
- The Atomic Energy Act, 1962
- The Insecticides Act, 1988
- The Delhi Municipal Corporation Act, 1957
- The Motor Vehicles Act, 1988
- The Wild Life (Protection) Act, 1972
- The Destructive Insects and Pests Act, 1914

J) To Promote Voluntary Work:

- The Red Cross Society (Allocation of Property) Act, 1936
- The Societies Registration Act, 1860

Source: Ministry of Health and Family Welfare, GoI

Distribution of Health Care Facilities in India

A) Number of Government Allopathic Hospitals and Hospital Beds in Rural and Urban Areas (Including CHCs)

Sl.No.	State/UT/Division	Rural Hospitals						Urban Hospitals						Total Rural and Urban Hospital	
		Community Health Centre		Other Rural Hospitals		Total Rural Hospitals		Community Health Centre		Other Urban Hospitals		Total Urban Hospitals		No.	Beds
		No.	Beds	No.	Beds	No.	Beds	No.	Beds	No.	Beds	No.	Beds		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Andhra Pradesh	47	1410	177	1595	224	3005	117	4550	180	27466	297	3201	521	35021
2	Arunachal Pradesh +	31 c	930	0	0	31	930	*		14	1236	14	123	45	2166
3	Assam +	100 c	3000	NR		100	3000	*		NR				100	3000
4	Bihar +	101 c	3030	NR		101	3030	*		NR				101	3030
5	Chattisgarh	116	3514	0	0	116	3514	*		22	2051	22	205	138	5565
6	Goa	5	222	7	660	12	882	0	0	8	1757	8	1757	20	2639
7	Gujarat	272	9741	40	2152	312	11893	-	-	191	23163	191	2316	503	35056
8	Haryana	36	870	6	198	42	1068	36	1080	55	4970	91	6050	133	7118
g	Himachal Pradesh	56	882	30	1506	86	2388	10	320	45	5078	55	5398	141	7786
10(a)	Jammu Division	25 c	750	2	80	28	830	*		8	870	8	870	38	1700
10(b)	Kashmir Division	33 c	990	0	0	33	990	*		7a	605	7	605	40	1595
11	Jharkhand+	47 c	1410	NR		47	1410	-		NR				47	1410
12	Karnataka	138	4280	304 (a)	3040	442	7320	161 (b)	9144	120	24840	281	33984	723	41304
13	Kerala	106	3645	21	4126	127	7771	8	1178	54	16890	62	18068	189	25839
14	Madhya Pradesh	229	6884	0	0	229	6884	*		95	10818	95	10818	324	17702
15	Maharashtra +	382 c	11460	0	0	382	11460	*		NR				1170 d	76447
16	Manipur	16	320	11	150	27	470	-	-	1	200	1	200	28	670
17	Meghalaya +	23 c	690	3	300	26	990	*		4	1167	4	1167	30	2157
18	Mizoram	9	270	1	20	10	290	3	106	7	773	10	879	20	1169
19	Nagaland	21	630	15	640	36	1270	-	-	12	790	12	790	48	2060
20	Orissa	222	3336	101	1385	323	4721	9	184	74	8241	83	8425	406	13146
21	Punjab	117	3852	22	738	139	4590	*				21	4383	160	8973
22	Rajasthan	214	7095	11	370	225	7465	85	3465	200	21150	285	24615	510	32080
23	Sikkim	4	350	2	80	6	430	-	-	1	300	1	300	7	730
24	Tamil Nadu +	35 c	1050	80	2268	115	3318	*		309	40249	309	40249	424	43567
25	Tripura	6	160	5	225	11	385	3	90	12	1756	15	1846	26	2231
26	Uttar Pradesh +	294 c	8820	NR		294	8820	*		NR				294	8820
27	Uttaranchal +	36 c	1080	NR		36	1080	-		NR				36	1080
28	West Bengal (c)	346	6955	39	3991	385	10946	-	-	257	47570	257	47570	642	58516
29	A&N Island	4	190	2	150	6	340	-	-	2	557	2	557	8	897
30	Chandigarh	1	35	1	15	2	50	*		5	2150	5	2150	7	2200
31	D&N Haveli	1	30	-	-	1	30	-	-	1	75	1	75	2	105
32	Daman & Diu	1	42	1	10	2	52	*		2	140	2	140	4	192
33	Delhi	0	0	0	0	0	0	*		105 b	20368	105	20368	105	20368
34	Lakshadweep	3	90	2	70	5	160	-	-	-	-	-	-	5	160
35	Pondicherry	3	90	-	-	3	90	1	30	11	3053	12	3083	15	3173
	Total	3080	88103	884	23769	3964	111872	433	20147	1802	268283	2256	292813	70084	469672

**B) Population Served per Government Hospital
and Government Hospital Bed**

Sl.No.	State/UT/Divison	Total no. of Govt.Hospitals	Total No. of Govt. Hospital Beds	Population served per Govt. Hospital	Population served per Govt. Hospital Bed	Projected population in (000) March 2005
1	Andhra Pradesh	521	35021	154376	2297	79501 (80430)
2	Arunachal Pradesh	45	2166	25311	526	1155 (1139)
3	Assam #	100	3000	280500	9350	28535 (28050)
4	Bihar#	101	3030	869406	28980	89319 (87810)
5	Chattisgarh #	138	5565	159500	3955	22444 (22011)
6	Goa	20	2639	74650	566	1493
7	Gujarat	503	35056	108974	1564	54007 (54814)
8	Haryana	133	7118	170444	3185	22669
9	Himachal Pradesh	141	7786	45106	817	6360
10 (a)	Jammu Division	36	1700	.	.	NA
10 (b)	Kashmir Division(a)	40	1595	-	.	11257
11	Jharkhand	47	1410	602191	20073	28742 (28303)
12	Karnataka	723	41304	76744	1343	55486
13	Kerala	189	25839	177614	1299	33223 (33569)
14	Madhya Pradesh	324	17702	186373	3411	65531 (60385)
15	Maharashtra	1170	76447	86560	1325	102692 (101275)
16	Manipur	28	670	91464	3822	2529 (2561)
17	Meghalaya	30	2157	80367	1118	2442 (2411)
18	Mizoram	20	1169	47150	807	943
19	Nagaland	48	2060	43938	1024	2109
20	Orissa	406	13146	96190	2971	38604 (39053)
21	Punjab	160	8973	158350	2824	25659 (25336)
22	Rajasthan	510	32080	120176	1910	61290
23	Sikkim	7	730	82714	793	572 (579)
24	Tamil Nadu	424	43567	153917	1498	64654 (65261)
25	Tripura	26	2231	129808	1513	3375

Contd

26	Uttar Pradesh #	294	8820	601241	20041	180318 (176765)
27	Uttaranchal #	36	1080	247917	8264	9071 (8925)
28	West Bengal	642	58516	13 19 24	1447	84695
29	A&N Island	8	897	48125	429	385
30	Chandigarh	7	2200	138428	440	990 (969)
31	D&N Haveli	2	105	121000	2305	242
32	Daman & Diu	4	192	42500	885	174 (170)

For details about (a) (b) (c) (d) and other annotations see: Health Information of India, 2005, Ministry of Health and Family Welfare (<http://www.cbhidghs.nic.in/hia2005/8.01.htm>)

National Health Programmes

Department Of Health—National Aids Control Programme

HIV infection today affects about 3.5 million Indians, with no state unaffected by the virus. HIV/AIDS continues to show itself to be one of India's most complex epidemics—a challenge that goes beyond public health, raising fundamental issues of human rights and threatening development achievements in many areas. The need to prevent the progression of this epidemic and provide care and support for those infected or affected is calling for an unprecedented response from all sections of society.

The National AIDS Control Organisation, MoH&FW launched the National AIDS Control Programme-11 in December, 1999 with a total budget of Rs. 1,425 crores. The new national programme in implementation sees the country on the threshold of a new approach—marked by a focus on encouraging and enabling the states to take on the responsibility of responding to the epidemic. It is also leading to growing partnerships between government, NGOs and civil society. National AIDS Control Programme-II has two key objectives, namely:

1. To reduce the spread of HIV infection in India; and
2. Strengthen India's capacity to respond to HIV/AIDS on a long-term basis. Reflecting the extreme urgency with which HIV prevention and control needs to be pursued in India, the AIDS-II project of the National AIDS Control Programme (NACO) will be across all states and UTs in a centrally sponsored scheme with 100 per cent financial assistance from the GoI—direct to state AIDS control societies and selected municipal corporations.

The NACO has undertaken various schemes to address specific areas for the prevention and control of HIV/AIDS in the country in which NGOs are also being involved.

With the purpose of reducing the rate of transmission among the high-risk behaviour communities, NACO has introduced targeted intervention programmes. These programmes are focused to each specific target group and bring about a change in high-risk behaviour through behaviour change communication, STD services, condom promotion and creation of an enabling environment.

National Leprosy Eradication Programme

Leprosy is the oldest disease known to mankind. The first evidence of a leprosy like disease was recorded in Egypt in 1,400 BC. Leprosy is the least infectious of all the communicable diseases. It can take years of living in close proximity to an untreated leprosy patient to develop the disease. Like tuberculosis to which the disease is related, droplets in the air spread leprosy germs.

In 1985, there were 122 leprosy endemic countries worldwide. In 1999, the figure was down to 24. Ninety per cent of the world leprosy cases are now confined to 11 countries. However, India has a sizable number of the world's recorded leprosy patients. The National Leprosy Control Programme has been in operation since 1955.

Vector Borne Disease Control Programme

Malaria

Malaria is one of the major public health problems. The disease is distributed in all parts of India except areas lying above 1,800 metres altitude. Two species of the malaria causing parasite are found in India namely *P. vivax* and *P. falciparum*.

Dramatic success was achieved in implementation of the anti-malaria programme in the past. From an estimated 75 million cases and 0.8 million deaths annually in 1952 the annual incidence was brought down to only 0.1 million cases with no deaths in 1965. An era of resurgence followed with a peak in 1976, when 6.47 million cases and 59 deaths were reported. The challenge was met with a change in the malaria control strategy and a Modified Plan of Operation (MPO) was initiated from 1977 onwards. The annual incidence came down to about two million cases in 1983. Since then the malaria cases have been contained to around two to three million cases annually.

Filaria

Filaria is another major public health problem in India. There are an estimated 454 million people at risk of the disease in 18 states and UTs. There are 205 control units and 199 filaria clinics functioning in urban areas under the National Filaria Control Programme (NFCP). The measures taken to control filaria are anti-larval measures at weekly intervals, environmental methods of controlling mosquito breeding, biological control through larvivorous fish and anti-parasitic measures through detection and treatment of microfilaria carriers. 13 districts in seven states of the country namely Andhra Pradesh, Bihar, Uttar Pradesh, Kerala, Tamil Nadu, Orissa, and West Bengal have been brought under the ambit of single dose mass administration of the drug since 1997, in accordance with the global plan for elimination of filariasis.

Kala-azar

Kala-azar is a visceral disease caused by the protozoan parasite *leishmania donovani* and transmitted by the *Phlebotomus argentipes* and is prevalent in the states of Bihar, West Bengal and eastern Uttar Pradesh. Kala-azar control strategy envisages free treatment with Sodium Stibo Gluconate (SSG) and treatment of unresponsive cases with Pentamidine isethionate. The spraying of pesticides is undertaken in the kala-azar affected villages, to interrupt kala-azar transmission.

Dengue

Dengue fever is a disease transmitted by the bite of the *Aedes aegypti* mosquito. Since 1956 outbreaks have been reported in different parts of India. In recent years the states of Delhi, Haryana, Punjab, Uttar Pradesh, Karnataka, Maharashtra and Tamil Nadu have been reporting dengue/dengue hemorrhagic fever cases. The dengue situation in the country is regularly monitored by the National Anti-Malaria Programme. Symptomatic treatment of dengue/dengue hemorrhagic fever cases, vector surveillance and control, and health education are important components of dengue control in India.

National TB Control Programme

TB is an infectious disease caused by a bacterium, *Mycobacterium tuberculosis*. It is spread through the air by a person suffering from TB. A single patient can infect 10 or more people in a year.

It primarily affects people in their most productive years of life and is commonly associated with poverty, overcrowding, and malnutrition. India contributes about one-third of the global burden of tuberculosis. Every year, there are approximately 22 lakh new cases in the country, of which approximately 10 lakh are new smear-positive and therefore highly infectious.

The National Tuberculosis Control Programme has been under implementation since 1962 on a 50:50 sharing basis between the centre and states. The Revised National Tuberculosis Control programme has been launched in 2005 with the objective of early detection and treatment. A strategy of treatment known as DOTS has been adopted.

TB-HIV Dual Infection

An individual, suffering from AIDS, has 10 times increased risk of developing TB disease. Around 60% of the AIDS cases reported in India have evidence of active TB.

National Programme for Control of Blindness

National Programme for Control of Blindness was launched in the year 1976 as a 100% centrally sponsored programme.

National Cancer Control Programme

There are various schemes under the National Cancer Control Programme for which central assistance is provided to the state governments/Institutions. The schemes are as under:

a) Development of Oncology Wing

This scheme is available only for government medical colleges to fill up the geographical gaps in the detection and treatment of cancer in the country.

b) Setting up of Cobalt Therapy Unit (Tele-therapy Unit)

Financial assistance up to Rs. 1.50 crore is provided to the state government for setting up of cobalt therapy units in government institutions.

National Mental Health Programme

To mitigate the hardship of mentally ill patients, the National Mental Health Programme was started in 1982. As decided in the meeting of the Central Council of Health in 1995 and as recommended by the workshop of all the Health Administrators of the Country held in February, 1996, the District Mental Health Programme was launched in 1996-97 in four districts, one each in Andhra Pradesh, Assam, Rajasthan and Tamil Nadu.

The District Mental Health Programme was extended to seven districts in 1997-98, five districts in 1998 and six districts in 1999-2000.

Drug De-addiction Programme

Drug addiction as a social problem has been in existence in the country and during the earlier periods (1961-1976) it was mainly alcohol abuse. However, in the post 1980 period, apart from traditional drugs like opium, cannabis, etc., synthetic drugs and psychotropic substances are also being abused. Because of the multifarious facets of this problem, two ministries in the Govt are involved in tackling drug abuse and related issues. The MoH&FW is mainly involved in providing treatment services to the addicts whereas the Ministry of Social Justice and Empowerment deals with other aspects of the problem like awareness creation, counselling and rehabilitation.

Central Drug Standard Control Organisation

The Central Drugs Standard Control Organisation in the DGHS along with Drug Control Transition in the states are responsible for safety, efficacy and quality of drugs, their import, manufacture, distribution, sale and standards.

Department of Indian Systems of Medicine and Homoeopathy

The Department of Indian Systems of Medicine and Homoeopathy was established as a separate department in the MoH&FW in March 1995.

Reproductive and Child Health Programme

The Reproductive and Child Health (RCH) Programme was launched in October 1997 incorporating a new approach to population and development issues, as exposed in the International Conference on Population and Development held at Cairo in 1994. The programme integrated and strengthened the services/interventions under the Child Survival and Safe Motherhood Programme and Family Planning Services and added to the basket of services, new areas on reproductive tract/sexually transmitted infections. The RCH Programme is the umbrella programme of the department within whose framework and approach, all the services being provided/arranged by the Department of Family Welfare are to be planned and delivered. It aims at providing need based, client centred, demand driven, high quality services to the beneficiaries with a view to enhancing the quality of reproductive life of the population and enabling the country to achieve population stabilisation.

The structure, strategy and functioning of the RCH Programme has been reviewed on the eve of launching of 10th plan in the light of the landmark National Population Policy, 2000. The programme now intends to gradually make a shift to address the entire gamut of women's health issues. The programme would also pay substantially more attention on the eight states lagging behind in population stabilisation efforts viz., Bihar, Chattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh and Uttaranchal and under served groups viz., adolescents, urban slum dwellers, males, etc. The inter-sectoral linkages will be brought to bear more upon the delivery of services and in enhancing the outcomes of reproductive services. A proposal for sourcing donor funds for the programme is under development now.

List of DNA Fingerprinting Laboratories

Centre for DNA Fingerprinting and Diagnostics

DBT, Ministry of Science and Technology, Govt. of India
ECIL Road, Nacharam, Hyderabad - 500 076
Tel: 040-2715 5604
Fax: 040-2715 5610

AP State Forensic Science Laboratory

Red Hills, Opp. Niloufer Hospital
Hyderabad - 500 004
Tel: 040-2339 0398
Fax: 040-2339 4449

Forensic Science Department

'Forensic House'
30-A, Kamarajar Salai
Mylapore, Chennai
Tamil Nadu - 600 004
Telefax: 044-2844 7767
E-mail: forensic@tn.nic.in

Central Forensic Science Laboratory

Directorate of Forensic Science
Sector 36-A, Plot-2
Dakshin Marg
Chandigarh, Punjab -160 036
Tel: 0172-2615 068
Fax: 0172-2605 923

Central Forensic Science Laboratory (CFSL)

Central Bureau of Investigation (CBI)
Block No.4, CGO Complex
Lodhi Road
New Delhi-110 003
Tel: 011-2436 1396
Email: dcfsl@cbi.gov.in

Department of Forensic Medicine and Toxicology

All India Institute of Medical Sciences
New Delhi-110 029
Tel: 011 -2658 8500 / 2658 8700
Fax:011-2658 8663

Contd

Forensic Science Laboratory

Govt. of NCT of Delhi
Madhura Chowk
Rohini, New Delhi -110 085
Tel: 011-2755 5890
Fax:011-27555 890

State Forensic Science Laboratory

Hans Bhugra Marg
Santacruz (E), Vidyanagari
Mumbai
Maharashtra - 400 098
Tel: 022-2667 0760
Fax:022-2667 0844

State Forensic Science Laboratory

New Mental Centre
Ahmedabad - 380 016

Central Forensic Science Laboratory

Directorate of Forensic Science
30, Gorachand Road
Kolkata-700014
West Bengal
Tel: 033-2284 1638
Fax: 033-2284 9442

In addition to the above laboratories, there are the following laboratories which are also in the process of setting up DNA profiling activities:

- a) Central Forensic Science Laboratory, Directorate of Forensic Science, Ramanthapur, Amberpet Post, Hyderabad, Andhra Pradesh - 500 013
- b) Rajiv Gandhi Centre for Biotechnology, Thycaud PO, Poojappura, Thiruvananthapuram, Kerala-695 014
- c) Forensic Science Laboratory, 5, Civil Lines, Sagar, Madhya Pradesh - 470 001
- d) Police Forensic Science Laboratory, Jaipur, Rajasthan - 302 016

Epidemiological Surveys, Surveillance Programmes and Prevention of Epidemics

The first goal of epidemiological programmes is to foresee the advent of health problems that will demand intervention in the aftermath of a disaster. Early warning systems serve as epidemiological instruments to detect a potential disaster. It is important to understand that external resources should only be used when the local resources are inadequate to cope. The institution of an epidemiological surveillance programme will make it possible to determine the impact on the victims' health status, the effectiveness of the services provided, and the way the inputs provided were used. The scope of epidemiological programmes are limited to those phases which are involved in crisis situations, specifically the following:

1. Initial assessment of an emergency situation
2. Assessment of an epidemic
3. Organisation of a surveillance system
4. Organisation of an early warning system

1. INITIAL ASSESSMENT

1.1 Principles of an Initial Assessment—The basic concept of an initial assessment is the necessity of determining whether there is a patent imbalance between the victims' vital needs and the local facilities normally responsible for meeting them. An initial assessment should be considered as a collection of information by a systematic method. The initial assessment in an emergency situation should aim at clarifying as quickly as possible the major health problems that pose a vital risk to the population affected.

a. Indicators—Depending on the situation, indicators should include:

Factors reflecting the victims' needs such as—Population census, number of sick, number of malnourished.

Local resources—Number of hospitals, agricultural production.

Circumstantial factors—Political situation (security incidents, belligerents' attitudes towards the civilian population in conflict situations); ecological situation (for example, in cases of drought, measurement of rainfall in the preceding months).

Structural factors—Evidence of a chronic incapacity in the local services to meet the population's needs (for example, weak immunisation coverage); evidence of socio-cultural practices that are harmful to health.

The choice of indicators depends on the level of analysis desired. If the goal is to define a serious crisis affecting the population, studies should be restricted to the main indicators capable of demonstrating the existence of a major crisis: mortality rate, malnutrition rate, prevalence of communicable diseases, access to medical care, access to food resources. If the goal is to determine

the underlying causes of a crisis, indicators must be selected which will outline the major infra-structural systems: agriculture, health, social services, etc.

b. Check Lists—Generally, relief agencies want check lists for the information needed in an emergency situation to be as complete as possible. The ideal list does not exist, however, lists can be established on the basis of:

The original problem—Assessment of health needs following floods, earthquakes etc., initial assessment of health problems in famine situations.

The type of victim—Assessment of health problems during sudden population movements, assessment of the problems of war-wounded.

A specific technical problem—Assessment of a water-supply point, assessment of the bacterial quality of water.

Assessment of a hospital—Structure, buildings, provision of water, provision of energy, etc.

Assessment of resources—Personnel, equipment and drugs in stock.

Quantitative assessment of activities—Number of hospital admissions or services for a given unit of time, average hospital stay.

Qualitative assessment of the work carried out—Type of procedures, type of prescriptions (standardisation).

c. Information Sources—Information sources are diverse:

Population—In principle, the population itself is the most reliable source of information. It is not always accessible however, and several factors must be taken into consideration like—the absence of a census, the mobility of populations, the identification of people actually affected by the crisis, changes in the number of people involved, changes in population structure relative to a normal population. Assessing a population's health status will require the use of the main epidemiological tools sampling, tests, questionnaires, etc.

Existing surveillance systems—Where infrastructural services (social services, health care, agriculture) are equipped for systematic data collection, they must be consulted. Nevertheless, the unreliability and irregularity of the data should be taken into account.

d. Analysis of Results—Analysing the information collected is the crucial point of every initial assessment, since it leads to the decision-making process. An incorrect appraisal of the situation may have disastrous consequences. Three cardinal rules must be respected:

Data analysis must be multi-sectoral—The examples of such analysis are—rate of diarrhea diseases and water supply, rate of malnutrition and communicable diseases, number of hospital admissions and rate of avoidable diseases.

Data must be analysed in context—The examples of such analysis are rate of malnutrition and season of the year, access to food resources and political context, quality of care and level of development.

Data should serve as a basis for projections over time—Projection over time is the most difficult level of analysis. A given situation will often develop haphazardly, even over a short time span.

e. Decision-making—To facilitate the decision-making process, the specific quantitative criteria for interventions, need to be developed.

2. PLANNING A SURVEILLANCE SYSTEM

The purpose of a surveillance system is to collect on a regular basis, data required for indicating the developments in a population's health status like functioning of the health care services, access to food resources and water supply; detecting epidemics; facilitating decisions concerning the conduct of operations.

2.1 Basic Principles—An effective surveillance system is based on the following conditions:

Standardisation of indicators, tests, sources, and methods of analysis—With no standardisation, there is a danger of comparing variables that are defined differently according to their source. Similarly, if tests are not standardised, it is difficult to compare results obtained by different organisations working in the same region.

Continuity in data collection—Trend analysis will be relevant if data is gathered at regular intervals over a long period.

Simplicity of operation—The surveillance system should be simple in operations so that there will be no extra burden on health care professionals in their daily care providing activities. Such approach will smoothen the overall functioning.

Planning an epidemiological surveillance system involves—choosing indicators, selecting indicator sources, establishing methods for collecting indicators, tabulating and organising results, analysing results, distributing results and making decisions based on results.

a. Indicators—The selection of indicators is much easier if precise operational objectives have been set at the beginning of the relief action, such as—immunise 90% of children under five years of age within three months; guarantee a food intake of 2,400 kcal per day for the entire population within one month; provide a minimum of 20 litres of potable water per person per day; treat all cases of malaria with a standard anti-malarial regime; reduce the malnutrition rate from 15% to 5% in children under age five within one month.

Operational objectives such as these provide a basis for determining the indicators that will serve as a gauge of achievement—immunisation coverage after three months; food ration distributed; number of people with access to food distribution; quantity of water distributed; rate of malnutrition after one month.

Choice of Indicators for Epidemiological Surveillance—Three kinds of factors must be considered for choosing the indicators:

Technical factors—Indicator relevance: What is being measured? Programme functioning, health status, etc. Reliability of information sources; possibility of systematic data collection.

Coordinating factors—Link with the indicators specified at the time of the initial assessment; link with the operational objectives; standardisation among the indicators collected by the different people or groups involved in the humanitarian intervention.

Political factors—Are the information sources free to furnish the necessary data? Is regular access guaranteed.

b. Selection of Indicators—It is important to avoid the danger of choosing too many indicators, the collection and analysis of which will prove impossible. Too few indicators, however, may be just as bad, permitting only a very basic level of analysis.

Indicators concerning population status—Number of people covered by the intervention, rate and causes of mortality, rate of morbidity for diseases of particular importance for public health (malaria, diarrhea diseases, respiratory infections, meningitis, etc.) rate of malnutrition.

Indicators concerning the functioning of services—Immunisation coverage, number of admissions to health facilities, number of food rations distributed, number of latrines built, number of shelters built.

c. Sources of Information—Health care facilities should be able to furnish routine information on a regular basis. If there are too many of them, a few should be selected to play the role of 'sentinels', or reporters. The rate of malnutrition should be monitored within the population, an important source of information, and not from the cases of malnutrition referred to the health care facilities.

d. Data Collecting Systems—There are two ways of collecting data. A routine surveillance system can be set up, through which the collected data is channeled every day, week, or month to the appropriate person or centre for analysis. This is the 'passive' system, which consists in waiting for the information to arrive. The second method involves starting an 'ad hoc' survey. This kind of evaluation may be repetitive—for example, measuring a population's nutritional status at regular intervals. It may also be initiated following an alert by the routine surveillance system. One example would be investigating the quality of the water provided by various sources following a significant increase in the rate of diarrhea diseases diagnosed by the health facilities. This is the 'active' system, which consists in going out and collecting information.

e. Data Analysis—Information on several levels may be analysed.

Impact on the population's health: This is the most important level, at least for health care personnel. To assess a population's health status, various points of reference must be used—for example, the previous level of health. The main criterion is still the mortality rate.

Quality and quantity of services provided: This level involves evaluating the operation and organisation of the inputs provided. For example, the evaluation of a medical consultation should take into account the factors such as—number of consultations (quantitative aspect), quality of the organisation of resources. A medical consultation involves the combined action of a care provider, a health care facility, equipment, and drugs. Are the treatments correct? Quality of relations with the patient.

f. Decisions—By collecting data, a surveillance system helps the administrators of intervention operations to make decisions concerning:

The functioning of programmes—Decision to increase the medical coverage of a population; decision to phase out a therapeutic programme when indicators (malnutrition rate, access to food) give the 'go-ahead'; decision to initiate operational research on a particular issue; decision to begin a study of food consumption within the family to discover the reason for persistent malnutrition in certain groups of children.

The management of resources—Modification of lists of available drugs to fit the pathology better; replacement of expatriate personnel by locally trained staff.

The purpose of the intervention itself—The surveillance system should allow administrators to judge, on the basis of technical information (local services' level of self-sufficiency) and political information (opportunities to return to normal life), whether aid should be continued or stopped within a certain time limit. This idea is important, since it obliges programme planners to establish criteria defining the limits of the intervention at the outset. These criteria might consist the establishment of conditions that prevailed prior to the crisis; or a liaison with long-term programmes designed to increase the level of development.

Research—If the surveillance system detects a problem with no immediate solution, it is not at all Utopian to contemplate a study on the subject, if such a study will help provide a practical response to the problem.

2.2 Organising a Surveillance System

Organising a surveillance system is more than just carrying out a few ad hoc assessments among the population and compiling statistics from health facilities. To be effective, a surveillance system must be planned in conjunction with the relief activities and should integrate all the components of the intervention. This also makes it more likely that indicators will be linked with the operational objectives. Thus facilitating linkages between different data and increasing the likelihood of correct decisions.

The organisation of a surveillance system requires—a definition of what is to be monitored; a definition of the norms governing data collection, provision of the forms on which information will be recorded (data recording sheets in dispensaries, hospitals, etc.); the establishment of mechanism by which information will be transferred (postal service, visits to data collection centres, telephones, fax machines, etc.); the establishment of a facility to process and analyse information (epidemiological centre); the establishment of a mechanism to transmit analyses to decision-making centres and to the providers of the raw data; the integration of new decisions in the surveillance system.

An initial analysis can be carried out directly by the people collecting the information. An epidemiological centre is justified only for large-scale interventions, in which the volume of data and the dispersion of collection centres demand a centralisation of all information in order to detect general tendencies. It is essential that the people who furnish the raw data get 'feedback' in the form of analyses. It will be difficult to maintain their motivation for paperwork if they never see what it is used for.

3. INVESTIGATING AN EPIDEMIC

3.1 Epidemic—The word 'epidemic' is a constant of disaster situations. The epidemics are due to population concentrations such as the often precarious hygiene conditions existing in camps or other densely populated locations may pose the threat of epidemics. However, several conditions must be present simultaneously (infectious agents, vulnerable population, vector) if an epidemic is to take hold. Thus, a population that moves out of a cholera-free region into another cholera-free region runs no particular risk of contracting this disease, whereas an epidemic of malaria is almost inevitable in a non-immune population arriving in an area where malaria is hyper-endemic—unless appropriate measures are taken. The deterioration of preventive services such as—the destruction of the means of communication, the reorientation of activities in response to the emergency, and insecurity are a few factors which explain the deterioration of health care services, particularly those concerned with preventive care can also lead to epidemics.

The epidemic threshold—An epidemic may be defined as an indisputable increase in the number of cases of a disease compared to its usual rate. This definition should reflect the norms for individual disease prevalence in a given geographical area.

The Alarm Signal—The alarm may be sounded by—the population itself, which notices spontaneously an unusual number of deaths following fever (malaria), rash (measles), diarrhea (cholera), or other symptoms; the surveillance system, which shows a significant increase in the number of cases of a particular pathology; rumours of unknown origin to the effect that people are dying. This information should then be passed on to all relevant health and administration departments besides the media. The reliability of such an alarm depends on its origin. By definition, information furnished by a surveillance system is more credible than rumours. Whatever the source of the alarm, however, an investigation will have to be undertaken to confirm or disprove the initial reports.

3.2 Organising the Investigation of an Epidemic

Investigating an epidemic involves several stages, these are:

a. Confirming the Epidemic—An investigation undertaken to confirm an epidemic must adopt a two-pronged approach, defining cases and confirming the increase in the number of cases.

b. Defining Cases—Establish with certainty the presence of cases of communicable diseases—for example, meningitis, cholera, and measles. Rumours should not be a basis for instituting a whole set of emergency measures, and in the case of such diseases as meningitis and cholera, bacteriological confirmation must be obtained. Establish the link between the duly documented cases and the beginning of an epidemic. There may be a number of sporadic cases but no confirmation of an epidemic. Once the cases have been documented and their epidemic character has been confirmed, subsequent cases will be diagnosed and treated solely on the basis of clinical criteria.

c. Diagnosing Cases—Diagnosing cases is relatively simple when the patients have been admitted to a health care facility. It is easy to visit the facility and talk to the nursing staff. If the alarm has been raised at an early stage, some of the patients will probably still be in the hospital, where they can be examined. If not, their files must be consulted. Depending on the reliability and specificity of the tests conducted (clinical examination, bacteriological tests), the patients admitted may or may not prove to have been infected with meningococcal meningitis, measles, typhoid fever, cholera, or whatever disease was suspected. When initial reports are based on rumours, in contrast, it is much more difficult to ascertain the truth of the matter. The source of the rumours must be sought so that the original cases can be found. The patients may be cured—in which case the patient's history may help establish a diagnosis; still sick—a clinical examination, and if necessary, biological tests will make diagnosis possible; dead or absent—the sole possibility in this case is to question the patient's family or friends. If doubts persist, new cases must be sought. If there is no longer any doubt, a case profile will have been defined which will serve as a basis for identifying subsequent cases.

d. Confirming an Abnormal Increase in the Number of Cases—The other step in confirming an epidemic consists in verifying that there is indeed an abnormal increase in the incidence of cases. It has already been noted that for some diseases—meningitis, for example—epidemic thresholds can be established.

For other diseases, the local context must be used as a reference. The cases will be inventoried on the basis of the data collected by the health care facilities, or from cases found among the population. The information recorded for each case should reflect in areas such as—the profile established for the case—for example, clinical signs such as fever, vomiting, diarrhea, etc.; the requirements of future analysis concerning (the group of people most affected (for which data on age, sex, occupation, etc., will be needed); the geographical areas most affected (origin of cases); the onset of the disease and the date of contact with other cases).

Three aspects constitute the traditional bases for a descriptive analysis of the epidemic: person, place, time. If this information is not collected at the outset, it will be difficult to find later. The epidemiologist's role is not only to confirm an epidemic once it has spread, but to predict such a spread on the basis of a few declared cases. Identification of risk factors is therefore essential and these include—size of the population groups susceptible to infection; way of life (overcrowding or widely scattered populations); malnutrition; unhealthy environment.

If an epidemic has not been openly declared, but a strong epidemic potential is present, it may be necessary to take control measures very quickly. These measures will determine whether the disease has epidemic potential and whether an epidemic or the risk of one exists. In displaced person camps, mass measures of control must be taken much more quickly than in normal settings, due to the high epidemic potential.

e. Surveying the Measures Taken and Local Resource Potential—Have the health care services already taken steps to control the epidemic? Do they have the resources required to implement the measures planned?

f. Data Analysis

Epidemiological data—Persons—What group or groups are affected? The rate of infection must be measured for different population groups. Similarly, the rate of mortality specific to the disease in question must be determined for each of the groups affected; Space—Where did the epidemic begin? Which regions are most affected? Both the rate of infection and the mortality rate must be determined by geographical area; Time—When were the first cases identified? An epidemic curve should be constructed to show the number of cases in relation to time.

Risk factors—The risk factors are—Vulnerability of the environment, nutritional status, housing conditions, level of health, education, deterioration of health care services, insecurity, size of the group at risk etc. Are these factors strong enough to contribute to the outbreak of the epidemic?

g. Determining a strategy for action—The strategy for action consists in reviewing all the stages of the communicable disease cycle and making a list of possible actions. Examples include:

Prophylactic action against the pathogenic agent—Treatment of healthy carriers.

Vector control—Destruction of vectors, action to eliminate breeding grounds.

Active protection—Immunisation.

Passive protection—Chemoprophylaxis.

Early screening for cases—Putting health facilities on alert, promoting public awareness (through the media), actively seeking out cases within the population.

Treatment of diagnosed cases—Reinforcement of health care personnel technical expertise, provision of necessary equipment.

Removal and cremation or burial of bodies—It should be remembered that an appropriate action is one which combines an acceptable rate of effectiveness with an acceptable degree of feasibility.

h. Determining Whether External Aid is Necessary—Local health care services do not always have the necessary resources to cope with an epidemic. This includes material resources, the technical expertise for making the initial diagnosis, and logistic support. International aid may prove necessary.

Support from the political authorities—Epidemics are a sensitive subject for health and political authorities. The political authorities must understand the health care personnel's proposals before they will agree to assist in the institution of control measures. The political authorities tend to minimise or deny the existence of an epidemic because of the negative image that such news projects to the outside world, or because of its repercussions on tourism. Where refugee populations are concerned, an epidemic may serve as an argument for reinforcing coercive measures against them.

Support from the population—The population too, must be clearly informed about the clinical manifestations of the disease which permit early detection; the risks involved; precautions that can be taken; means of treatment.

i. Evaluating and Adapting the Measures Already Implemented—The set of measures already being implemented, adapting to the problem and the urgency of the epidemic, constitutes a kind of surveillance system in itself, particularly in terms of organisation.

4. EARLY WARNING SYSTEMS

Early warning systems are a variant of surveillance systems, designed to anticipate a disaster and limit its effects. In fact, the concept of EWS is not new. In ancient cities crossed by rivers, the inhabitants used to measure the water level regularly in order to see when the danger level had been reached. At that point they would begin to take steps to protect themselves against the rising waters. Theoretically, all disasters can be predicted by an EWS, such as the results of seismological, volcanic, and hydrological surveillance.

Important Features For Mobile Hospitals

The mobile hospital is used for creating additional hospital bed capacity at the site of disaster to provide basic life-support and advanced life-support. Such a containerised hospital can be transported by road, train and air to a designated destination. It can be deployed specifically in cases where the local hospital infrastructure is totally destroyed or where hospital facilities do not exist. These hospitals are required for on-site management of mass casualties to treat patients during the golden hour and to provide advanced health care facilities. The containerised hospitals are available internationally and used by defence forces and medical agencies of many countries. Deployment of these hospitals would create additional capacity in case of MCE due to a disaster. The important highlights of the containerised hospitals are:

- i. These are self-contained hospitals capable of providing advanced life-support facilities at the site of incidence. The services in hospitals can be modified according to the type of casualties.
- ii. These hospitals have an Operation Theatre, X-ray facilities, Central Sterile Supply Department, various laboratories, and other acute wards. The capacity of hospital beds can be enhanced by additional containers/tentage.
- iii. They can be modified for CBRN management when fitted with a CBRN filter.
- iv. The hospitals are self-contained logistically in terms of power, waste disposal, food, water, sanitation/hygiene, toilet facility and crane. Crane is required for loading/unloading the containers in trains/aircraft.
- v. The hospital complex should have water treatment plant and adequate storage containers for water.
- vi. A mobile kitchen with provision of seven days rations needs to be taken to the incident site for emergency response.
- vii. The mobile hospital when not in use will be placed next to a medical facility and be used to provide training to medical personnel. This will also ensure its maintenance.

Important Considerations for Developing the Hospital Disaster Management Plan

AIM OF A HOSPITAL DISASTER MANAGEMENT PLAN

The aim of a hospital disaster plan is to provide prompt and effective medical care to the maximum possible, in order to minimise morbidity and mortality resulting from any MCE.

OBJECTIVES AND GOALS OF A HOSPITAL DISASTER PLAN

The main objective of a hospital disaster plan is to optimally prepare the staff and institutional resources of the hospital for effective performance in different disaster situations.

The hospital disaster plans should address not only the mass casualties which may result from MCE that has occurred away from the hospital, but should also address the situation where the hospital itself has been affected by a disaster—fire, explosion, flooding or earthquake.

In case of MCE away from the hospital and not affecting the hospital the further goals are:

- i. To control a large number of patients and the resulting problems in an organised manner.
- ii. By enhancing the capacities of admission and treatment.
- iii. By treating the patients based on the rules of individual management, despite there being a greater number of patients.
- iv. By ensuring proper ongoing treatment for all patients who were already present in the hospital.
- v. By a smooth handling of all additional tasks caused by such an incident.
- vi. To provide medications, medical consultation, infusions, dressing material and any other necessary medical equipment.

In case of incidents affecting the hospital itself the further goals of the plan would be:

- i. To protect life, environment and property inside the hospital from any further damage—
 - By putting into effect the preparedness measures.
 - By appropriate actions of the staff who have to know their tasks in such a situation.
 - By soliciting help from outside in an optimal way.
- ii. To re-establish as quickly as possible an orderly situation in the hospital, enabling a return to normal work conditions.

PRINCIPLES OF A HOSPITAL DISASTER PLAN

- i. **Predictable:** The hospital disaster plan should have a predictable chain of management.

- ii. **Simple:** The plan should be simple and operationally functional.
- iii. **Flexible:** (Plan should have organisational charts)
The plan should be executable for various forms and dimensions of different disasters.
- iv. **Concise:** (Clear definition of authority)
The plan should specify various roles, responsibilities, work relationships of administrative and technical groups.
- v. **Comprehensive:** (Compatible with various hospitals)
It should be comprehensive enough to look at and network various other health care facilities along with formulation of an inter-hospital transfer policy in the event of a disaster.
- vi. **Adaptable:**
Although the disaster plan is intended to provide standard procedures which may be followed with little thought, it is not complete if there is no space for adaptability.
- vii. **Anticipatory:**
All hospital plans should be made considering the worst case scenarios.
- viii. **Part of a Regional Health Plan in Disasters:**
A hospital cannot be a lone entity making its plans in isolation. The hospital plans have to be integrated with the regional (district/taluka) plan for proper implementation.

CATEGORISATION OF EMERGENCIES

(Reference: http://whoindia.org/en/Section33/Section34/Section38_51_.htm)

In order to find out what constitutes a disaster or unmanageable incident for the hospital, the hospital needs to calculate its normal capacity, beyond which it has to act according to the disaster plan. The mass casualty emergencies can be categorised in one of the following ways:

Based on the Number of Casualties:

Here the categorisation is based on the number of casualties coming to a hospital in a given time and the ability of the hospital to cope with those casualties. Categorisation will differ from hospital to hospital and depend on several factors, such as the number of doctors and nurses available and the availability of supplies and support services. Assessment of the capacity of a hospital to respond to a given emergency situation can be assessed by the following two ways:

- i. **Hospital Treatment Capacity (HTC)** is defined as the number of casualties that can be treated in the hospital in an hour and is usually calculated as 3% of the total number of beds.
- ii. **Hospital Surgical Capacity (HSC)** is the number of seriously injured patients that can be operated upon within a 12 hour period i.e. $HSC = \text{Number of operation rooms} \times 7 \times 0.25 \text{ operations/12 hours}$.

Note: Above categorisation is for a 1,000-bed tertiary hospital, and modifications can be made depending on the bed strength and staff strength (doctors, nurses and support staff) for individual hospitals.

Category 1: Up to 30 patients belonging to a single accident or any other emergency, coming to a hospital casualty at one time.

Category 2: 30 to 50 patients belonging to a single accident or any other emergency, coming to a hospital casualty at one time.

Category 3: More than 50 patients belonging to a single accident or emergency coming to a hospital casualty at one time.

Based on the Type of Casualties:

Here the categorisation is based on the number of seriously injured patients belonging to the same emergency coming to the hospital at one time.

Category a: Patients in critical condition

Includes cases of head injuries, thoracic injuries, abdominal injuries, fractures of major bones with profuse bleeding, etc. These patients require immediate resuscitation and supportive measures. About 10% of these are beyond salvage.

Category b: Patients in serious but not life threatening condition

Include polytrauma cases of a less serious nature, for example, fractures and crush injuries of limbs without major blood loss, facial injuries, spinal injuries, etc.

Category c: Walking wounded

These patients may have minor injuries requiring cleaning the wounds, dressing and/or limb fractures requiring closed reduction and immobilisation.

Based on this categorisation it is advisable to further classify the contingency plan into three classes:

CLASS A

The plan can be put into practice **without any disruption to the normal and routine work** of the institution.

CLASS B

The plan can be put into practice with **minor disruption to the day-to-day functioning** of the hospital and with some readjustments. The plan may be upgraded to C if the number of casualties increases.

CLASS C

There would be definite disruption of routine work. **Major readjustments would be required in hospital functioning**, inpatient treatment, duty arrangements, laboratory and operation theatre scheduling, and increased demand on stores, pharmacy etc.

A HOSPITAL CONTINGENCY PLAN IS UNIQUE TO EACH HOSPITAL AS IT DEPENDS ON ITS BED STRENGTH, STAFF AND OTHER RESOURCES

The Disaster Manual

The plan should also be written down as a document in the form of a 'disaster manual'. The reporting, recording, coordinating and evaluating activities associated with DM should be specified in this disaster manual. The disaster manual should incorporate the following:

- i. Medical Command Authority (unified incident command).
- ii. Control centre location.
- iii. Disaster alert codes.
- iv. QRTs formation, responsibilities and movement details.
- v. Responsibilities of individuals and departments.
- vi. Job action cards.
- vii. Chronological action plan.
- viii. Details of resource mobilisation for logistics and manpower.
- ix. Details of operational areas (patient care areas). This should include the existing patient care areas (reception and triage areas, emergency and resuscitation areas, definitive care areas, intensive care areas, etc.) the plan should also label certain areas which are free in the hospital area which can be used optionally as patient care areas during the initial surge of patients.
- x. Hospital triage criteria.
- xi. Documentation details.
- xii. Communications (intra and inter hospital).
- xiii. Networking including capacities and capabilities of health facilities.
- xiv. Pre-hospital transports.
- xv. Security arrangements.
- xvi. Police networks.
- xvii. Evacuation details.
- xviii. Medico-legal responsibilities.
- xix. Disposal of the dead (role of mortuary services and forensic departments in identification, storage and disposal of the deceased).

PHASES OF HOSPITAL DISASTER PLANNING

I. PRE-DISASTER PLANNING

It is recommended that all hospitals involved in emergency care of patients embark upon planning for the worst at the earliest. It is always good to have a ready working plan before the next disaster strikes.

The planning process should highlight the following areas:

a. Formation of Hospital Disaster Committee

The formation of a disaster committee for the hospital is the first step in making a disaster plan for the hospital. The members of the disaster committee should be from the following basic facilities of the hospital.

The following positions may not confirm to each and every hospital. It is therefore left to the discretion of individual hospitals and their administration to formulate their own disaster committees. In general these should be senior doctors/officials of the hospital having considerable administrative experience:

- i. The hospital administration.
 - The director/principal/dean/head of institution/medical superintendent.
 - Member/members from hospital management board.
- ii. The chiefs/heads of various clinical departments supporting the emergency services; e.g., casualty and emergency services, orthopaedics general surgery, medicine, neurosurgery (if present), cardio-thoracic surgery (if present), anaesthesia.
- iii. The chiefs/heads of various ancillary departments e.g., radio-diagnosis, transfusion medicine/ blood bank, laboratory services/pathology, forensic medicine.
- iv. The chief nursing superintendent/matron.
- v. The finance department.
- vi. The stores and supplies department.
- vii. The hospital engineering department.
- viii. The public relation and liaison office.
- ix. The chief of security of the hospital.
- x. The sanitation department.
- xi. Hospital kitchen/dietary services.
- xii. The social welfare department (if present).
- xiii. Hospital unions.

b. Formulation of Central Command System (Incident Command System)

In order to ensure effective control and avoidance of duplication of action there should be a hierarchical chain of command. It will also ensure effective coordination of the planning and execution of all activities after the disaster plan has been activated.

Incident command system earlier approved by MHA is being reviewed and modified and will be issued soon. We recommend that administrators of all hospitals will adopt the same and will be backed by adequate organisational setup.

The advantages of the ICS are many. It has a predictable chain of management; flexible organisational charts allowing flexible response to specific emergencies; prioritised response checklists; accountability of position function; improved documentation for better accountability and cost recovery; a common language to promote communication and facilitate outside assistance; cost-effective emergency planning within health care organisation.

c. Delineation of Jobs According to Command System

- The titles used in the disaster plan are carried by functions, not individual people.

- The Job Action Sheets.
 - These action sheets should be detailed and chronological (immediate, urgent, and later).
 - Stored safely.
 - Colour coded as a pocket book or laminated sheets.

d. Planning for Activation of Additional Hospital Areas in case of need

The areas which should find a mention in a hospital disaster plan are:

- i. Command centre.
- ii. Communications office/paging/hotline area/telephone exchange.
- iii. Security office/police picket (chowki).
- iv. Reception and triage area.
- v. Decontamination area (if needed).
- vi. Minor treatment areas.
- vii. Acute care area (emergency department).
- viii. Definitive care areas (OTs, wards).
- ix. Intensive treatment area and activation of High Dependency Units.
- x. Mortuary.
- xi. Holding area for relatives/non-injured.
- xii. Area for holding media briefings (separate media/PRO/spokesperson room).
- xiii. Area for holding patients in case a part of the hospital is evacuated.

All these areas should be mapped on the outlay map of the hospital. The normal capacities of the existing areas should be mentioned on these maps. Enhanced admission of patients requires an enlargement of suitable spots, if necessary even by changing their function.

To increase the capacity of hospitals a surge of additional beds for newly arriving patients should also be considered in the plan. This can be achieved by the following actions:

- Discharge elective cases.
- Discharge stable recovering patients.
- Stop admitting non emergent patients.
- Convert waiting/non-patient care areas into makeshift wards.

e. Public Information and Liaison Planning

A single spokesperson for the MCE needs to be identified in advance; press and media briefings need to be regularly scheduled away from the hospital(s) but with supporting medical expertise.

f. Security Services in Disasters (Liaison with Local Police)

Security services have to be operational at very early stages. Some of their duties are:

- i. To secure the driveways for authorised parties, namely ambulances, police vans, hospital staff vehicles.
- ii. Traffic control and blocking access to certain areas helps to avoid chaos in the case of a mass accident. Cooperation with police forces will be necessary.
- iii. To restrict and strictly control entry to the hospital.
- iv. To direct the entry for authorised persons into appropriate areas, e.g., for relatives or media people.
- v. To protect personnel and patients.

g. Logistics Planning

- i. Communications (inter/intra hospital)
 - A communication centre should be set up to handle and coordinate all internal communications.
 - Telephone lines should be made available for outgoing and incoming calls. One line will be designated as the open line to the external command centre.
- ii. Transportation (to and from other health care facilities)

Both intra-mural and extra-mural transport services should be predetermined.
- iii. Stores Planning—Commissioning of a Dedicated Disaster Store.

It is recommended that adequate stores of linen, medical items, surgical items should be kept separately in the emergency/casualty and should be marked 'Disaster Store'.
- iv. Personnel Planning—Medical and Non-Medical

Medical Staff: Duty roster for standby staff should be available in the control room/ command centre.

Nursing Staff: List of nursing staff which may be made available at short notice. Mobilisation of additional nursing staff from non-critical areas.

Other Staff: Duty roster including those on standby duty of all ancillary medical services (e.g. radiology, laboratory, blood bank) and also other hospital services (e.g., house keeping, sanitation, stores, pharmacy, kitchen, etc.)

Volunteers: The role which volunteers will assume in the course of a disaster should be predetermined, rehearsed, coordinated and supervised.
- v. Finances

An important aspect of any management plan is the financial management. It is recommended that the disaster plans are made in close association with the financial advisors of the hospital/ institution. This will make them more cost-effective and avoid unnecessary and repeated expenditure.

h. Operations Planning

- i. Essential Medial/Non-Medical Staff Activation (In Different Areas)
 - Reception and triage area: Initial registration and triage should be done in this area hospital.

- Registration officer at the registration desk.
- Triage officers/nurses.
- Adequate number of stretcher/trolley bearers.
- Hospital attendants.
- **Triage criteria** for disasters and the patients will be color coded according to the kind of treatment they deserve e.g., **ONE Immediate Resuscitation (RED); TWO Potentially Life Threatening Injuries (YELLOW); THREE Walking Wounded (GREEN); FOUR Dead (BLACK).**
- Decontamination area (if needed).
- Acute care area (emergency department).
- Definitive care areas (operation theaters, wards).
- Intensive treatment area activation and High Dependency Units.
- Minor treatment areas.
- Laboratory services.
- Radiology services.
- Mortuary services (care for the dead). The mortuary should be situated away from the main entrance of the hospital. It should be adequately staffed with a senior forensic specialist/ any designee appointed for that purpose.
 - Patients pronounced Dead On Arrival (DOA) should be tagged with a disaster tag and the body should be sent to the mortuary.
 - Alternate morgue area should be identified.
 - Medical records should be notified as to the identification of the patient.
 - The bodies will be removed via a separate gate to the hospital in knowledge of the mortuary in-charge.
 - Be sure that the appropriate paperwork is done.
 - Holding area for relatives/non-injured: A hospital social services staff member will stay with the family members.
- ii. Essential Nursing Staff Activation
- iii. Other Ancillary Services
 - Hospital dietary services (kitchen).
 - Sanitation services.

II. PHASE OF STAFF EDUCATION AND TRAINING

Once the disaster plan is ready the next phase would be the education and training of the staff of the hospital about the disaster plan and specific roles of each staff member in case of disaster.

a. Concept of Common Language in Disaster Situation

- i. Everyone knows his/her job.
- ii. Work continues in an orderly fashion without confusion.

b. Introduction of Disaster Management Training to Hospital Leadership

A presentation is made to all administrators, department heads and managers regarding the implementation of the hospital disaster plan.

c. Introductory Lessons for all Hospital Staff

An orientation and education programme for personnel who participate in implementing the emergency preparedness plan. Education should address the following:

- i. Disaster Drills
As a part of the emergency management plan, every hospital is required to have a structure in place to respond to emergencies. This structure is routinely tested during drills.
- ii. Table Top Drills
Table top exercises are a paper drill intended to demonstrate the working and communication relationships of functions found within the disaster organisational plan.
- iii. Partial Evacuation/Non-Evacuation Drills
Hospital evacuation drills in case of an internal disaster.
- iv. Revision of Hospitals Disaster/Emergency Plan
Continuous revisions should be made in the hospital disaster management plan taking leads from the regular disaster drills in the hospital.
- v. Continuing Staff Education

III. PHASE OF DISASTER

a. Disaster Activation—Alert and Mobilisation Phase

(Plans for alerting the disaster committee, staff, other facilities via phones/paging and mobilising resources to appropriate activated areas).

b. In-Hospital Response Phase

(Small multi-casualty incident, using only main emergency department patient care).

c. Hospital Support Phase

(Large multi-casualty incident using additional areas of the hospital as overflow zones. Also utilising other definitive care areas of the hospital like the OTs, ICU, High Dependency Units, pediatric/maternal facilities).

d. Damage to Hospital Phase

(Structural assessment plans, damage control plans and evacuation plans are activated).

e. Catastrophic Disaster in City Phase

(e.g. earthquake/serial bombings, hundreds of patients coming to hospital—inter-hospital transfer protocol plans come into force).

f. Deactivation of Disaster Alert

(Demobilisation phase).

IV. POST-DISASTER DEBRIEFING

Debriefing is a process in which the disaster committee sits down after the disaster has been deactivated and tries to figure out how things went. It can be best described as a critical self review of the hospital's own performance during a disaster. What went right is taken cognisance of and what went wrong will be corrected and incorporated in the disaster plans.

List of Important National Referral Laboratories

National Institutes

- i) National Institute of Communicable Diseases, Delhi
- ii) All India Institute of Medical Sciences, New Delhi
- iii) National Institute of Cholera and Other Enteric Diseases, Kolkata
- iv) National Institute of Virology, Pune
- v) PGIMER, Chandigarh
- vi) Kings Institute of Preventive Medicine, Chennai
- vii) Enterovirus Research Centre, Mumbai

ICMR's Permanent Institutes/Centres/Regional Medical Research Centres

- i) National JALMA Institute for Leprosy and Other Mycobacterial Diseases (NCJILMD), Agra
- ii) National Institute of Occupational Health (NIOH), Ahmedabad
- iii) Tuberculosis Research Centre (TRC), Chennai
- iv) National Institute of Epidemiology (NIE), Delhi
- v) National Institute of Malaria Research (NIMR), Delhi
- vi) Institute of Pathology (IOP), Delhi
- vii) National Institute of Medical Statistics (NIMS), Delhi
- viii) National Institute of Nutrition (NIN), Hyderabad
- ix) National Centre for Laboratory Animal Science (NCLAS), Hyderabad
- x) Food and Drug Toxicology Research Centre (FDTRC), Hyderabad
- xi) National Institute of Cholera and Enteric Diseases (NICED), Kolkata
- xii) Centre for Research in Medical Entomology (CRME), Madurai
- xiii) National Institute for Research in Reproductive Health (NIRRH), Mumbai
- xiv) Institute of Immunohaematology (IIH), Mumbai
- xv) Enterovirus Research Centre (ERC), Mumbai
- xvi) Genetic Research Centre, Mumbai
- xvii) Institute of Cytology and Preventive Oncology (ICPO), Noida, UP
- xviii) Rajendra Memorial Research Institute of Medical Sciences (RMRIMS), Patna, Bihar
- xix) Vector Control Research Centre (VCRC), Bhubaneswar
- xx) Microbial Containment Complex (MCC), Pune

- xxi) National Institute of Virology (NIV), Pune
- xxii) National AIDS Research Institute (NARI), Pune
- xxiii) Regional Medical Research Centre, Bhubaneswar
- xxiv) Regional Medical Research Centre, Dibrugarh
- xxv) Regional Medical Research Centre, Port Blair
- xxvi) Regional Medical Research Centre, Jabalpur
- xxvii) Desert Medicine Research Centre, Jodhpur
- xxviii) Regional Medical Research Centre, Belgaum

Important Components of the Epidemic Outbreak Investigation Kit

<ul style="list-style-type: none"> • Disposable storage vials (5ml) • Disposable sample collection vials • Stool culture bottle • Throat swabs • Blood culture bottles • Viral transport medium • Gary Blair medium/ Stuart's transport medium • Vacutainer (plain and EDTA) • Syringes and needles disposable (5ml) • Tourniquet • Gloves • Masks (triple layer surgical mask) • Disposable gowns • Puncture proof discarding bags (disposable) • Spirit swabs/alcohol swabs • Band-aid • Vaccine carrier with ice-packs • Spirit lamp/gas lighter • Match-box • Test tube rack • Centrifuge tubes • Lancets • Slides and cover slips 	<ul style="list-style-type: none"> • Rubber bands • Ziploc plastic bags • Absorbent material (tissue paper, cotton wool, newspaper) • Labels • Glass marking pen • Adhesive tape • Scissors • Scalpel/blade • Spatula • Forceps • Loop holder • Pasteur pipettes/pipettes and pipette aids (rubber teats) • Rapid diagnostic kits • Sodium hypochlorite concentrates (4%) • Hand disinfectant • Stationery (writing pads, pens, pencils, erasers, sharpeners etc.) • Calculator • Torch with spare batteries/rechargeable batteries. • Laboratory request forms • OT test kit • Epidemiological survey formats • Epidemiological reporting formats • Outbreak investigation guide/module
<p>Selected entomological equipment such as:</p> <ul style="list-style-type: none"> • Aspirator and flashlight for indoor/outdoor mosquito collection • WHO susceptibility kit for adult and larvae with reagents • Bioassay kit • Kit for outdoor mosquito collection • Ladle bottles for keeping larvae, strainer, dropper, trays and funnel net for wells • Vector dissection equipment: 	
<ul style="list-style-type: none"> • Pyrethrum spray (0.02%) with flit gun • White bed sheet to spread on floor • Dissection needle • Petridishes • Slides cover slips 	<ul style="list-style-type: none"> • Physiological saline • Dissecting microscope • Staining equipment and material • Filter paper • Mosquito net
<ul style="list-style-type: none"> • Synoptic keys for identification of vectors • Any other, as per the requirements of the outbreak 	

Collection, Transportation and Storage of Clinical Specimens

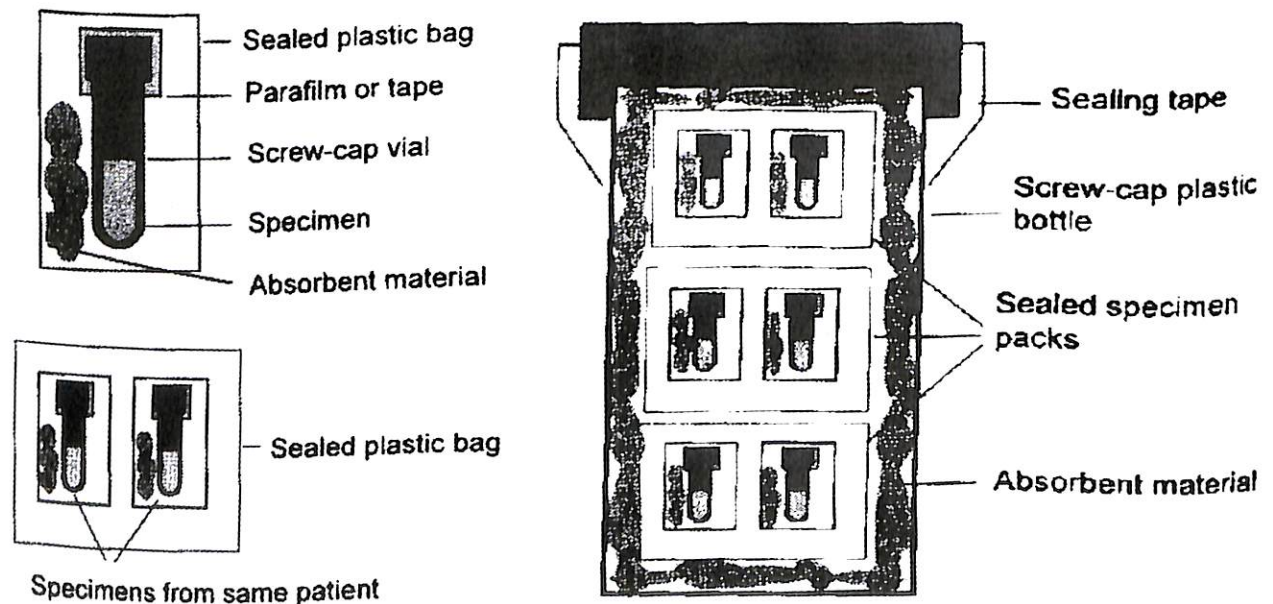
- i. All the samples have to be collected in a sterile leak proof container and under biosafety precautions and should be accompanied with the detailed clinical information of the patient.
- ii. Each patient should be assigned a unique identification number. This unique identification number and the patient's name should be present on specimens, epidemiological data forms, and the laboratory transmittal forms.
- iii. The information contained in the case investigation form is collected along with the specimen.
- iv. Glass slides for microscopy must be labelled individually, using glass marking pencil. This should not interfere with the staining process.
- v. A laboratory request form must be completed for each specimen and contain information to interpret the necessary tests. This may include:
 - Patient information: age (or date of birth), sex, complete address.
 - Clinical information—date from which the symptoms have begun, clinical and immunisation history, risk factors or contact history where relevant, antimicrobial drugs taken prior to specimen collection, etc.
 - Laboratory information—acute or convalescent specimen, other specimens from the same patient.
 - The receiving laboratory should record:
 - Date and time when the specimen was received.
 - Name and initials of the person receiving specimen.
 - Record of specimen quality.
- i. Maintain the transit temperature at 2-8°C. The sample should be transported in a vaccine carrier with ice packs and triple package box.
- ii. DNA analysis can be used even when the recovered human remains are quite small or severely fragmented.
- iii. Environmentally harsh conditions at the incident site may limit the quantity of typable DNA.
- iv. Collected samples are preserved at the site and then sent to the laboratory for analysis.
- v. Creation of a chain of custody documentation system for all materials collected at the scene is important not only for scene reconstruction and quality control, but also in the event of any subsequent legal procedure.
- vi. There are several sources of reference samples for DNA identification:
 - Personal items used by the victim (e.g., toothbrush, hairbrush, razor) and banked samples from the victim (e.g., banked sperm or archival biopsy tissues stored in a medical facility).
 - Biological relatives of the victim (i.e., 'blood kin').
 - Human remains previously identified through other modalities or other fragmented remains already typed by DNA.

Basic triple packaging system

- The specimen is in the labelled primary container that must be watertight and airtight. After tightening the cap, apply sealing tape over the cap and top of the specimen container and wrap in absorbent material (e.g., cotton wool) to absorb any leakage.
- The sealed specimen container must then be placed in a suitably sized plastic bag with a small amount of absorbent material. The bag must be sealed. Two or more sealed specimens from the same patient may be placed in a larger plastic bag and sealed. **Specimens from different patients should never be sealed in the same bag.**
- Place the sealed bags containing the specimens inside secondary plastic containers with screw capped lids. Specimens from several patients may be packed inside the same secondary plastic container. Place additional absorbent material inside the secondary container to cushion multiple primary receptacles and absorb any leakage that may occur. Tape the laboratory request form sealed in a plastic bag to the outside of this secondary container.
- The outer package or tertiary container protects the contents from physical damage and water while in transit. It should have a resistant, high-density external cover (e.g., metal, wood, or fibreboard), shock absorbent padding on the inside, and a tight fitting lid. The outer package must be leak proof and well insulated, and can contain ice, cold packs or dry ice when required.
- EPI vaccine carriers or other commercially made containers may be used as a tertiary container for transportation. **Vaccine carriers once used for transportation of specimens, must never be reused for carrying vaccines.**
- The specimen carriers and ice packs can be reused after disinfection.

Note:

- Avoid repeated thawing and freezing of specimens.
- Freeze the specimen only if transport is assured at -20°C .
- Store and transport all specimens at $2-8^{\circ}\text{C}$, except CSF obtained from suspected cases of pyogenic meningitis.



Biosafety and Decontamination Procedures

- i. Use disposable gloves while collecting clinical specimens.
- ii. Wear laboratory coats while collection and handling of specimens.
- iii. Use protective eye wear or face shields if procedure is likely to generate aerosols.
- iv. All laboratory waste should be handled with care to avoid injuries from sharp objects.
- v. As far as possible manual handling of waste should be avoided.
- vi. The waste should be placed in appropriate leak proof biohazard bags and autoclaved.
- vii. A first aid kit is essential, and should be readily accessible at the site of specimen collection.
- viii. Disinfection of work areas and decontamination of blood spills or infectious body fluids is generally achieved by chemical disinfection with chlorine-based solutions (see table).
- ix. It is not practicable to achieve adequate sterilisation of contaminated materials in the field. The reuse of such contaminated equipment or materials such as gloves or clothing is not recommended.
- x. Sharp objects and soiled glass slides should be discarded directly into a puncture resistant disposal container.
- xi. Work areas and surfaces should be organised and disinfected with 1% household bleach daily. Use 10% bleach to clean up spills after wiping the surface clean.
- xii. Personnel carrying out cleaning or decontamination should wear a protective coat and thick rubber gloves.
- xiii. Contaminated non-disposable equipment or materials should be soaked in 1 % household bleach for five minutes. Before use, wash in soapy water and sterilise if necessary.
- xiv. Heavily soiled disposable items should be soaked in 10% household bleach before safe disposal.

Preparation and use of Chlorine Disinfectants

Chlorine Product	0.5% available chlorine solution used for disinfecting: <ul style="list-style-type: none"> • Excreta • Cadavers • Spills of blood, body fluids 	0.05% available chlorine solution used for disinfecting: <ul style="list-style-type: none"> • Gloved hands • Bare hands and skin • Floors • Clothing • Equipment • Bedding
Household bleach (5% active chlorine)	Add 1 litre of bleach to 9 litres of water (1 : 10 solution)	Add 100 ml of bleach to 9.9 litres of water or add 1 litre of 1 : 10 bleach solution to 9 litres of water (yields a 1 : 100 solution)
Household bleach (30% active chlorine)	Add 16 grams or one tablespoon to 1 litre of water	Add 16 grams or 1 tablespoon to 10 litres of water
Calcium hypochlorite powder or chlorine granules 70%	7 grams or ½ tablespoon dissolved in 1 litre of water	7 grams or ½ tablespoon dissolved in 10 litres of water

Sample Collection for DNA Analysis

Principle — DNA analysis is a comparison science requiring one or more valid reference samples to identify human remains accurately. Three types of biological samples are collected to conduct DNA analysis:

- A. Human remains.
- B. Appropriate family references.
- C. Direct references (e.g., biological specimens and personal effects).

Collect samples in a manner that prevents loss, contamination, or deleterious change and a proper chain of custody. Ensure that sample preparation includes provision for specimen inventory, appropriate transport and storage of large numbers of samples, and accompanying documentation.

Procedure — Consider these following steps when collecting the following reference samples.

A. Human remains:

i) Collection:

- a. Collect, place, and store samples appropriately in separately labelled containers of suitable size.
- b. Store samples without preservatives.
- c. When possible, collect samples from human remains for DNA analysis in conjunction with other forensic specialists at the designated morgue facility.

ii) Documentation:

- a. Ensure that all remains submitted for DNA analysis have been photographed and documented at the designated morgue facility.
- b. Use a numbering system that is integrated or derived from the Incident Command System (ICS) to uniquely identify each specimen. This can reduce transcription errors, minimise confusion, and reduce the possibility of mis-attribution that can arise from the use of alternative or redundant numbering systems. Avoid creating a new numbering system whenever possible.

iii) Staff:

- a. Designate qualified staff members responsible for collecting samples for DNA analysis. This collection process may involve teams of two or more individuals:
 - i) The staff member who takes the sample (e.g., the medical examiner/coroner or anthropologist) is expected to be able to assess its suitability for DNA analysis and identify the species and anatomical origin of the specimen.
 - ii) The staff member who records the sample verifies the sample description, assigns or maintains a unique identifier, maintains the chain of custody, and ensures proper storage (e.g., freezing the sample in a secure location).
- b. Request that the staff involved in collecting samples, provide a DNA reference sample to be used for elimination purposes.

iv. Samples for analysis. Take specimens for analysis from:

- a. Positively identified remains. Take samples for DNA analysis even if the remains have already been identified because the DNA results can be used for re-association of fragmented remains, the identification of kindred victims, or elimination purposes.
- b. Fragmented remains. The medical examiner/coroner is expected to determine the goal of the identification effort and establish criteria for sample collection:
 - i) Will all fragments be tested?
 - ii) Will only fragments meeting a certain size requirement be tested?
 - iii) Will only anatomically recognisable fragments be tested?

v) Preferred samples. Human remains sources include:

- a. Blood.
- b. Soft tissue:
 - i) Deep red skeletal muscle.
 - ii) Organ tissue.
 - iii) Skin.
- c. Hard tissue:
 - i) Bones.
 - ii) Teeth.

vi) Sample handling:

- a. Tell staff members responsible for collecting DNA samples for analysis to take proper precautions to minimise the risk of contamination.
- b. Handle samples in a manner that prevents loss or deleterious change:
 - i) Use sterile and disposable supplies for sample collection whenever possible.
 - ii) Discard or clean gloves and cutting instruments after taking each sample.
 - iii) Clean instruments, work surfaces, gloves, or other items with commercial bleach (one part bleach to nine parts of water).

B. Family references:**i) Collection:**

- a. Initiate the collection of reference samples from members of the victims' immediate families at the Family Assistance Centre (FAC) or other designated sites.
- b. Develop and implement a plan to initiate the remote collection of reference samples from family members. Use other agencies to assist as necessary.
- c. Place and appropriately store individual reference samples in separately labelled containers.

ii) Documentation:

- a. Obtain and document informed consent using consent forms that have undergone legal review:
 - i) Include the purpose for requesting the sample.
 - ii) Describe the intended use of the sample, restrictions on its use, and the confidentiality of the DNA results.
- b. Identify the donor:
 - i) Confirm the donor's credentials.

- ii) Clearly establish the donor's biological relationship to the victim.
- iii) Obtain the donor's contact information.
- iv) Use an appropriate form.
- c. Originate and maintain a chain of custody for donor reference samples.
- d. Initiate a logical numbering system for all reference samples that is compatible with the ICS (e.g., consider allocating a predetermined block of numbers to assist in identifying the source of the sample).
- iii) Staff:**
 - a. Identify and utilise appropriate individuals or agencies for the collection of family reference samples.
 - b. Train individuals to:
 - i) Interact with victims' relatives with sensitivity.
 - ii) Use proper collection methods (e.g., buccal swabs, fingerstick devices).
 - iii) Record accurate and reliable kinship information.
- iv) Preferred samples:**
 - a. Blood sample collected using venipuncture or a fingerstick device.
 - b. Two properly collected buccal swabs.
- v) Preferred donors. Collect the following types of samples from the preferred donors indicated:**
 - a. Short tandem repeat or other autosomal markers. Preferably, collect samples from the following:
 - i) Either or both biological parents of the victim.
 - ii) The victim's mate and their biological children.
 - iii) Biological siblings who share the same parents as the victim.
 - b. Mitochondrial DNA. Use maternally related family members as references.
 - c. Y-chromosomal markers. Use paternally related family members as references.

The suitability of the donor depends on the type of DNA analysis used. Consult the testing laboratories for clarification.

C. Direct reference samples:

- i) Collection:**
 - a. Immediately establish a point of contact responsible for receiving and managing the collection of direct reference samples.
 - b. Ensure that the FAC and other family services widely publicise the name or location of the point of contact and a list of items suitable for direct DNA referencing.
 - c. Notify family members that they can submit direct reference samples at the same site where they provide family reference samples.
 - d. Place and appropriately store individual reference samples in separately labelled containers.
- ii) Documentation:**
 - a. Obtain appropriate documentation to allow for the correlation of direct reference samples to a particular victim.

- b. Originate and maintain a chain of custody.
 - c. Initiate a logical numbering system for all reference samples that is compatible with the IMS/ICS (e.g., consider allocating a predetermined block of numbers to assist in identifying the source of the sample).
- iii) Samples for analysis:**
- a. Take care in choosing appropriate direct reference samples for analysis.
 - b. Ensure that more than one item is submitted.
 - c. Ensure that items are:
 - i) Directly attributable to the victim.
 - ii) Submitted as soon as possible.
- iv) Preferred samples:**
- a. Biological samples suitable for testing include:
 - i) Bloodstain cards (e.g., Guthrie cards or cards obtained from other repositories).
 - ii) Buccal swabs (e.g., home DNA identification kits).
 - iii) Blood stored for elective surgery.
 - iv) Pathology samples (e.g., biopsy samples, PAP smears).
 - v) Extracted teeth (e.g., baby or wisdom teeth).
 - vi) Hair samples.
 - b. Personal items include:
 - i) Used toothbrushes.
 - ii) Used shavers/razors.
 - iii) Unwashed undergarments and other suitable clothing items.
 - iv) Used personal hygiene items (e.g., feminine sanitary napkins).
 - v) Other personally handled or used items (consult the testing laboratory for specific criteria).
- Personal items may need to be returned to the donors.

Summary: The proper selection, documentation, and handling of samples and corresponding reference submissions for DMA analysis can provide maximum assistance for identifying the deceased.

Source: Section 4.4—Mass Fatality Incident—NIJ USA Guide

	Decorporation Drugs	
33	Barium Sulphate	100 Bottles/Hospital*
34	Tab Potassium Iodide 130 mg	1 lac Tab/ Hospital*
35	Dimercaprol (BAL10)	500 Amp/Hospital*
36	Penicillamine	500Amp/Hospital*
37	NaHCOS	500Amp/Hospital*
38	Hexacynoferate (Radiogardase)	500Vial/Hospital*
39	Ditripentate (DTPA)	500Vial/Hospital*
40	Prussian blue	500Vial/Hospital*
	Chemical Casualty Treatment Kit	
41	Autoinjectors (Obidoxime)	1000/Hospital*
42	Atropine Sulphate Injection	5000Amp/Hospital*

* Hospital to be specified by Central, State and District Authority. SOPs will be laid down for turnover/ disposal of these drugs and injectables.

CBRN Management Equipment for QRMTs/MFRs

SNo	Items	Remarks
	CBRN Detectors	
1	Pocket Personal Radiation Dosimeter	1 per Rescue Worker
2	Team Radiation Survey Meter	1 per QRMT
3	Radiation Survey Vehicle	1 per Hospital*
4	Biological Aerosol Warning System	1 per Hospital*
5	Rapid On-site Biological Agent Detection System	1 per Hospital*
6	Chemical Agent Monitor (CAM)	1 per Hospital*
7	Portable Gas and Vapour Indicator	1 per Hospital*
8	Automatic Chemical Agent Detector and Alarm (ACADA)	1 per Hospital*
9	Individual Chemical Agent Detector	1 per QRMT
10	CBRN Protective Shelter	10 per Hospital*
11	Residual Vapour Detection Kit	1 per QRMT
12	Water Poison Detection Kit	1 per QRMT
13	Three Colour Detection Paper	1 per QRMT
	CBRN Protection and Decontamination Equipment	
14	CBRN Protective Suit	1 per Rescue Worker
15	Charcoal Underwear	1 per Rescue Worker
16	Protective Boots	1 per Rescue Worker
17	Protective Gloves	1 per Rescue Worker
18	CBRN Protective Mask	1 per Rescue Worker
19	Disposable Plastic Protective Suit	1 per Rescue Worker
20	Personal Decontamination Kit	1 per Rescue Worker
21	CBRN Casualty Evacuation bag	Adequate Number per QRMT
22	Decontamination Tent	1 per QRMT
23	Decontamination Sprayer	1 per QRMT
24	Hot Air Decontamination System	1 per QRMT
25	Contamination Clearance Module	1 per QRMT
	Material for Area and Equipment Decontamination	
26	Potassium Bisulphite	100kg/QRMT
27	Sodium Bisulphite	100kg/QRMT
28	Titanium Dioxide	10 ltrs/QRMT
29	Sulphuric Acid	10 ltrs/QRMT
30	EDTA Disodium (AR)	100 ltrs/QRMT
31	Potassium Permanganate	5kg/QRMT
32	Teepol	50 ltr/QRMT

	Decorporation Drugs	
33	Barium Sulphate	100 Bottles/Hospital*
34	Tab Potassium Iodide 130 mg	1 lac Tab/ Hospital*
35	Dimercaprol (BAL10)	500 Amp/Hospital*
36	Penicillamine	500Amp/Hospital*
37	NaHCOS	500Amp/Hospital*
38	Hexacynoferate (Radiogardase)	500Vial/Hospital*
39	Ditripentate (DTPA)	500Vial/Hospital*
40	Prussian blue	500Vial/Hospital*
	Chemical Casualty Treatment Kit	
41	Autoinjectors (Obidoxime)	1000/Hospital*
42	Atropine Sulphate Injection	5000Amp/Hospital*

* Hospital to be specified by Central, State and District Authority. SOPs will be laid down for turnover/ disposal of these drugs and injectables.

Major Components of CBRN Management

- a. CBRN Emergency Van**—Hospitals with CBRN casualty treatment centres must have a CBRN emergency van equipped with CBRN detection, protection and decontamination equipment and material so that it can move immediately at the time of requirement. It will be made available at the district level.
- b. Radiation Detectors**—Detection of the radiation level at the site of disaster is very important for the proper management of radiation emergencies. The exposure dose can be detected with the help of detectors. The radiation level will also indicate exposure dose to the victim. The following detection equipment is essential for rescue teams and QRMTs:
- i. **Personal Radiation Dosimeter:** The equipment is available in different forms i.e., pocket size, watch like, pen size etc. It gives a direct visual reading and a safe radiation range can also be set on the equipment. If the radiation dose exceeds the range, the alarm gives an audio signal.
 - ii. **Thermo Luminescence Dosimeter (TLD) Badges:** The TLD gives the information about the cumulative radiation dose. Individuals are supposed to wear the TLD badge all the time. At regular intervals, the cumulative exposure dose can be estimated, using the TLD reader.
 - iii. **Radiation Dose Survey Meter:** This equipment is designed for use by rescue and QRMTs where the accurate dose rate measurement is of paramount importance. Its range is 0.1 iSv to 10 iSv. It can be hooked with a computer and data can also be transferred through telephone lines.
 - iv. **Micro Bomb Detectors:** They are very useful for detecting dirty bombs at airports, shipping centres and border crossings. It contains a real time alerting mechanism through a brightlight and buzzer.
 - v. **Vehicle Detectors:** A moving vehicle monitor designed for measuring and determining radioactivity of vehicles is to be provided at all entry and exit gates.
 - vi. **Whole Body Counters:** Whole body counters will detect any radioactive material inside and outside the body. It will also indicate the concentration of radioactive material in a particular tissue.
- c. Chemical Detectors**—Chemical agent monitors, AP2C, 3 colour detector papers, portable gas chromatographs, residual vapour detection kits.
- d. Biological Integrated Detection System**—It is a high mobility, multi-purpose, wheeled vehicle-mounted system that concentrates aerosol particles from air, then subjects the particle sample to antibody-based detection schemes for selected agents. It is presently capable of detecting eight BW agents within 45 minutes.
- e. Protective Equipment**—Protective equipment is required by rescue teams and QRMTs, for evacuation of victims from the contaminated area. Adequate PPE will be made available at the district level for the use of other responders/service providers.

- i. *Face Masks:* Various types of face masks are available. Usually there are two types of face masks—one is fitted with a canister and the other has got a self-contained breathing apparatus (SCBA). The filters and canisters require change from time to time. Face masks should provide a clear field of vision, prevent fogging, and have a system which allows fluid intake without removing the mask as well as an integral speech transmitter for communication.
- ii. *CBRN Protective Clothing:* It should be available with rescue workers, QRMTs, district hospitals and other service providers. The purpose of protective clothing is to keep contaminating material away from the skin. Protective clothing cannot stop penetration of radiation, however, it definitely protects the skin from dust contaminated with radioactive particles. PPE clothing should be able to stop dust but should be porous to water vapour so that it does not hinder the maintenance of body temperature. A good fabric material like untreated cotton fabric blended with polymer can be used for protective clothing. The PPE clothing so designed should not leave any gaps between gloves, shoes and mask. It should be easy to wear and remove.

f. Creation of CBRN Decontamination Room—Earmarked hospitals must have a decontamination room having appropriate equipment and material. The decontamination room should have a lightweight, durable, impermeable, washable and reusable fiberglass tabletop with a flexible drain hose, locking straps, spray nozzle and wall mounting bracket. Two 100 litre waste collection containers must also be available. All nuclear casualties should be decontaminated prior to shifting into the treatment ward.

g. CBRN dust filter fitted ward—CBRN casualty treatment ward must be fitted with CBRN filtration units to provide purified air with positive pressure inside so that contaminated air cannot come in.

h. Radioactive Biowaste Disposal Facilities—A delay tank is to be constructed to handle waste from the contaminated patients, at a place where there is no movement of the public. Only authorised workers are to be allowed to control the flow of effluent from the tank to the main sewerage. The tank has to be leak-and corrosion proof, and should have a smooth surface from the inside. The outlet of the sewerage tank has to be much higher to avoid back flow. During a one month period the effluent should be allowed to flow into only one tank using a set of valves provided on the pipelines leading to the tanks from the radiation ward. When this is full the tank inlet should be closed and the effluent allowed to flow into the second tank. During the collection period the radioactivity in the first tank will undergo decay so that it can be disposed off when discharge limits are achieved. The activity level at the time of discharge into the sewer will come down to 0.6 micro curie/litre and maximum of 100 micro curie can be discarded into the sewer per day. For a 50-bed ward 5 delay tanks of 6,000 litres may be adequate.

i. Special laboratories

Radio Bio-dosimetry Laboratories—Radio bio-dosimetry includes lymphocyte estimation along with the other formed elements of the blood. Chromosomal study is an important tool for radiation bio-dosimetry. Chromosome exchanges resulting in unstable aberration such as dicentrics, rings, acentric fragments and other asymmetrical rearrangements which can be measured using the technique of Fluorescence In-Situ Hybridization (FISH) which is currently the assay of choice for definitive bio-dosimetry. Measurements of radiation induced apoptosis in human lymphocytes

are also considered the most sensitive reproducible bio-dosimeter. Counting the frequency or number of micro-nuclei in the cytoplasm of irradiated cells, electron spin resonance detection of free radical formation in tooth enamel, and measurement of serum bio-chemical markers such as amylase, Interleukin 6 (IL6), cholesterol and apolipoprotein levels have also been considered as potential technique for determining the radiation dose.

Haematology Laboratories/Blood Banks—Blood and bone marrow are very sensitive to radiation. Following radiation exposures, neutropaenia will occur suppressing the immunity of the casualty leading to infection. To combat the problem, granulocyte concentrates are very useful. Therefore a haematology laboratory/ blood bank with a cell separator for granulocyte concentrates is an essential requirement for the management of radiation injuries.

Genetic Laboratories—Genetic damage is one of the long-term adverse effects of radiation and chemicals. Genetic studies must be carried out in a properly equipped genetic laboratory for proper monitoring, surveillance and counselling of victims.

Molecular Laboratories—Radiation injuries damage DNA, therefore a molecular laboratory needs to be established in the radiation injury treatment centre for DNA and other molecular studies.

Immunology Laboratories—Immuno suppression is the major damage caused by radiation injuries. Proper immunological studies will help in the restitution of the immune system and bone marrow transfusion. The immunology laboratory will facilitate studies in cell mediated and humeral immunity. The laboratory will also be useful for antibody detection of various biological agents.

j. Bone Marrow Bank—For the restitution of the immune system, bone marrow transfusion is very important. However, Human Leucocyte Antigen compatibility and host versus graft reaction may lead to rejection of the bone marrow. Stem cell harvesting and transfusion will avoid the above problems. The bone marrow of persons with high risk of radiation exposure will be harvested, cryo preserved and stored to transfuse at the time of requirement. Therefore, stem cell harvesting facilities and bone marrow banks are essential components of acute radiation injury treatment centres.

k. Immunoprophylaxis and Chemoprophylaxis—Prophylactic immunisation is an important means for providing protection against biological agents. For some biological agents the only available counter measures might be specific anti-serums. Chemoprophylaxis using broad spectrum antibiotics offers an additional option for biological agents. Some cases like anthrax may require coupling of antibiotics with vaccines.

Cold Chain System for Storage and Transportation of Blood and Blood Components

INTRODUCTION

A viable cold chain system for storage and transportation of blood and blood components is an essential requirement of any blood transfusion service particularly for disaster situations, CBRN warfare and for operational preparedness. Blood preparedness for disasters comprises of a readily available supply of screened blood and blood components matching projected patient need, effective management of current inventory and healthy blood donors close at hand when needed. It also includes a well organised and effective cold chain system for transportation of blood and blood components to the disaster site by modes such as air or road in suitable transport boxes at prescribed temperatures with facilities for storage at the disaster site.

STORAGE FACILITIES

Blood demand during disasters is unpredictable. One of the most important aspects in blood preparedness for disasters is maintaining an adequate inventory.

Blood banks should ideally maintain a seven day stock position to handle normal usage and be prepared for a catastrophic event till such time as fresh donations can be organised if needed. In addition, the reference blood banks should maintain a frozen stock of cryopreserved packed red cells of O negative group as well as other rare blood groups.

Specifications for Component Storage Areas

Storage areas for blood components must operate within a specified temperature range and should provide adequate space, suitable lighting and be arranged and equipped to allow dry, clean and orderly storage. Good manufacturing practice requires that components of different status are appropriately identified and effectively separated.

Recognised status categories include:

- i) **Untested Blood/Blood Components**—Procedures should ensure that untested components are stored separately till such time as the results of the mandatory microbiological screening tests are available.
- ii) **Non-conforming Blood/Blood Components**—Components which do not comply with the specification for mandatory tests or are otherwise unsuitable for transfusion should be categorised as non-conforming. Normally, such components would be discarded after the requisite disinfection.
- iii) **Returned**—Components which have been returned from blood transfusion centres outside the direct control of the blood centre normally should not be returned to stock as the storage conditions of these components during the period they were outside the centre cannot be monitored.

- iv) Stock—Only those components which have been deemed satisfactory for issue by a designated person should be held in stock.

Appropriate security and status labelling of component storage areas are essential. A current inventory should be maintained of components in each storage category/area. Areas/equipment in which components are to be stored should be validated before their introduction into routine use and checked for calibration to a documented schedule thereafter. A permanent, continuous record of storage temperatures should be made, reviewed and stored. There should be a log of alarm events that describes the actions taken.

Procedures for Component Storage

Written procedures must be established for the storage of blood components. These should include the following:

- i) Procedures to ensure components are not released to stock unless authorised by a designated person.
- ii) Definitions of the designated storage areas including the storage specification, the status of components to be stored in each area and the persons who are authorised to access each specific area.
- iii) Procedures for validating and monitoring the conditions of storage.
- iv) Procedures for ensuring the good order and cleanliness of storage areas.
- v) Procedures to ensure the storage of blood components does not jeopardise their identity, integrity or quality.
- vi) Procedures which ensure appropriate stock rotation.

NACO Guidelines for Storage and Transportation

- i) It is necessary to maintain the cold chain at all times during transport, storage and issue.
- ii) Proper insulated carry boxes should be used during transportation of blood.
- iii) The ice in use should be clean and should not come in direct contact with the blood bags.
- iv) Whole blood and packed cells should be kept in the blood bank refrigerator at $4-6\text{ }^{\circ}\text{C} \pm 2$ up to 35 days. Red cells in additive solutions can be stored up to 42 days.
- v) When packed cells are prepared from a whole blood unit after sedimentation using an open system, the packed cells should be used within 24 hours.
- vi) Fresh Frozen Plasma (FFP)/Cryo can be stored up to one year at minus $18\text{ }^{\circ}\text{C}$ or lower.
- vii) Platelet concentrates can be stored at $20-24\text{ }^{\circ}\text{C}$ for 3-5 days depending on the bags in which these are prepared.
- viii) Due care should be taken to maintain sterility of blood and blood components by keeping all storage areas clean.
- ix) The temperature of all storage areas should be monitored continuously preferably using a graphic recorder. The alarm system should indicate any deflection in temperature and this should be checked periodically. These facilities should have a battery backup.

- x) The storage centres should check the condition of the blood on receipt from the regional centre and also during the period of storage, as the responsibility of problems if any arising from storage, cross-matching, issue and transfusion will be of the storage centre. Any unit showing haemolysis, turbidity or change in colour should not be taken in stock for transfusion.

Recommended Storage Temperature and Shelf Life

<u>Component</u>	<u>Storage Temp</u>	<u>Shelf Life</u>
Packed RBC/Whole Blood	2-6 °C	35-42 days
FFP	minus18°C	1 year
Cryoprecipitate	minus18°C	1 year
Platelet Concentrate	20-24 °C (with agitation)	05 days
Frozen RBCs	minus 80 °C	10 years

Additional Criteria for Storage and Handling

- i) Blood and blood products must be stored in labelled designated storage areas/units.
- ii) Alarm checks of storage units must be performed and adequate corrective action taken when indicated.
- iii) When released to another department, blood components must be maintained within appropriate storage temperatures.
- iv) Stored in an orderly fashion to prevent crowding and to allow air circulation.
- v) Do not store quarantined components above other components.
- vi) Do not store reagents above blood components.
- vii) Segregate autologous components from allogeneic components, and biohazard labelled autologous components from other autologous components.
- viii) Do not overlap platelet bags during storage, and place face down to optimise oxygen exchange.

TRANSPORTATION FACILITIES

Transportation of blood and blood products from the blood bank to the disaster site is an extremely important role of the blood bank.

Blood may be transported by road or by air:

- i) Road—transportation by road may be hampered by natural obstacles such as landslides, flood, etc., or man-made obstacle such as mine fields, shelling in war situations.
- ii) Air—transportation by helicopters and planes provides an excellent mode of transportation if it is possible to find some landing space at the disaster site.

Maintenance of the cold chain is extremely important in the transportation of blood in disaster as in peace.

Equipment required for this is:

- Blood Transport Boxes
- Refrigerated vans
- Blood storage cabinets
- Platelet incubator cum agitator
- Deep freezers

Run on electricity/generator at the disaster site

General Considerations

- i) Donated blood and blood components should be transported by a secure system using transit containers, packing materials and procedures which have been validated for the purpose to ensure the component surface temperature can be maintained within the correct ranges during transportation.
- ii) Monitoring of routine transport temperatures should be performed periodically.
- iii) As far as is practicable, transit containers should be equilibrated to a component's storage temperature prior to filling.
- iv) Transport containers should be appropriately labelled and should be secure to protect components and samples from damage during transit.
- v) Documentation should accompany components in transit to permit their identification.
- vi) Transport containers should not be exposed to temperatures beyond the range and time for which they have been validated.
- vii) Where normal ice is used to achieve an appropriate storage temperature, it should not come into direct contact with the components.
- viii) Dead air space in packaging containers should be minimised.
- ix) Written procedures for the transportation of components should be established and should ensure that the guidance given above is complied with. In addition, written procedures should include the following:
 - Definition of approved systems of packaging, transportation and transport conditions required for each component.
 - Instructions for monitoring approved systems of packaging and transportation.

Transportation from Collection Site to Processing Centre

Blood and samples from donor camps must be transported to the receiving blood centre under appropriate conditions of temperature, security and hygiene. Donations from which it is intended to prepare platelets should be transported in conditions that ensure the surface temperature of the blood packs does not drop below 20°C. Blood and samples being transported from donor camps must be accompanied by documentation, which ensures that all donations in the consignment can be accounted for.

Transport of Components from Blood Establishments to Hospital Blood Banks/Users

Blood components should be transported under conditions which are as close as possible to their specific storage requirements. Transport time should be kept to a minimum. It should be noted that, occasionally, red cell components are issued before they have been cooled to their storage temperature ($4^{\circ}\text{C}\pm 2^{\circ}\text{C}$). In such circumstances, it may be neither possible nor necessary to maintain the transport temperature within the range 2°C to 10°C and local judgement should be exercised. The recommended transportation temperatures of various components are as follows:

Product	Temperature
Whole Blood	20 to 24 °C (if platelets are to be prepared)
	1 to 10 °C (if platelets are not to be prepared)
Packed RBC	1 to 10 °C
Platelet Concentrate	20 to 24 °C
Fresh Frozen Plasma (FFP)	minus 18 to minus 25 °C
Cryoprecipitate	minus 18 to minus 25 °C

There are several types of blood transport boxes available having varying capacities. The transport boxes may be divided into two broad categories—battery operated and non battery operated.

- i) Battery Operated—these boxes run on both AC and DC power supply and can maintain the desired temperature for as long as the power supply is available. Once disconnected from a power source it can hold the temperature for only about 1 hour. The boxes are of two main types:
 - (a) For transport of Packed RBC—maintain a temperature of 2 to 6 °C.
 - (b) For transport of FFP/Cryoprecipitate—maintain a temperature of $< -20^{\circ}\text{C}$
- ii) Non battery Operated—these boxes use ice packs/gel packs/dry ice to achieve the desired temperature. They are available in different sizes and specifications depending on the component required to be transported.

Centres may use all or only certain types of containers for transport. Components dispatched from a blood establishment should be accompanied by a dispatch note detailing as a minimum:

- The donation number of each component.
- If relevant, the component's ABO and Rh D blood group.
- The signature(s) and designation of the person(s) responsible for the issue.
- Space for the signature(s) and designation of the person(s) receiving the consignment.
- Standard Protocol for Transport of Blood and Blood Components.

Standard Protocol for Transport of Blood and Blood Components

<u><i>Procedural Steps</i></u>	<u><i>Instructions</i></u>	<u><i>Rationale</i></u>
Procure Standard Blood Transport Boxes and Dry Ice if needed	<ul style="list-style-type: none"> • Procure Standard Blood Transport Boxes for transport and proper coolant. • Use ice packs, gel packs or obtain dry ice if plasma/Cryoprecipitate is to be transported. 	Dry ice is available for transport if plasma/ Cryoprecipitate is to be transported.
Acceptable Conditions for Transport Media	<p>Storage:</p> <ul style="list-style-type: none"> • Ice packs are stored frozen between minus 18°C and minus 30°C. • Gel packs are stored refrigerated between 1°C-8°C. • Dry ice is stored in Styrofoam containers. <p>Size:</p> <ul style="list-style-type: none"> • Ice pack should be approximately 8" x 8". • Gel packs should be approximately 8" x 6" or 9" x 5.5", sufficient to cover a unit of red cells. • There should be sufficient dry ice to surround the product being transported. <p>Condition:</p> <p>Any ice pack or gel pack that is damaged or leaking must be discarded.</p>	<p>Packs are at optimal temperature for use.</p> <p>These sizes have been validated for use.</p> <p>Damaged packs are not used.</p>
Transportation of Packed Red Cells	<ul style="list-style-type: none"> • Place two ice packs along the side of the transport box so they fit snugly. • Place cardboard/thermacol separator next to each ice pack. Place gel packs on bottom of transport box. • Place packed red cells in a plastic bag/ aluminum foil pouch and lay them on top of the gel pack. • Place a layer of gel packs on top of the plastic bag/aluminum foil pouch containing the packed red cells. • Close the box. 	Ice packs maintain Temperature. Cardboard separates ice packs from red cells to avoid hemolysis. Gel packs maintain temperature of red cells between 2 and 6°C.
Transportation of Platelets	<ul style="list-style-type: none"> • Place all platelets in plastic bag/aluminum foil pouch and place in container. • A room temperature gel pack should be placed on top of the plastic bag/aluminum foil pouch containing the platelets. • Close the box. 	Maintain temperature between 20 and 24 °C.
Transportation of FFP/ Cryoprecipitate	<ul style="list-style-type: none"> • Place frozen products in plastic bag. • Place dry ice in transport box. • Place frozen products on top and cover with dry ice. • Close the box. 	Maintains product in frozen state. As the products are fragile they should be insulated by any packing material.
Documentation	Include any required paperwork on top of the lid. This may include Chart	Required paperwork is included.

Important Websites

<u>Ministry/Institute/Agency</u>	<u>Website</u>
Ministry of Health and Family Welfare	www.mohfw.nic.inhttp://www.cbhidghs.nic.in/hia2005/8.01.htm
Ministry of Railways	www.indianrailways.gov.in
Ministry of Defence	www.mod.nic.in
Ministry of Civil Aviation	www.civilaviation.nic.in
Ministry of Shipping, Road Transport and Highways	www.morth.nic.in
Bhabha Atomic Research Centre	www.barc.ernet.in
World Health Organization	www.who.int
Directorate General Armed Forces Medical Services	www.indianarmy.nic.in
Indian Council of Medical Research	www.icmr.nic.in
All India Institute of Medical Sciences	www.aiims.edu
Disaster Management Institute, Bhopal	www.dmibpl.org
National Institute of Disaster Management	www.nidm.net
National Institute of Communicable Diseases	www.nicd.org
Defence Research Development Organisation	www.drdo.org
National Institute of Occupational Health	www.icmr.nic.in/pinstitute/nioh.htm
National Environmental Engineering Research Institute	www.neeri.res.in
Centre for DNA Fingerprinting and Diagnostics	www.cdfd.org.in
National Institute of Mental Health and Neuro Sciences	www.nimhans.kar.nic.in
International Health Regulations	www.who.int/csr/ihr/ihr1969.pdf