Sudan Medical Specialization Board
Pharmacy Specialization Board

Assessment of the pharmaceutical Supply System after Disaster in Sudan – case-study Khartoum State

By

Sawsan Yousif Ahmed Elbashir
B. pharm, university of Khartoum
1994

A thesis submitted in partial fulfillment for the requirements of the Degree of
Fellowship on Management of Pharmaceutical Services

Supervisor
Dr. Eltayeb Mohammed Eltayeb
M.Sc. Clinical pharmacy

July 2007

Dedication

To my mother, husband, sisters and kids

With endless love

Acknowledgement

I would like to express my deep thanks to my supervisor Dr. Eltaib Mohammed Eltaib for his extensive advice and suggestion.

Special praise of thanks are due t Dr. Khalid Hamid for his guidance, useful comments and supervision during the courses of my study.

Thanks are also due to Dr. Mandor El Mahadi and to central medical supplies public corporation directorate for their financial support.

Deepest thanks should also be extended to my family for supporting and encouraging me throughout this study, and to every one who helped me to complete this manuscript.

List of contents page no.

List of figures **page no.**

List of tables **page no.**

Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
CMSPC	Central Medical Supplies Public Corporation
FMoH	Federal Ministry of Health
HIV	Human Immunodeficiency Virus
IDA	Inter National Dispensary Association
IDPs	Internally Displaced People
NGOs	Not-for-profit Organization
MoH	Ministry of Health
PAHO	Pan-American Health Organization
RDF	Revolving Drug Fund
SPSS	Statistical package for social studies
UNICEF	United Nation Children's Fund
WHO	World Health Organization

Abstract

The term “disaster” is usually applied to a breakdown in the normal functioning of a community that has a significant adverse impact on people, their works, and their environment, And can be defined as "*every event which infect people environment, to an extend over the capacity of community to naturally deal with it."* This situation may be the result of a natural event or it may be the result of human activity (man-made). Disasters occur frequently around the world, and their incidence and intensity seem to be increasing in recent years. They can cause an unexpected number of deaths, injuries or illnesses in the affected community, thereby exceeding the therapeutic capacity of the local health-care services. In this situation pharmaceuticals supply is a top priority for the effected population, it is necessary to ensure that they are readily available, but also that they are used rationally.

This study has been done in Khartoum state the federal capital of Sudan, the main objective of this study were to assess the pharmaceutical supply system after disaster in Sudan in Khartoum state as representative, in addition the study shed some light on disaster definitions and types and also the disaster history in Sudan.

To achieve the objective of this study a questionnaire type of survey was conducted in some Khartoum state health institutions and it designed to get the essential information about pharmaceutical supply system in disaster. The sample chosen was 8 health institutions, 6 hospitals, and the main drugs supplier for all Sudan states central medical stores public corporation and revolving drug fund Khartoum state. The data collected was analyzed using software program SPSS and subjected to descriptive analysis.

The main findings of this study were that there is an urgent need of a system for disaster management in all the health institution, and this system must include financial resources, trained personnel, large well designed stores, transportation methods and any other resources needed for disaster management and risk reduction.

Chapter One - Introduction

1.1. Disasters – General Aspects

The term “disaster” is usually applied to a breakdown in the normal functioning of a community that has a significant adverse impact on people, their works, and their environment, overwhelming local response capacity (PAHO 2001). And can be defined as "*every event which infect people environment, to an extend over the capacity of community to naturally deal with it."* (Eltaib E. and Elmasaad H. 2002) Or a disaster is *"any occurrence that causes damage, ecological disruption, loss of human life, or deterioration of health and human services on a scale sufficient to warrant an extraordinary response from outside the affected community or area"*.(FMoH (2006) Furthermore, a disaster is defined as ‘a serious disruption to community life which threatens or causes death or injury to property which is beyond the day-to-day capacity of the prescribed statutory authorities and which requires special mobilization and organization of resources other than those normally available to those authorities’

This situation may be the result of a natural event—say, a hurricane or earthquake—or it may be the result of human activity (man-made) Some organizations make a distinction between “disasters”—the result of natural phenomena—and “complex emergencies” that are the product of armed conflicts or large-scale violence and often lead to massive displacements of people, famine, and outflows of refugees. Examples would include the Balkan crisis, the Ethiopian, Somali and Sudanese famines, the genocide in Rwanda and the violence in East Timor. (PAHO 2001)

Disasters occur frequently around the world, and their incidence and intensity seem to be increasing in recent years. They can lead to widespread loss of life, directly and indirectly (primarily or secondarily), affect large segments of the population and cause significant environmental damage and large-scale economic and social harm. Whether disasters are essentially natural or man-made in origin, their consequences derive from a combination of human action and interaction with nature’s cycles or systems. In the health sector, the effects of disasters are not confined to mortality and morbidity directly caused by disaster, but the damage to the health sector's infrastructure and the direct effects on the health professionals render

the health services jeopardized and nonfunctioning, or functioning below the optimal level, at the time of the great need for this type of services

They can cause an unexpected number of deaths, injuries or illnesses in the affected community, thereby exceeding the therapeutic capacity of the local health-care services and forcing authorities to reorganize the sector or to solicit outside help. (FMoH 2006)

1.1.1. A natural disaster

It is the consequence of when a potential natural hazard becomes a physical event (e.g. volcanic eruption, earthquake, landslide) and this interacts with human activities. Human vulnerability, caused by the lack of planning, lack of appropriate emergency management or the event being unexpected, leads to financial, structural, and human losses. The resulting loss depends on the capacity of the population to support or resist the disaster, their resilience. This understanding is concentrated in the formulation: "disasters occur when hazards meet vulnerability". A natural hazard will hence never result in a natural disaster in areas without vulnerability, e.g. strong earthquakes in uninhabited areas. The term natural has consequently been disputed because the events simply are not hazards or disasters without human involvement. The degree of potential loss can also depend on the nature of the hazard itself, ranging from a single lightning strike, which threatens a very small area, to impact events, which have the potential to end civilization.

1.1.2. Man-made hazards

Disasters having an element of human intent, negligence, error or involving a failure of a system are called man-made disasters. Man-made hazards are in turn categorized as technological or sociological. Technological hazards have an aspect of failure of technology, such as engineering failures, transport accidents or environmental disasters. Sociological hazards have a strong human aspect, such as crime, stampedes, riots and war. (Wikipedia 2007)

1.1.3. Types of disasters: (Eltaib E. and Elmasaad H. 2002)

Disaster whether natural or man –made can be classified to different types:

A. Natural factors:

- Fast occurrence:
  - Earthquake
  - Heavy rains.
  - Volcano explosions.
  - Equatorial wind.
  - Storms.
  - Fires
  - Floods

B. Natural and man-made factors:

- Fast occurrence:
  - Fire.
  - Earthquake
- Slow occurrence:
  - Drought.
  - Desertification.
  - Famine.
  - Floods.
  - Epidemics

C- Man-made factors:

- Fast occurrence:
  - Toxic dump.
  - Circulation accidents.
  - Technical accidents.
  - Industrial accidents.
- Slow occurrence:
  - War and civil conflicts.
  - Environmental pollution.
  - Economic crises.

1.2. Effects of disaster:

Each disaster is unique—its effects not only have to do with the type of natural or man - made phenomenon, but also with the economic, health, and social conditions of the area. (PAHO 2001) We have to consider disaster within the social and political framework and within the environmental situations where they occur,

because these dimensions determine and influence the quickness of problem and the steps to be followed and the need for external aids. (Eltaib E. and Elmasaad H. 2002)

However, there are common features, and identifying them can help improve the management of humanitarian assistance and the use of resources. The following aspects should be taken into account when considering the nature of a disaster (see also Table 1.1): (PAHO 2001)

1. There is a correlation between the *type* of disaster and its impact on health, particularly the occurrence of injuries. For instance, earth- quakes cause many traumas that demand medical attention, while floods tend to produce relatively few injuries;
2. Some of a disaster's effects do not have an immediate impact on public health, but pose a potential threat. Population displacements and environmental changes may increase the risk of a spread in communicable diseases. In general, though, epidemics are not *caused* by natural disasters;
3. Immediate and potential health hazards in the aftermath of a disaster ; they tend to strike at different times, and with variable intensity within the affected area. Thus, injuries tend to happen at the time and place of the impact, demanding immediate medical attention, while the risk of an increase in communicable diseases evolves more slowly and reaches maximum intensity with overcrowding and breakdowns in hygiene;
4. After a disaster, the need for food, clothing, shelter, and primary health care is rarely absolute; even the displaced often have the resources to satisfy some of their own basic needs. Moreover, it is common for the victims of a disaster to recover quickly from the initial shock and participate spontaneously in search and rescue efforts and other relief initiatives, such as the storage and distribution of emergency supplies;
5. Wars and civil conflicts generate a particular set of health problems and operational obstacles. Overcoming them requires dealing with many political, social, ethnic and geographical issues.

Effective humanitarian relief management is based on anticipating problems and identifying them as they arise, and providing specific supplies at the right time where they are most needed.

So, epidemiology can provide much needed information on which a rational, effective, and flexible policy for the management of disasters is based. In particular, epidemiology provides the tools for rapid and effective problem solving during public health emergencies such as natural and technological disasters. (Eric K. 2003),

1.3. Impact of disasters:

The various effects of disasters on the population and its surroundings generate different kinds of needs and require different approaches to meet those needs. It is therefore important to have a general sense of what these effects are, and which systems are most commonly affected.

However, experience shows that the effects in question cannot be taken as absolutes, since the impact and form a disaster takes depends on the specifics of the affected region. Bearing this in mind, the following is an overview of some basic characteristics of these effects (see also Table 1.1): (PAHO 2001)

1.3.1. Social Reactions

The behavior of disaster victims rarely explodes into general panic or sinks into stunned apathy. After the initial shock, people tend to start acting positively to meet well-defined personal goals, leading to an increase in individual activities that, in spite of being spontaneous, quickly self-organize into collective endeavors. Since rumors abound after a disaster, especially concerning epidemics, the authorities may face tremendous pressure to adopt emergency measures, such as massive vaccination campaigns against typhoid or cholera, without there being solid public health evidence for doing so.

1.3.2. Communicable Diseases

Natural disasters do not cause massive outbreaks of infectious diseases, although in some circumstances they may increase the odds of their spreading. In the short term, the increase in morbidity is frequently the result of fecal contamination of drinking water and food, causing gastrointestinal diseases.

The risk of epidemic outbreaks of communicable diseases is proportional to the density and displacement of the population, since these factors degrade living conditions and substantially increase the demand for drinking water and food, which tend to be scarce in such circumstances. In the immediate aftermath of a disaster, the risk of contamination grows—as in the case of refugee camps—as existing sanitation

services such as water supply and sewerage systems break down and it becomes Impossible to maintain or restore public health programs. In the case of complex disasters, malnutrition, overcrowding, and the lack of basic sanitary conditions are frequent. In such circumstances, outbreaks of cholera and other diseases have occurred.

1.3.3. Population Displacements

When large population displacements take place, whether spontaneous or organized, humanitarian assistance becomes crucial—and urgent. People tend to flock to urban areas, where public services do not have the capability to handle sudden, very large increases in the population served, leading to increased mortality and morbidity rates. If the disaster destroys most homes in a given area, large local “migrations” may take place within the same urban environment, as victims look for shelter in the homes of relatives and friends.

1.3.4. Exposure to the Elements

Health hazards associated with exposure to the elements are not common in temperate zones, even after a disaster, as long as the displaced are kept in dry places where they can remain sheltered from the wind and cold. However, in other climates with significant extremes in temperature, whether too hot or too cold, proper shelter can be vital. Hence, the need to provide emergency shelter should not be seen as a given, but depends instead, to a large extent, on local circumstances.

1.3.5. Food and Nutrition

Food shortages in the aftermath of a disaster are generally due to two causes. The first is the destruction of food stocks in the affected area, which combines with personal losses to reduce the immediate availability or affordability of food. The second is disorganized distribution systems, which may contribute to shortages even if there is no absolute scarcity of food. After an earthquake, lack of food is rarely severe enough to cause malnutrition. River floods and unusually high tides causing coastal flooding may affect food stocks and ruin crops, as well as interfering with distribution.

1.3.6. Water Supply and Sewerage

Water supply and sewage systems are especially vulnerable to natural disasters. The interruption of such services leads to severe health risks. These systems are widely distributed, often poorly maintained or in disrepair even before a disaster strikes, and exposed to a variety of hazards.

Deficiencies in the quantity and quality of drinking water, or the safe disposal of fecal and other human waste, bring about a degradation of sanitary services, which in turn contributes to creating favorable conditions for the spread of water-borne diseases.

1.3.7. Mental Health

In the immediate aftermath of a disaster, anxiety, neurosis and depression are not a major public health issue, and can generally be handled temporarily by other members of rural or traditional communities without external support. Confounding expectations, it is relief workers who may comprise a high-risk group. Whenever possible, all efforts must be made to preserve the social structure of families and communities. Likewise, the indiscriminate use of sedatives or tranquilizers during the relief stage of the disaster must be vigorously discouraged. In the industrialized or urbanized areas of developing countries, a significant increase in mental health problems often accompanies the long term rehabilitation and reconstruction phase. Treatment must be provided. Special reference must be made to the traumas that are the result of contact with the horrors of armed confrontation and other forms of extreme violence. The violent death, disappearance, or injury of relatives and friends aggravates the trauma, which generally calls for protracted therapy.

1.3.8. Damage to Infrastructure

Natural disasters frequently cause severe damage to key facilities, affecting the health of those sectors of the community that depend on the services provided. In the case of hospitals and health centers whose structure is unsafe, natural disasters put its occupants at risk and limit institutional capacity to provide services to the victims. These destructive effects also have an impact on infrastructure, equipment, and other useful resources for managing the arrival, storage, and distribution of emergency supplies.

Table (1.1): Short term effect of major disasters

Effect	Earthquakes	Wind storms (without flooding)	Tsunamis and sudden floods	Slow-onset floods	Landslides	Volcanoes and mud slides
Deaths	Many	Few	Many	Few	Many	Many
Severe injuries requiring extensive treatment	many	moderate	few	few	few	few
Increased risk of communicable diseases	This is a potential hazard after any significant natural disaster. The potential increase in close with correlation with overcrowding and the degradation of the sanitation situation					
Damage to health facilities	Severe (structure and equipment)	Severe	Severe, but localized	Severe (equipment only)	Severe, but localized	Severe (structure and equipment)
Damage to water supply systems	Severe	Minor	Severe	Minor	Severe, but localized	Severe
Lack of food	Infrequent (generally caused by economic or logistical factors)		Common	Common	Infrequent	Infrequent
Large population displacement	Infrequent (tend to occur in urban areas that have suffered severe damage)		Common (generally limited)			

Source: (PAHO 200)

1.4. The impact of disaster on health: (Eltaib E.and Elmasaad H. 2002)

Disasters as general affect health status of the population by many ways although the majority of disasters may not be followed by epidemics or unknown disease. In fact, every thing potential to danger before disaster, Will be more potential to it after the disaster. Those effects can be appear as follows:

- Direct effect of the disaster on the people health.
- Indirect way. By disturbing or cutting the necessary services.

- Increase the urgent demand to health services due to:
- High number of infected people.
- Limited resources and capacity for health services.
- Quantity of existing medicines supply.
- Excessive Work load with limited number of health workers.
- Existence of risk factors by the dissemination of epidemic diseases.

1.5. Disasters in Sudan:

1.5.1. Demography and Geography:

With an area of one million square miles Sudan is the largest country in Africa. The Northern part of the country is an extension of Sahara desert, the central part is a dry Savannah area and the southern part is a tropical forest climate. (FMoH 2007) The total population of Sudan is 35.6 million, of which 33% live in urban areas. (FMoH 2006) The population of metropolitan Khartoum is growing rapidly, exceeding 6 million, including internally displaced people (IDPs) from the southern war affected zone as well as western and eastern war/drought-affected areas. However, the majority of the displaced people have migrated seeking better job / educational opportunities. (FMoH 2007)

1.5.2. Epidemiologic context

Sudan not infrequently; experiences natural disasters including floods, heavy rains and drought. The epidemiological profile of the country is typical of Sub-Saharan African countries; malnutrition and communicable diseases dominate the health scene with high vulnerability to outbreaks. There is also emerging and re-emerging diseases, many of which are compounded by factors beyond the health system. The main causes of morbidity and mortality are infectious and parasitic diseases such as malaria, TB, Schistosomiasis, diarrhea diseases, ARIs and protein-energy malnutrition. (FMoH 2007)

Sudan is vast and sparsely populated. Its epidemiological profile is marked by a heavy burden of endemic diseases, including a growing threat from Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome (HIV/AIDS), and high risk of epidemics and other natural disasters -the latest being the drought looming now in Darfur and Kordofan. Insecurity and poverty are widespread. Armed conflict is ongoing in Darfur, and is close to erupt in other areas. The caseload

represented by the IDPs is already one of the largest in the world, and is likely to increase with the return of refugees and the demobilization of the military. People's coping strategies and health systems are exhausted. The consequent levels of risk that face human life and health are unacceptable. (WHO 2005)

1.6. History of Disasters in Sudan:

Given the natural environment of Sudan, its vulnerability profile and the current and foreseen transitions, Sudan is prone to many types of disasters (table 1.2); as an example, in the year 2003, in addition to the ongoing civil strife in the **south**, local tribal conflict flared up in **Darfur**, and is still continuing, with social and economic impacts on the Darfur's people. During the same year, **El Gash river**, in the eastern part of the country, flooded with almost total damage to Kasala city (population approximately = quarter of a million). Many parts of Sudan are still affected annually by such incidences of floods and flash-floods during the rainy season. This adds to the burden of endemic diseases such as malaria and is sometimes the source of epidemics of other diseases. The capacity to respond to these incidents at the local level is, at best, weak. A public health approach to emergency management will aim to decrease the risk by reducing the vulnerabilities of communities (prevention and mitigation measures), building the capacity of the health systems to address the health needs (preparedness), and by the provision of prompt and efficient emergency response (response) once the disaster has occurred. (FMoH 2006)

Table (1.2): Types and dates of disasters in Sudan from the year 1965 to 2002

Date	**Disaster type**	**Remarks**
27.2.1965	Accident	Train (Abou – near Port-Sudan)
1.4.1965	Epidemic	Meningitis – Khartoum
1/3/1966	Epidemic	Cholera (all of the country)
9/10/1966	Earthquake	All of the country
1/1/1974	Drought	All of the country
1/10/1974	Floods	All of the country
1/9/1975	Floods	Flood of Al-gash stream
1/9/1976	Epidemic	Fever of Maridi
1/7/1978	Floods	Al-gazira
1/1/1980	Drought	East of Africa (5 country)
1/1/1983	Drought	The northern region
1/1/1983	Civel war	Southern Sudan
1/4/1983	Drought	Maban
15/8/1983	Floods	Kassala – heavy rains
1/10/1983	Floods	Fast floods- Mandry
1/5/1984	Famine	Red sea, Kordofan and Darfor
6/1/1984	Displacement	----------
1/6/1985	Epidemic	Cholera
6/1/1986	Grass hoover invasion	Desert grass hoover
1/1/1987	Grass hoover invasion	Grass hoover
1/1/1987	Mice	----------
1/10/1987	Drought	Kordofan – Darfor
1/1/1988	Epidemic	Meningitis – Khartoum and central region
4/8/1988	Floods	Khartoum, Northern and central region
1/11/1988	Epidemic	Malaria
19/5/1990	Earthquake	Juba – Tirkaka
26/5/1990	Earthquake	Tirkaka
28/5/1990	Refugees	50,000 Ethiopian soldiers – A-Laffa kassala

Date	Disaster type	Remarks
22/8/1992	Floods	Kassala - Al-gash stream
18/4/1993		Port-Sudan (26 death cases)
1/8/1993	Earthquake	Many region in the country (death of a woman and her child in Khartoum)
1999	Gastro-enteritis	Many region in the country
1998	Floods	The northern region
1999	Meningitis	Most of the country
2001-2002	Sun stroke	The Red sea

Source: (Eltaib E.and Elmasaad H. 2002)

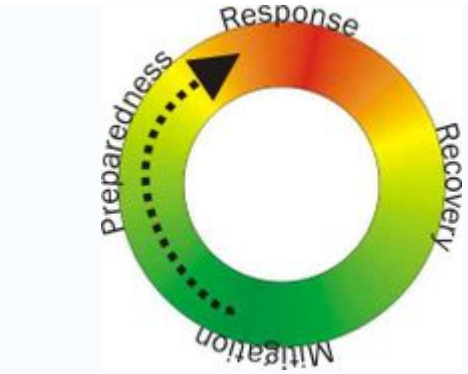
1.7. Disaster management Phases:

The probability of avoiding a disaster is greatly improved when those potentially affected by them implement mitigative action and develop emergency preparedness plans. The science of disaster management deals with this issue. Although the term disaster is subjective, it is often used in the developed world to refer to situations where local emergency management resources are inadequate to counteract the negative effects of the event. (Wikipedia 2007)

The nature of disaster management is highly dependent on economic and social conditions local to the emergency, or disaster. This is true to the extent that some disaster relief experts have noted that in a sense the only real disasters are economic. Experts have long noted that the cycle of emergency management must include long-term work on infrastructure, public awareness, and even human justice issues. This is particularly important in developing nations.

The process of emergency management involves four phases: mitigation, preparedness, response, and recovery, and can be represented as follows: Figure (1.1)

Figure (1.1): A graphic representation of the four phases in disaster and emergency management.



Source: Wikipedia 2007

***Prevention* (Mitigation)**

Regulatory and physical measures to ensure that emergencies are prevented, or their effects mitigated, these include land-use zoning, safe building design and personal safety measures. Epidemiologists can contribute to prevention and preparedness by identifying engineering, other features of the built and natural environment, and personal actions/ behavior which have contributed to increased survival rates and reduced morbidity

Preparedness

Arrangements to ensure that, should a disaster occur, all those resources and services which may be needed to cope with the effects, can be rapidly mobilized and deployed. Planning, training and exercising are important elements of preparedness.

Response

Actions taken in anticipation, during and immediately after impact to ensure that its effects are minimized and that people are given immediate relief and support. Disaster response requires well-planned and practiced arrangements for rapid assessment, multiagency cooperation and coordination, quick and informed decision-making and deployment of field teams.

Recovery

The coordinated process of supporting disaster-affected communities in reconstructing their physical infrastructure and restoration of emotional, social, economic and physical well-being In the health sector public health and mental health professionals play significant roles in community recovery. (Abrahams J. 2001)

1.8. Emergency preparedness:

Catastrophic disasters inevitably lead to large numbers of dead and injured in the immediate aftermath and this need a quick action with the available resources at the limited time. Emergency preparedness and disaster risk reduction are core responsibilities of the Ministry of health (MoH). These functions are not transient or short-term, but are permanent. Therefore, a corresponding structure (office, unit, or department) must be institutionalized within the MoH of each country.

Emergency preparedness and disaster reduction is a programmatic area requiring coordination with other disciplines and departments within the health sector and with other sectors such as Ministries of Finances, Public Works, Planning, Transportation, Civil Protection, and Foreign Affairs as well as other stakeholders such as the, armed forces, academic institutions, Red Crescents and cross, and not-for-profit organization (NGOs). For the MoH, the first step is to assess the capabilities of each actor that contributes to reducing the health risk and improving public health. Linkage with other actors can be a continuous, formal relationship or a one-off relationship for a specific decision or activity. Linkage is not an end in itself: it should lead to joint projects, exchange of information, and other activities benefiting all of the participating actors. (WHO 2006)

1.9. Emergency management system in Sudan:

The emergency preparedness and humanitarian action system in Sudan is still in development and fragmented with an unclear line of demarcation between its different levels on one side, and between the different sectors in each level on the other side (the system is structurally built on three levels following the federal system of the country: federal, state, and local level). Moreover, the system is largely concentrating on the response phase with none to very little attention given to preparedness and mitigation activities. The newly established unit in the Federal

Ministry of health (FMoH) within the Directorate General of International Health is now looking into the issue of emergency mitigation, preparedness and response in relation to health and is establishing several committees that include related sectors especially at the time of emergency. At the state level, functioning structures at the Ministries of Health is still unclear. At the local level, the structure is weak and unclear too and is only being activated during emergency. (FMoH 2007)

1.10. Supply chain logistics in disaster

Supply chain logistics in emergency situations, the purpose of which is to "deliver the right supplies, in good condition and the quantities requested, in the right places and at the time they are needed". The links in this logistics chain are not necessarily sequential or linear; indeed, they are often carried out in parallel. However, they must not be considered as separate activities but integrally, due to their complex interrelationships. (PAHO 2001)

1.10.1. Medical supplies

Catastrophic disasters inevitably lead to large numbers of dead and injured in the immediate aftermath.

The term "medical supplies" applies to pharmaceuticals and medical, dental, and laboratory products and equipment. In an emergency, pharmaceuticals are a top priority: it is necessary to ensure that they are readily available, but also that they are used rationally. Even in normal times, the health system must optimize the use of resources and make sure they are available to all who need them. When disaster strikes, the same supply procurement and distribution process must remain in place—and it must remain effective in more challenging circumstances, since it must adapt to both the urgency of the situation and the scarcity that often accompanies an emergency.

Pharmaceuticals and other medical supplies must be selected, procured, stored, and distributed in such a way that the right supplies are available at the right time, that their quality and safety can be guaranteed, and that they are used correctly.

1.10.2. Managing drug supply in disaster:

In general managing drug supply aims to ensure that high quality essential drugs are available, affordable and used rationally. Its main concerns with the public and private pharmaceutical market are availability (geographic access), affordability (economic access) and rational use of drugs. Measures to improve availability include training of pharmacy aides and drug sellers, licensing provisions and incentives for wholesalers, pharmacies and drug outlets. Affordability can be improved with greater insurance coverage, better price information, price competition through generics. Finally, rational use of medicines can be promoted by regulation of drug information and marketing. (PAHO 2001)

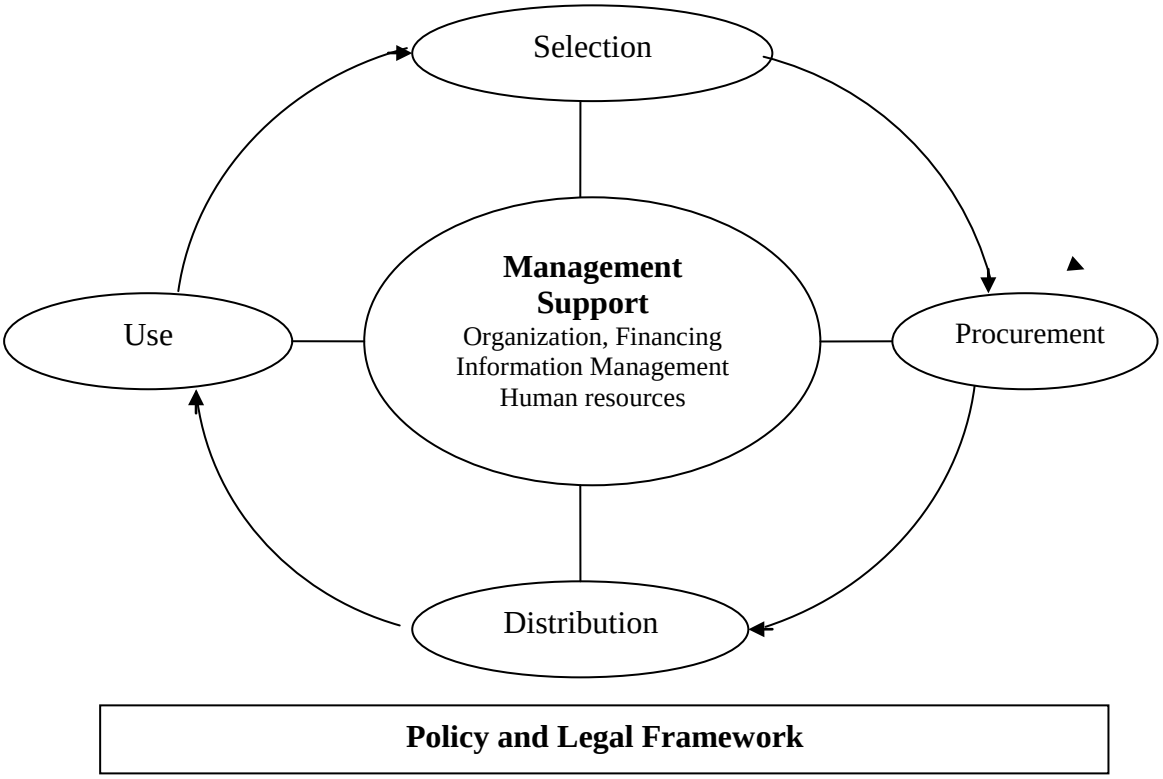
Managing drug supply is concerned with the practical ways in which government policy makers, essential drug program managers, nongovernmental organizations, donors, and others worked to close the huge gap between the need for essential medicines and public access to them between the vast number of people who could benefit from modern pharmaceuticals and much smaller number of people who actually do benefit. It also worked on closing the gap between the availability of medicines and their rational use. (Quick, et al 1997)

In disasters the drug supply system should take into account all the selection, quantification, procurement, distribution and use of medicines, but they must be some sort of flexibility in those functions because of the urgent situation and all the routine and financial problems should be neglected.

1.10.3. The Drug Management Cycle:

Drug management cycle involves four basic functions: selection, procurement, distribution and use (Quick, et al 1997).

Figure (1.2) The Drug Management Cycle



Source (Quick, et al 1997)

Drug management cycle emphasizes connections among four drug management activities: Selection of essential drugs, procurement of selected drugs, distribution of procured drugs and use of distributed drugs. (Quick, et al 1997)

Selection involves reviewing the prevalent health problems, identifying treatment of choice, choosing individual drugs and dosage forms and deciding which drugs will be available at each level of health care. Procurement includes quantifying drug requirements, selecting procurement methods, managing tenders, establishing contracts terms, assuring drug quality and ensuring adherence to contracts terms. Distribution includes clearing customs, stock control, stores management, and delivery to drug depots and health facilities. Use includes diagnosing, prescribing, dispensing and proper consumption by the patient. At the centre of drug management cycle is a core of management support systems: organization, financing and sustainability, information management human resources management. These management support systems hold the drug management cycle together. The entire

cycle rests on policy and legal framework that establishes and supports the public commitment to essential drug supply.

Selection

The objective of the selection process is to develop a list of basic and critical medical supplies to be provided to the affected population in a safe and effective manner. A medical supplies selection committee must be appointed, comprising a multidisciplinary team—doctors, nurses, pharmacists— who know the situation at the local level, including the needs of the affected population. Representatives of the ministry of health must also participate in the group. The selection of medical supplies must take into account the health care needs of the affected population, the characteristics of the patients who require treatment, the availability of supplies, and the capacity of the health system to meet these requirements. It is also essential to establish the degree of competence required to define a group of drugs or a special therapeutic category, so that sound decisions are made. Table (1.3) show suggested basic drugs list for emergency situations

The list of medical supplies must be prepared to deal with the acute phase of the disaster and potential epidemics. To prepare this list, one should take into account the types of risks and the most common pathologies that occur in this kind of situation. World health organization (WHO) has prepared standard lists of essential drugs and medical supplies (known as "emergency kits") for use in emergency situations. The purpose of these kits is to ensure the prompt and effective provision of those supplies needed to satisfy priority needs.

Table (1.3)

Suggested basic drugs for emergency situations

1. Analgesics, antipyretics, non-steroid anti-inflammatory drugs	
Acetylsalicylic acid	Tab 500 mg
Ibuprofen	Tab 200, 400 mg
Paracetamol	Tab 500 mg, bottle 125 mg / 5 ml
Morphine hydrochloride	Injection 10 mg/ml
2. Anti-allergic drugs	
Chlorpheniramine maleate	Tab 4 mg, inj 10 mg/ml
Dexamethasone phosphate	Inj 4 mg/ml
3. Anti-infectives	
3.1 Anthelmintic and antiparasitic drugs	
Albendazole	Tab 400 mg
Mebendazole	Tab 100 mg
Metronidazole	Tab 500 mg, inj 500 mg, suspension 200 mg/5 ml
3.2 Antibacterial drugs	
Amoxicillin	Tab or capsule 500 mg, suspension powder 125 mg/5 ml
Penicillin sodium	Inj powder of 1 million UI, 5 million UI
Procaine penicillin	Inj powder 1 million UI
Cloxacillin sodium	Cap 500 mg, suspension powder 125 mg/5 ml, inj powder 500 mg
Chloramphenicol	Inj powder 1 g
Trimethoprim-sulfamethoxazole	Tab 80 mg + 400 mg, suspension 40 mg / 200 mg
3.3 Antifungals	
Ketoconazole	Tab 200 mg, oral suspension 100 mg / 5 ml
Benzoic acid + salicylic acid	Tube 6% + 3
3.4 Antiseptics	
Chlorhexidine	Solution 5%
Polyvidone iodine	Solution 10%
4. Respiratory tract, drugs acting on	
Salbutamol	Tab 4 mg, bottle 2 mg/ml
Theophylline	Tab 200 mg
5. Oral Rehydration Salts	

Source (PAHO 2001)

Programming Acquisitions or procurement

In the normal situation the acquisition of medicine is called procurement but in the disaster as it is called programming acquisition in the system management of

NGOs considering the same is aim at having the necessary health supplies in the quantities required to care for the affected population at the right time, while guaranteeing the quality of the supplies. In order to plan ahead and forecast the needs of the affected population, a close relationship must exist between the people in charge of supply management and the health workers in the field, by means of adequate exchange of information. The quality of the supplies must be the chief criterion, independently of the providers, so it is vital to determine what supplies will be needed.

Estimating Needs

In order to anticipate the need for supplies, one must Identify and clearly define what sources of supplies are available, since it is not wise to depend exclusively on foreign assistance and carry out an epidemiological assessment to estimate the quantity of supplies needed, bearing in mind not only situations during the acute phase of the disaster but also the potential epidemics that may occur after that phase, also must identify the affected population, including if possible its demographic composition, grouped mainly by age also establish the frequency of each type of illness and compare the uniform treatment standards for each of the morbidity patterns with the national list, if one exists. Should one not exist, health professionals must be consulted about the supplies needed to deal with each ailment.

Types of Providers

Once the quantity of supplies needed has been estimated, it is necessary to identify and define the various sources of the supplies, including the following:

- Local or national purchases: Have an inventory of local providers and the quantities of the required drugs that they have available for immediate delivery,
- International purchases: International providers can facilitate these purchases, particularly NGOs such as United Nation Children's Fund (UNICEF) or Pan-American Health Organization (PAHO),
- Donations: Considering that this is one of the main sources of emergency supplies, and hence of medical supplies, this issue will be explored at length below.

Donations

The drugs and other health supplies donated by foreign organizations or countries and local donors can be tailored to the specific needs of the affected population, or they can be the result of spontaneous solidarity.

Regrettably, the latter case is the most frequent, which often creates more problems than solutions, including the following:

- Spontaneously donated supplies may not meet the needs of the affected population. Drugs, in particular, may not be therapeutically useful for the types of morbidity prevalent in the emergency zone, or else may not match the level of care of the institution receiving them;
- In most cases, donated drugs may not be correctly classified. The labels may not meet the necessary specifications for identification, such as the international generic name for the drug, they may carry commercial names unknown in the recipient country, lack expiry dates, or be labeled in a language that is not understood locally;
- Sometimes donated quantities may surpass current needs, putting a strain on storage efforts;
- Quite often, the drugs received have already expired or suffered some form of decay that makes their consumption dangerous.

Storage Systems

The purpose of storage is to ensure that health supplies retain their quality and effectiveness by creating the necessary physical, hygienic and infrastructural conditions. Adequate storage conditions guarantee: The quality of the drugs until they are used, their therapeutic effectiveness and the prevention of accelerated aging or decay. The warehouse or other storage site must be well-ventilated and easily accessible.

Distribution

In disaster situations, distribution is one of the key steps in the management of health supplies. Its purpose is to ensure that medical supplies are quickly made available to the people who need them, preserving the quality of the supplies and preventing waste and the inappropriate use of resources. For distribution to be carried out effectively, the various organizations receiving supplies must coordinate their efforts, particularly with government agencies responsible for health care, such as the ministry of health. This calls for the development of an information system that records the number of people affected, the health problems that require care, current stocks in each of the warehouses or storage facilities, and the deliveries that have been made or are expected in the near future. Supplies must be distributed based on the demand for them and on the existing stock. To ensure effective distribution A reliable transport system must be in place. Transport is the means whereby supplies reach the

places where they are needed. The vehicles of the public health system or agencies such as the Red Cross can be used. Sometimes it may be possible to negotiate with supplier's delivery of the products directly to health care units or other sites where they are required. (PAHO 2001)

1.11. Drug supply in Sudan:

The major actors in the pharmaceutical supply system in Sudan can be categories in tow main groups:

1- The public sectors:

a) The central medical supplies public corporation (CMSPC) it is the largest supply organization and is the international center for selection, procurement, storage and distribution of medicines and medical supplies to the public and private sector.

b) The revolving Drug Fund (RDF), which work in Khartoum state.

2- The private sector which include for profit business organization (importers and local manufacturers) and (NGOs). (GDoP 2005)

1.12. The focus of the dissertation:

As we discussed earlier the disaster situation is catastrophic situation which lead to large numbers of dead and injured in the immediate aftermath so Pharmaceuticals are a top priority as their important to save lives.

In disasters situation the resources are limited and also the time and quick action is needed to save the people lives, so they must a complete plan for disaster management in health institutions to phase this situation, so the focus of the dissertation will be in the area of the pharmaceutical supply system after disaster in the major drugs suppliers and the hospitals pharmacies. I hypothesize that there may be some problems in the system and this exploratory limited effort will try to make a quick assessment and formulate some recommended solutions for any of the problem proved to be existent.

1.13. Aims and Objectives of the research:

1.13.1. Aim:

To study the disaster pharmaceutical supply system and to assess the preparedness of hospitals and central medicines stores in Khartoum state during the period Jan-august 2007.

1.13.2. Specific Objectives

- To identify if there is a plan or a system for pharmaceutical supply system for disaster management.
- To estimate the degree of preparedness for emergency and disaster risk reduction.
- To determine the obstacles facing the continuous supply of pharmaceutical during and after disaster.
- To reveal potential solutions and make recommendations on drug supply management after major disasters.

Chapter Two - Research Methodology:

This chapter includes presentation of research methodology and explains the data collection procedure and sources, sample size and the methods of analysis to be followed in this study.

2.1. Research Methodology:

2.1.1. Data collection:

The study was conducted in Khartoum state the federal capital of Sudan. The research has been designed in a form of a limited assessment which relied primary on:

A. Primary data:

Interviewing by Standardized, self administered Questionnaire for the three main teaching Hospitals (Khartoum, Omdurman and Khartoum north) in Khartoum state with the senior pharmacist. And three regional hospitals in Khartoum state (Elnau, Ibrahim Malik, and Elban Gadid) in addition to the central medical supplies public corporation which is the main supplier for public sector, and Khartoum state hospitals manager in the MoH in Khartoum state who is responsible for drug supply to Khartoum state hospitals.

Since the general objective of this research is to study the pharmaceutical supply system after disaster, And to assess the preparedness of health institutions during and after disaster, the questionnaire was prepared in order to obtain detailed information about drug supply systems in the health institution (Appendix 1), and mainly focused in these areas:

- Selection
- Quantification
- Procurement
- Transportation
- Training
- Emergency plan and drugs stocks
- Drug supplies problems

The data used for the purpose of the study was obtained through field survey conduct in July 2007.

B. Secondary data:

The secondary data were from Literature and document review from books, reports, references and internet, And also from interviewing with responsible person in the emergency and humanitarian action department - federal ministry of health**.**

2.1.2. Sample size:

The samples chosen were indicative rather than fully representative.

The three main teaching hospitals have been chosen in Khartoum state which contains the three largest cities in Sudan. The population Khartoum State is 7 million (country profile, 2007) and represents 20% of the total population thus greater opportunity to cover large number of people. Khartoum state was chosen as it is the most developed state in Sudan and it is the capital of the country. It has three main cities (Omdurman, Khartoum North and Khartoum). With the most updated technologies applied in Khartoum, it is attractive for the public and most of the peoples from other states prefer to live in it, which makes a lot of city extensions. The small size of sample is because of the limited time.

2.1.3. Data analysis:

Data gathered from the self administered Questionnaire were subjected to descriptive statistics and frequencies analysis and it has been analyzed manually using computer software programme which is SPSS (Statistical package for social studies) version 10.

2.1.4. Ethical Consideration:

Interviewers have been clearly informed about the academic purpose, consequences and anticipated disclosure of data. The data will be fairly processed and used only for the purpose of this study and will not cause any substantial damage or distress. The information and data obtained from the questionnaire will be used to help assess the preparedness and capacity of hospitals and any pharmaceutical supply system to respond to any type of disaster.

Chapter Three - Research results:

This study has been done in Khartoum state the federal capital of Sudan, to assess the pharmaceuticals supply system after major disaster.

The study depend on primary data and represent by self administer questionnaire which designed to get the essential information about pharmaceutical supply system and hence for the research. The sample chosen was 8 health institutions, the three largest federal hospitals (Omdurman , Khartoum and Khartoum north), and three regional hospitals one hospital from each state (Ibrahim Malik, Elban Gadeed and Elnaw), and the main drugs supplier for all Sudan states (central medical stores public corporation) and lastly the Khartoum state MoH hospitals manager who is responsible for drugs supply to Khartoum state hospitals.

The data collected was analyzed using software program SPSS and subjected to descriptive analysis, the results were found as follows:

Table (3.1) : Institution Type

	Frequency	Percent
hospital	6	75.0
supplier	2	25.0
Total	8	100.0

Figure (3.1) : Institution type

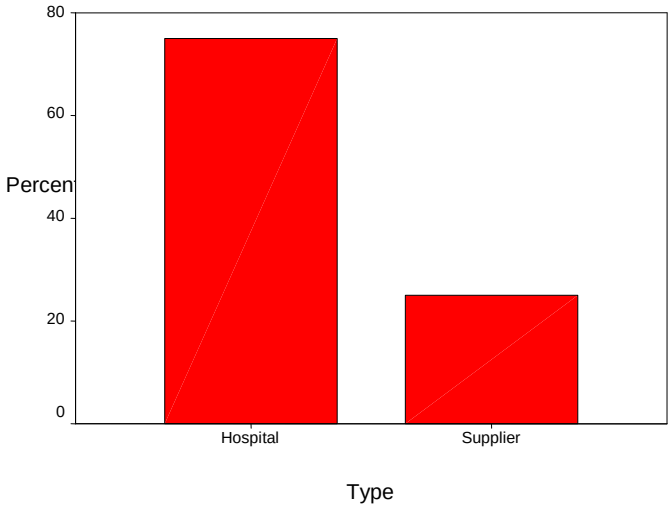


Table (3.2) : Institution status

	Frequency	Percent
fedral	4	50.0
state	4	50.0
Total	8	100.0

Figure (3.2) : Institution status

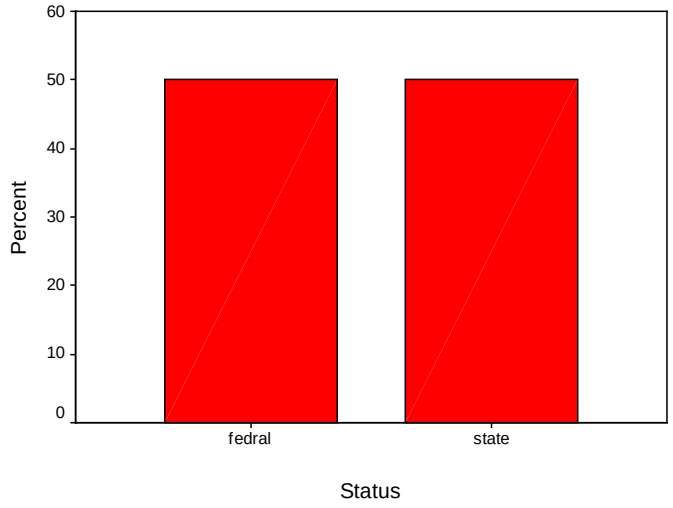


Table (3.3): Response towards drug supply during and after disaster.

	Frequency	Percent
following a plan or policy	3	37.5
personal response	5	62.5
Total	8	100.0

Figure (3.3): Response after disaster.

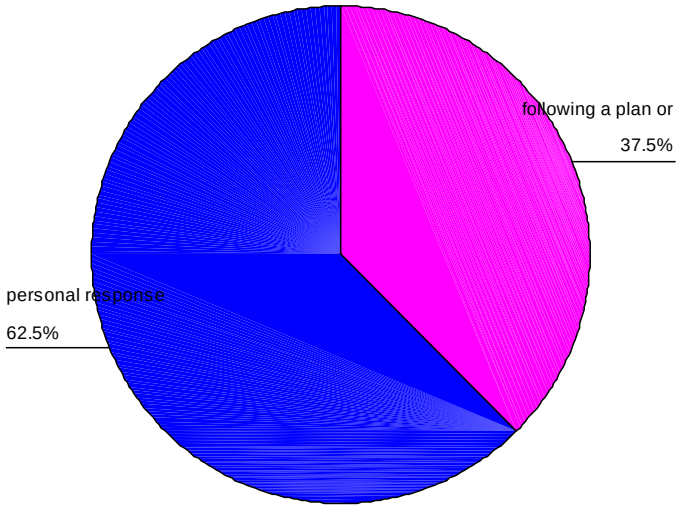


Table (3.4): List of on call persons and their phones

	Frequency	Percent
yes	5	62.5
no	3	37.5
Total	8	100.0

Figure (3.4): List of on call persons

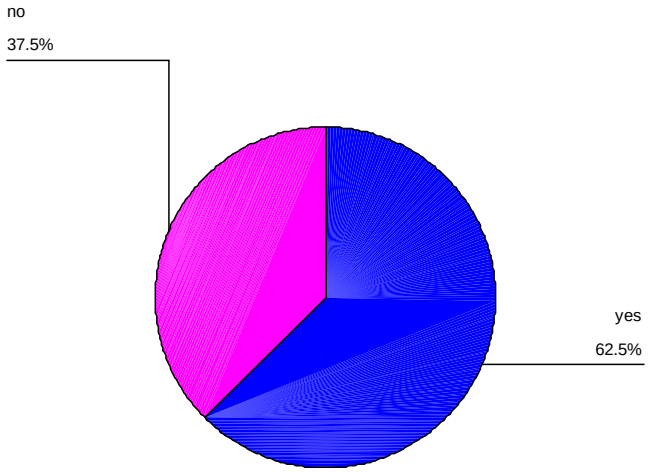


table (3.5): on call persons know what to do and where in case of major disaster.

	Frequency	Percent
yes	5	62.5
no	3	37.5
Total	8	100.0

Figure (3.5): Persons know their rolls in disaster.

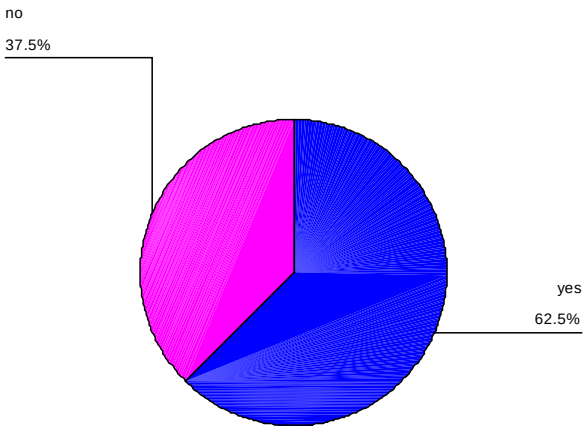


Table (3.6): Applicablility of their response.

	Frequency	Percent
yes	6	75.0
no	2	25.0
Total	8	100.0

Figure (3.6): Applicablility of their response.

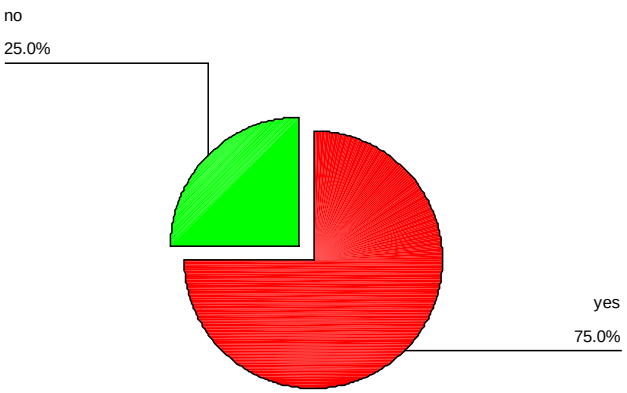


Table (3.7): Sufficiency of their response for managing major disaster.

	Frequency	Percent
yes	1	12.5
no	7	87.5
Total	8	100.0

Figuer (3.7): Sufficiency of their response.

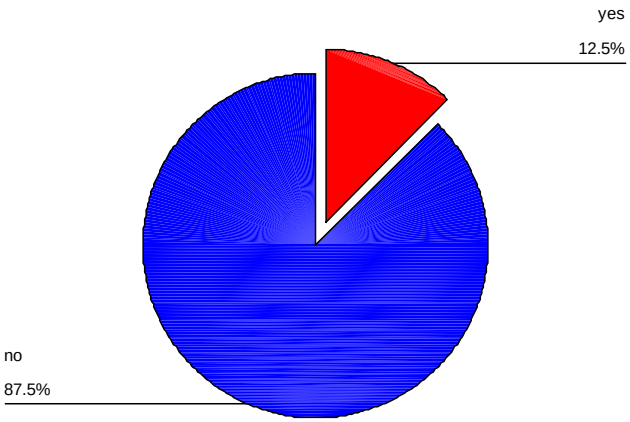


Table (3.8): Separate medicine stocks for disaster only replaced when it was due to be expired.

	Frequency	Percent
yes	1	12.5
no	7	87.5
Total	8	100.0

Figure (3.8): Separate medicine stock for disaster

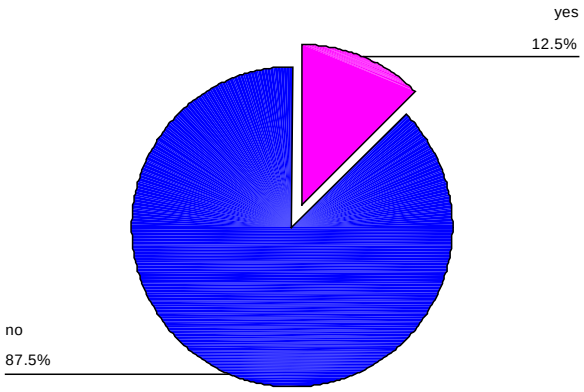


Table (3.9): Classification of drug list according to disaster (floods, fire, epidemics, ...etc)

	Frequency	Percent
no	8	100.0

Figure (3.9): Classification of drug lists

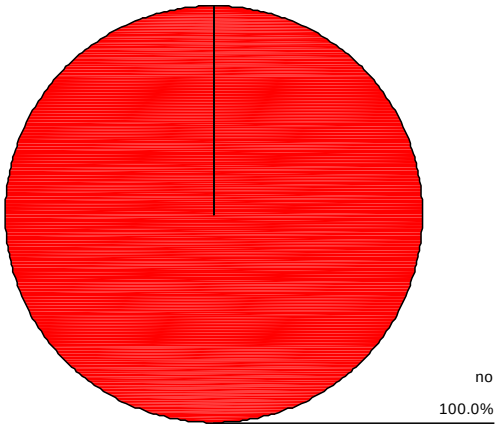


Table (3.10): Time for drugs to be out of stocks in case of disaster.

	Frequency	Percent
24 hour	2	25.0
1 week	2	25.0
other	4	50.0
Total	8	100.0

Figure (3.10): Time for drugs to be out of stocks

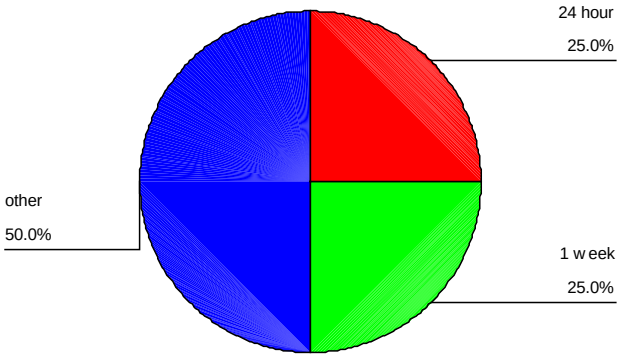


table (3.11): supplier which contact for extra emergency and disaster medicines supplies in case of drugs shortages.

	Frequency	Percent
central medical stores	2	25.0
others	6	75.0
Total	8	100.0

Figure (3.11): Supplier for disaster medicines supply

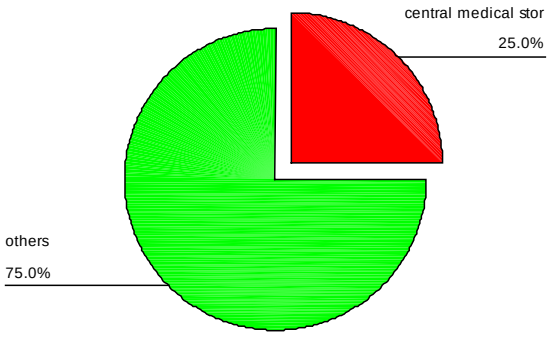


Table (3.12): Supplier takes immediate response.

	Frequency	Percent
yes	7	87.5
no	1	12.5
Total	8	100.0

Figure (3.12): Immediate response of drug supplier.

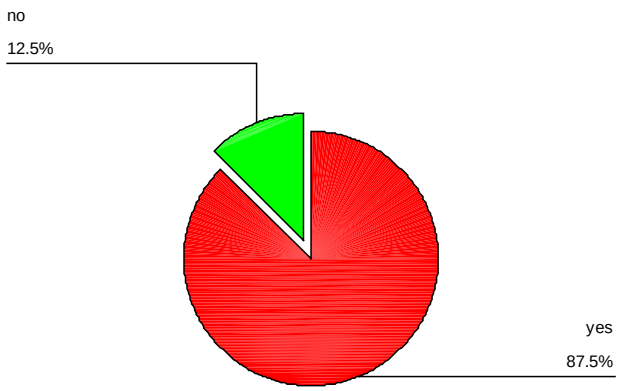


table (3.13): drugs source(s) meets all your needs

	Frequency	Percent
yes	4	50.0
no	4	50.0
Total	8	100.0

Figure (3.13): Drugs source(s) meets all your needs

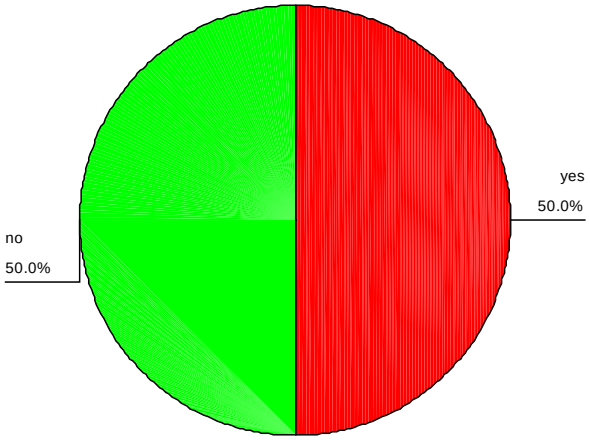


table (3.14): time taken to fill the gap in stocks.

	Frequency	Percent
2 hour	3	37.5
1 day	1	12.5
other	4	50.0
Total	8	100.0

Figure (3.13): Time taken fto fill the gap in stocks.

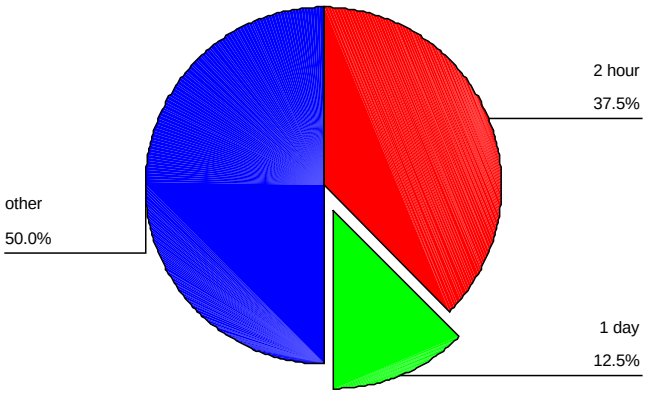


table (3.15): transportation methods available for quick drug supply.

	Frequency	Percent
normal truck	5	62.5
rented normal truck	3	37.5
Total	8	100.0

Figure (3.14): Transportation methods for drug supply.

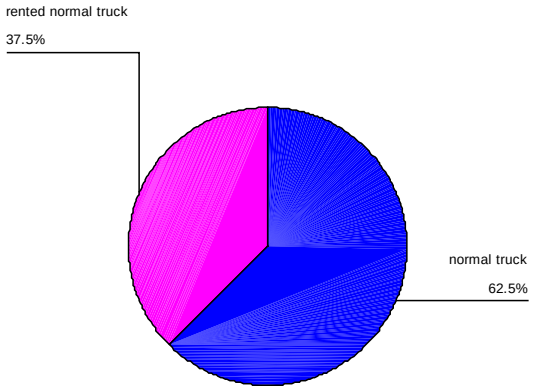


table (3.16): quantification method use in case of disaster.

	Frequency	Percent
consumption method	7	87.5
morbidity method	1	12.5
Total	8	100.0

Figure (3.16): Quantification method used.

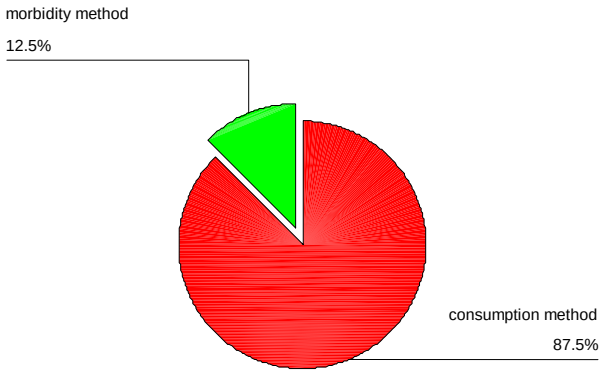


table (3.17): type of problems in the drug supply in disaster.

	Frequency	Percent
availability of stores	1	12.5
transportation	1	12.5
availability of stores+financial source	4	50.0
availability of stores+transportation	2	25.0
Total	8	100.0

Figure (3.17): type of problems in the drug supply in disaster.

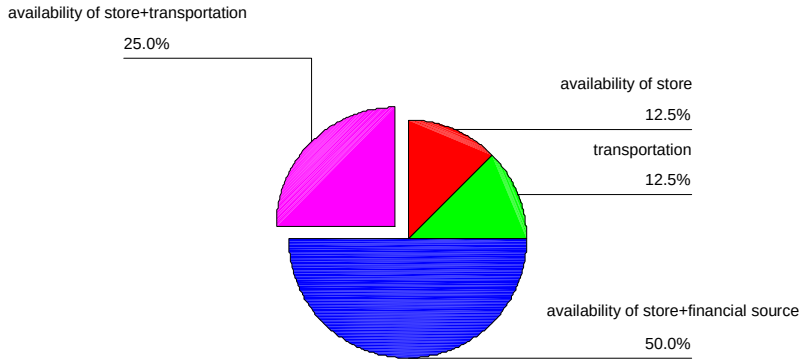
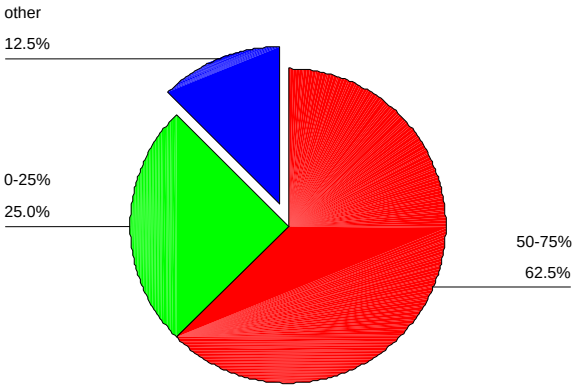


table (3.18): percent of the pharmaceutically trained persons for disaster management from the staff.

	Frequency	Percent
50-75%	5	62.5
0-25%	2	25.0
other	1	12.5
Total	8	100.0

Figure (3.18): pharmaceutically trained persons for disaster management



Chapter Four - Discussion, Conclusion and Recommendation

4.1 Discussion:

Most of disasters which happen in Sudan in the last 37 year were drought, floods and epidemics. (Table 1.2), in this chapter the results which have been represented in the previous chapter will be discussed to see the health institutions pharmaceutical supply system after disaster, and the preparedness of each to face a disaster.

4.1.1 Response of health institutions towards pharmaceuticals supplies in case of major disaster:

The research results shows that only 37.5 % have a plan or policy, while 62.5% have no plans only their personal response(figure 3.3), but 62.5% have lists of on call persons in emergency(figure 3.4) and they all know what to do and where (figure 3.5). 75% of the samples say that their response, whether it is according to stated plan or personal response, is applicable at any time (figure 3.6). Only 12.5% of the sample show that their response is sufficient for managing a disaster and 87.5% say that their response whether is a plan or personal, is not enough for pharmaceuticals supplies management in major disasters (figure3.7). In Australia where many disasters of different types attack the Australian community in the past 30 years they have a powerful system for disaster management which is called Australia's Emergency management system which performs a wide range of functions and the medical emergencies are vital member of this system. (Ibrahams. J. 2001)

After Hurricane Katrina in united state of America, pharmacists learn to review disaster planning and emergency management strategies. Disaster planning takes place on federal, state, and local levels. The United States approaches emergency management through the National Response Plan, which uses a comprehensive model to address mitigation, preparedness, response, and recovery activities. (David S. 2005)

4.1.2 Pharmaceuticals stock for disasters:

Only 12.5% of the sample have a separate pharmaceuticals stocks for disasters and emergencies and only replaced to avoid expiration, while the majority of the sample (87.5%) has not, (Table 3.8) some of the health institution (e.g Khartoum hospital) keep stock of some items like I.V fluids, gypsona and gloves.

The research result shows that all the selected sample (100%) their drugs list is not classified according to the nature and type of disaster or emergency whether it is floods, epidemics, fire, earthquake ……. Etc, and all of them have only one emergency drugs list. (appendix 2) for the hospitals which have their drugs supplies from state ministry of health the epidemic department of the state have epidemic drugs lists for some epidemic disease like malaria and watery diarrhea, which they send to state hospitals.

From the research result we can find that 25% of the selected health institutions will be out of drug stocks in major disaster after 24 hours only (table 3.8), other 25% say that their drugs stock will be enough up to 1 week, while the rest (50%) select the answer other and their answers are that: some say the drug stock will be enough for 10days while others say that they will not have any drug shortages, the rest say that it depend on the time of the disaster if it is at the beginning of the month they will be no problems otherwise there may be some drugs shortages.

For the catastrophic situation in disaster where quick action must be taken in a limited time they must be a separate pharmaceutical stocks, and differentiate a pharmaceutical list for disasters as The Australian medical coordination group which complied a pharmaceutical and medical lists for disasters which details the drugs and medical supplies for 500 persons for 3 days in disaster-affected population of 50000. (Ibrahams. J. 2001) and this was known as emergency kits and this system was followed by WHO, Red/cross crescent and other NGOs.

4.1.3 The drugs suppliers and their behavior:

Only 25% of the selected sample contact the central medical store to get extra drugs quantities in case of drugs shortages in major disaster (figure 3.11) while the rest of the sample select the answer other and their answers are that the contact local company, international dispensary association (IDA), Mission Pharma, awarded companies and NGOs these for the federal and Khartoum state drugs supplies centers, for hospitals some contact the public pharmacies in and out their hospital, some contact the private pharmacies near their hospitals, some contact the medical officer of the hospital for money to buy the drugs they need, other contact the RDF Khartoum state and some contact department of medical treatment in the ministry of health.

87.5% of the sample says that the suppliers they contact to get extra drugs quantity for emergency, usually take immediate response (table 3.12). 50% show that these sources meet all their pharmaceuticals need (figure 3.13).

4.1.4 Time needed to fill the gap in drug stocks and the transportation method use for drug supply in major disaster:

From the research result we can see that 37.5% from the sample need 2 hours to fill the gap in drug stock, 12.5% need 1 day and 50% select the choice - other - (table3.14) and these others are: some answer are less than 2 hours others need more than 2 hours (3 to 4 hours) while one answered by that it depends on whether the drugs supplier is local or foreigner. For the transportation methods for quick drug supply in disaster 62% of the samples use their hospital normal trucks 37% use rented normal trucks (figure 3.15) and no any of the selected sample have any emergency vehicle for drug supply where in disaster quick supply is needed and the roads may not be empty and may not be safe.

4.1.5 Quantification method use for drug needs assessment in disaster:

87.5% of the sample use the consumption methods for drug quantification and only 12.5% use the morbidity methods (figure 3.16) and most of the refer to that they but in mind the season and the last epidemic cases like malaria and watery diarrhea, so they the increase the quantities of some items in procurement process and this may help them in managing epidemic disasters.

4.1.6 Problems of drug supply in major disaster:

The main problems in drug supply which faces 50% of the represented sample is the availability of large stores and availability of the financial resources, 25% add the transportation to the availability of stores, while 12.5% have only stores problems and 12.5% they problem is only the quick transportation method (figure 3.17).

In addition to all that some of the senior pharmacist of the represented sample add many other problems some of them are the bad response from the suppliers, transaction and routine, the working staff is not enough for quick services, some items of drugs may not be found in the central stores, and difficulties to reach some areas.

4.1.7 Pharmaceutically trained personnel for disaster management

For the training of the personnel (figure 3.18) whether are pharmacists, stock keepers, assistant pharmacists, accounting personnel or workers the majority of the samples (62.5%) have 50-75% of the staff are pharmaceutically trained for disaster management, 25% have 0-25% trained persons and 12.5% say there no any one of the staff have training in disaster management even the senior and the head pharmacist of the casualty pharmacy.

They have to be continuous training courses in emergency and disaster management for all the hospitals and health institution working staff. A national disaster medicine course is conducted annually at Australian emergency management institute the commonwealth has also sponsored the development of an external disaster which design to be run at state level. (Ibrahams. J. 2001)

4.2 Conclusions and recommendations:

4.2.1 Summary:

Disasters occur frequently around the world, and their incidence and intensity seem to be increasing in recent years. They can cause an unexpected number of deaths, injuries or illnesses in the affected community, thereby exceeding the therapeutic capacity of the local health-care services. Supply chain logistics in disaster and emergency situations is very important, the purpose of which is to "deliver the right supplies, in good condition and the quantities requested, in the right places and at the time they are needed". In this situation the pharmaceuticals are a top priority, it is necessary to ensure that they are readily available, but also that they are used rationally.

This study has been done in Khartoum state the federal capital of Sudan, the main objective of this study were to assess the pharmaceutical supply system after disaster in Sudan in Khartoum state as representative, in addition the study shed some light on disaster definitions and types and also the disaster history in Sudan.

To achieve the objective of this study a questionnaire type of survey was conducted in some Khartoum state health institutions and it designed to get the essential information about pharmaceutical supply system in disaster. The sample chosen was 8 health institutions, the three largest federal hospitals (Omdurman, Khartoum and Khartoum north), and three regional hospitals one hospital from each state (Ibrahim Malik, Elban Gadeed and Elnaw), and the main drugs supplier for all

Sudan states CMSPC (Central Medical Stores Public Corporation) and lastly the Khartoum state MoH hospitals manager who is responsible for drugs supply to Khartoum state hospitals.

The data collected was analyzed using software program SPSS and subjected to descriptive analysis.

4.2.2 Conclusion:

Based on the findings of this study the most important conclusions that could be drawn were as follows:

1. The majority of health institutions in Khartoum state have no emergency system or clear written plans for disaster management; they depend on their personal response at the time of emergency or disaster. In spite of that the responsible persons in these institutions are trusted that their response can applied at any time and can, to some extent, manage any type of disaster as their past experience. But they also see that their response is not enough to manage major disasters and there is a need for a clear system or plan with sufficient resources.
2. There are no drug lists classified according to the type of disaster or emergency whether it is floods, epidemics, fire, earthquake ……. Etc, and there is no separate emergency drug stocks in the 87.5% of the health institution only the working stock. In most of the Khartoum hospitals emergency department the ability to maintain disasters is depend whether it beginning or at the end of the month and this is from financial point of view.
3. Each health institution has its own methods to get their extra emergency drug stocks from different sources and it's different in each case i.e. no clear system for pharmaceuticals supplies was followed.
4. There was no any method of transportation suitable for disasters situations all the health institution including CMSPC use their normal trucks and some of them use rented normal trucks.
5. The main problems in drug supply which faces the majority of the health institution were as followed: the availability of large stores, the financial resources, the quick transportation method, bad response of the suppliers, transaction and routine, the working staff is not enough for quick services and some items of drugs may not be found in the central stores.

4.2.3 Recommendations:

The suggested recommendations which can help in the improvement of the pharmaceutical supply system in disasters were as followed:

1. Actively promote the establishment or strengthening of an emergency preparedness /disaster risk reduction department, unit, or office in each health institution in the country ,it have to be responsible for preparedness for all types of hazards: natural, technological, *or* complex emergencies (multi-hazard) also be interdisciplinary to facilitate the bridging between the different technical programs in the MoH that have a role in disaster preparedness and have a direct access to the decision-making level and have permanent personnel and resources dedicated to disaster risk reduction and preparedness.
2. Promote a clear written plans and procedures with distinct roles and responsibilities to reduce the disaster risk on public health.
3. Strengthen national human resources and promote public education, awareness, and participation. And develop joint ventures with academic institutions/organization for personnel training.
4. Strengthen collection, analysis, and dissemination of health-related information and build strong health and drug information systems.
5. Possibly pre-position supplies and equipment for disasters and emergencies and make them in a separate stores from that of the working stocks. And make a selected drug list for the different type of disaster for ease and quickness of procurement and distribution.
6. Prepare special vehicles for drugs transportation in disasters situations especially in the main drugs stores.
7. Encourage the MoH to foster cooperative ventures with the CMSPC, the health sector, and with other sectors. Special attention should be given by the MoH to collaborative arrangements with the Civil Protection (or other similar institutions responsible for overall safety of the population through multi-sectorial preparedness and response), relevant Ministries, and other related agencies. This is relevant particularly for those agencies that are likely to provide international assistance for improving the levels of preparedness of the country for all types of hazards for which the country is at risk.
8. Official recording and documentation of any past data and information which were very important for any research, plan and strategy. And one of the main

limitations of this study was that there were no any data for the previous disaster and how the heath institutions deal with them, or the data was available but not published.

References

1. Eric K. 2003, The Use of Epidemiologic Methods in Disasters. M.P.H Office of the US Surgeon General US Public Health Service August, 2003. [online]. Available at: http://www.pitt.edu/~super1/ [Accessed July 2007]

2- Country profile, (2007), Foreign and Commonwealth Office. Countries and regions. Sudan Country profile 2007. [online]. Available at: http://www.fco.gov.uk/servlet/Front?pagename=OpenMarket/Xcelerate/ShowPage&c=Page&cid=1007029394356 [Accessed July 2007]

3- David S. 2005, What Can Pharmacists Learn from Hurricane Katrina? *U.S. Pharmacist Journal* Vol. no.30:10, 10/19/2005 [online].
Available at: http://www.uspharmacist.com/ [Accessed July 2007]

4- Eltaib E., and Elmasaad H. 2002, *Early Preparedness for Health Emergency* 2nd ed. Khartoum. D.C.: Marafi El Ibdaa November 2002.

5- FMoH (2006), Sudan's National Policy for Emergency management in the Health sector. Sudan federal ministry of health, directorate of emergency and humanitarian action. November 2006.
[online]. Available at: http://en.wikipedia.org/wiki/Disaster [Accessed July 2007]

6- FMoH (2007), *5-year Health Sector Strategy*: Investing in Health and Achieving the MDGs (Millennium Development Goals) 2007-2011. Sudan federal ministry of health 2 5 Feb. 2007. [online]. Available at:
http://www.fmoh.gov.sd/nhpcbw/Health%20Five%20year%20strategy.pdf
[Accessed July 2007]

7- GDoP (2005), Annual Statistical Report. General Directorate of Pharmacy, Federal Ministry of Health, Khartoum Sudan.

8- Ibrahams. J. 2001, *disaster management in Australia*: The national emergency management system. Emergency medicine 2001. 13,165-173. [online]. Available at: http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&uid=11482853&cmd=showdetailview&indexed=google [Accessed July 2007]

9- PAHO 2001, Pan American Health Organization: *Humanitarian supply management in logistics in the health sector*. Washington, D.C.: PAHO 2001.

10- Quick, J.D., et al, 1997. *Managing Drug Supply*: *The Selection, Procurement, Distribution and Use of Pharmaceuticals* 2nd ed. West Hardford. CT: Kumarian Press.

11- WHO 2005, World Health Organization Consolidated Appeal 2005, *Saving Lives and Reducing Suffering*. Based on the UN Work Plan 2005 Sudan:. [online]. Available at: http://www.who.int/hac/crises/sdn/appeal/2005/sudan_appeal_032005.pdf [Accessed July 2007]

12- WHO 2006. Emergency Preparedness for the Health Sector and Communities, *Report of World Health Organization Expert Consultation* 19 April 2006.[online]. Available at: http://www.who.int/hac/events/WHOExpertsMtg041906.pdf [Accessed July 2007]

13- Wikipedia 2007,: Disaster management. *The free encyclopedia*. [online] Available at: http://en.wikipedia.org/wiki/Disaster_management [Accessed July 2007]

Appendices

Appendix (1)
Questionnaire questions

Ministry of health, hospitals and Healthcare facilities play a vital role in response and risk reduction of any type of disaster and emergency, including floods, epidemics, war, earthquake… etc. Also pharmaceuticals play a critical role in delivering effective and efficient healthcare for patients. The information and data obtained from this questionnaire will be used to help assess the preparedness and capacity of your pharmaceutical supply system to respond to any type of disaster.

Name of health institution . . . . . .

Address. . . . . .

Position of person(s) completing the form. . . . . .

1. What is your response towards drug supply during and after disaster?
    - Following a plan or policy
    - Personal response (explain)
    - Other (specify)

2. Do you have a list of on call persons and they e. g. phone no.?
    - Yes
    - No

3. Do any one of them know what to do and where in case of major disaster?
    - Yes
    - No

4. Is this response applicable at any time?
    - Yes
    - No
    - I don't know

5. Is it enough for managing major disaster?
    - Yes
    - No
    - I don't know

6. Do you have a separate medicine stocks for disaster only replaced when it was due to be expired?
    - Yes
    - No

7. Is your selected drug lists classified according to the nature of disaster (floods, fire, earthquake, epidemics, ware …etc)

- Yes
- No

8. In case of disaster how long do you think your medicines quantities in the stock enough for

- 24 hour
- 48 hour
- 72 hour
- 1 week
- Other (specify)

9. Who do you contact to get extra emergency and disaster medicines supplies in case of drugs shortages

- Central medical stores
- Emergency department in MoH
- Others (specify)

10. Do they take immediate response?

- Yes
- No

11. Dose this source(s) meets all your needs

- Yes
- No

12. How long dose it take to fill the gap in stocks

- 2 hour
- 1day
- 2 day
- Other (specify)

13. What are the transportation method(s) available for quick drug supply?

- Special cars for emergency
- Normal truck
- Other (specify)

14. What the quantification method you use in case of disaster

- Consumption method
- Morbidity method
- Other (specify)

15. What is the type of problems in the drug supply in case of disaster (you can select more than one answer)

- Availability of stores
- Financial source
- Transportation
- Other (specify)

16. What is the percent of the pharmaceutically trained persons for disaster management from the staff?

- 75 – 100%
- 50 – 75%
- 25 – 50%
- 0 – 25%
- Other (specify)

17. What areas relative to drug supply during disaster do you want to improve? Give your opinion.

. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .
. . . .

Appendix (2)
List of emergency drugs

No.:	Name
1	Absorbent gauze 90cm x90m
2	Adhesive plaster 5cm x 5cm
3	Adrenaline HCL 1mg inj
4	Aminophylline 250mg/ 10ml inj
5	Anti scorpion lyophilized venom 1ml inj
6	Anti snake polyvalent lyophilized venom single dose/ vial
7	Anti tetanus immunoglobulin 250 I.U
8	Atropine sulphate 1mg/ ml
9	Benzyl penicillin 1 million I.U inj
10	Blood bags
11	Blood transfution set
12	Canulas
13	Catheters
14	Chlopheniramine maleate 10mg/ ml inj
15	Chloramphenicol 500 mg Oily inj
16	Chloramphenicol sodium succinate 1gm powder for inj
17	Cotton Absorbent 500g
18	Developer powderr
19	Diazepam 10mg/ 2ml inj
20	Digoxin 0.5 mg/ 1ml inj
21	Diphtheria antitoxin 10000 I.U/ 10ml vial
22	Disposable syring
23	Ergometrine hydrogen maleate 0.5 mg/ 1ml inj
24	Fixer powder
25	Furosemide 20mg/ 2ml inj
26	Gemsa stain
27	Gentamycin sulphate 80mg inj
28	Glves
29	Glyceryl trinitrate 25mg/ 5ml inj
30	Glyceryltrinitrate 500mcg tablets
31	Halothane 250ml/ bottle
32	Heparin sodium 5000 I.U/ 1ml (5ml) inj
33	Hydralazine 20mg inj
34	Hydrochloric acid
35	Hydrocortisone sodium succinate 100 mg powder for inj

No.:	Name
36	Hyoscine N-butyl bromide 20mg/ 1ml inj
37	I.V Fluids
38	Insulin mixed human 100 I.U/ 1ml in 10ml/ vial
39	Insulin soluble human 100 I.U/ ml in 10ml vial
40	Insulin Zinc 100 I.U/ 1ml in 10ml/ vial
41	Lidocaine Hcl 1% 5ml
42	Lidocaine Hcl 2% + adrenaline 50ml
43	Lidocaine Hcl 2% + adrenaline Dental
44	Lidocaine Hcl 2% 10ml
45	Lidocaine Hcl 2% 50ml
46	Lidocaine Hcl 5% spinal + Dextrose (Heavy)
47	Lidocaine Hcl 5% spinal inj
48	Morphine sulphate 15mg/ 1ml inj
49	N.G Tubes
50	Neostigmine 0.5 mg inj
51	Neostigmine 2.5 mg inj
52	Oxygen
53	Oxytocin 10 I.U/ 1ml inj
54	Pethidine HCL 50mg/ 1ml inj
55	Plaster of paris
56	Promethazine 50mg/ 2ml inj
57	Quinine sulphate 600mg/ 2ml inj
58	Sera
59	Suxamethonium HCL 100mg/ 2ml inj
60	Tetanus antitoxin 1500 I.U
61	Thiopental Sodium 500mg powder for inj
62	Urin bags
63	Vitamine K 10mg inj
64	X ray films
65	الخيوط الجراحية
66	المطهرات
67	بودرة أستون
68	زيت الميكروسكوب
69	سبيرتو
70	شرائح زجاجية
71	شرائط رسم القلب
72	غطاء الشرائح الزجاجية

No.:	Name
73	محلول بندكس
74	مواد فحص البولينا
75	مواد فحص السكري في الدم