

CHAPTER 1

1. Introduction and literature review:

1.1 Importance of Pharmaceuticals:

Health is a fundamental human right. Access to health care, including essential medicines is central to realizing this right. Despite many notable successes in expanding safe essential medicines with low-cost during the last two decades, problems persist. In the public sector of many countries, the available resources may not be well managed; drug stock outs are common, drug deliveries often late and inadequate. In both public and private sectors there are problems of drug quality and irrational drug use. In Europe the principal concern is often cost containment whereas in sub-Saharan Africa improving the accessibility of drugs is a much greater concern (WHO 1997).

Medicines play an important role in delivering effective and efficient health care for patient. To fulfill the right to health we have to attain accessibility to medicines. According to Quick, et al (1997), Medicines are essential for the following reasons:

- Medicines save lives and improve health.
- Medicines promote trust and participation in health services.
- Medicines are costly.
- Medicines are different from other consumer products.
- Substantive improvement in the supply and use of medicine are possible.

In addition to their role in preventing and treating disease, they serve other social, psychological, and political functions (Geest, et al, 1990).

Poor people - in both developed and developing countries - experience more ill health and shorter life spans than their richer fellow citizens. Although people's health is influenced by a wide range of socio-economic and lifestyle factors, access to high quality and affordable health care and public health services makes a critical contribution to health status. Health services are failing poor people - with lower rates of child immunization, skilled attendance at child birth, and other diseases. It's also true that richer groups tend to benefit more from public sector subsidies to health care - hospitals in urban centers that often receive disproportionate funds compared with primary care in poor rural areas.

In most poor countries which lack formal taxation and insurance systems, out-of-pocket payments are paid to both private and public providers and this consume household income and assets, and contribute to impoverishment. Better access depends on a wide range of factors:-

- (1) National policies that give priority to health sector.
- (2) Health policies that give priority to availing medicines at different levels of health system.
- (3) Strategy and plans that prioritize health needs and set out revenue sources and resource requirements (including mechanisms to address inequalities)
- (4) On motivated, properly trained and remunerated health workers.
- (5) On infrastructure, drugs and equipment.
- (6) On good referral links and communication.
- (7) On well-informed clients and their representative bodies (WHO 2007).

1.2. Essential Medicines

1.2.1. Definition of Essential medicines:

“Essential medicines are those that satisfy the priority health-care needs of the population. They are selected with due regard to disease prevalence, evidence on efficacy, safety and comparative cost-effectiveness. Essential medicines are intended to be available within the context of functioning health system at all times in adequate amount, in the appropriate dosage forms, with assured quality, and at a price the individual and the community can afford. The implementation of the concept of essential medicines is intended to be flexible and adaptable to many different situations; exactly which medicines are regarded as essential remains a national responsibility.” (WHO 2002 p.1)

The WHO Constitution (1946) states: *"The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, and political belief, economic or social condition."* Article 25.1 of the Universal Declaration of Human Rights (1948) reads: *"Everyone has the right to a standard of living adequate for the health of himself and of his family, including food,*

clothing, housing, medical care and necessary social services". The fundamental right is to the enjoyment of the highest attainable standard of health. (Hogerzeil, 2006)

1.2.2. Concept of Essential medicines:

Since the 1970s, WHO has promoted equitable access to basic health services through the concepts of primary health care and essential medicines. The first Model list of essential medicines of 1977 preceded the famous 1978 Alma Ata Declaration on Health For All "provision of essential drugs" as one of the eight elements of primary health care, and is widely regarded as one of WHO's most influential public health achievements.(Hogerzeil,2006, WHO 2004 a). Since 1977 the concept of essential medicines has become truly global. By the turn of the century over 150 countries had a national list of essential medicines, and over 100 countries had a national medicines policy. Although initially aimed at developing countries, the concept of essential medicines is increasingly seen as relevant for middle- and high-income countries as well (WHO 2004b). Perhaps most importantly: in 1977, less than half the world's population had regular access to essential medicines, while today nearly two-thirds do, through a combination of public and private health systems. In absolute terms, the number of people estimated to have access to essential medicines grew from roughly 2.1 billion in 1977 to 3.8 billion in the late 1990s.

In spite of so much achievement, however, it is estimated that a third of the world's population - roughly two billion people - lack regular access to essential medicines. In the poorer parts of Africa and South-East Asia 50% of the population lack such access. The Report of the Commission on Macroeconomics and Health (2001) estimated that by 2015 over 10 million deaths per year could be averted by scaling up interventions for communicable diseases, non communicable diseases, and maternal and perinatal conditions. (Quick, et al. 2002). The majority of these interventions depend on essential medicines.

While in many developed countries over 70% of pharmaceuticals are publicly funded through reimbursement plans and other mechanisms, in developing and transitional

economies 50-90% of drugs are paid for by the patients themselves. Medicines are the major out-of-pocket health expense for poor households in most developing countries. (Quick, et al 2007)

Table 1.1: Health Expenditure indicators in Sudan :(WHO, 2006)

	\$	Year
GDP per capita	489	2003
Total expenditure on health (per capita)	21	2003
General government expenditure on health (per capita)	9	2003
Total expenditure on health of % of GDP	4.3	2003
General government expenditure on health as % of total health expenditure	43.2	2003
Out-of-pocket expenditure as % of total health expenditure	54.6	2003
General government expenditure on health as % of total general government expenditure	9.1	2003
Ministry of health budget as % of government budget	2.4	2004

Source: World Health Report 2006, except otherwise noted.

Table 1.2: Coverage with primary health care services indicators : (WHO, 2006)

	%	Year
Population with access to local health services, total (%)	66	2000
Population with access to local health services, urban (%)	84	2000
Population with access to local health services, rural (%)	58	2000
Contraceptive prevalence rate (%)	7	2000
Antenatal care coverage (%)	72	2000
Births attended by skilled health personnel	57	2000
Infants attended by trained personnel (%)	na	na

na = Not available for 2000-2005 or not reported.

Thus a limited range of carefully selected essential medicines leads to better health care, better drug management and lower cost. (Hogerzeil, 2004)

Much has been achieved in the 25 years since the first WHO model list of essential medicines was drawn up. But there is a large unfinished agenda. Fairer financing, affordable prices, rational selection and use, effective drug regulation, and efficient supply systems are all central to closing the gap between those who today benefit from essential medicines and those who do not. . (Quick, et al 2007)

1.2.3 Development of National List of Essential Medicines in Sudan:

In 1981 the Ministry of Health formulated a national drug policy (NDP) based on the concept of essential medicines. The first component was the selection of a national list of essential drugs (NLED) that was published in 1982. In 1985 national workshop was convened in Khartoum in which the (NLED) was revised, updated and levels of use allocated. In 1987 the list was revised by the standing committee for Drug Products Registration, printed and widely distributed. In 1993 national workshop was convened in Khartoum and revised 1987 (NLED). The updated list was adopted in 1995, printed and widely distributed. It was then revised in 2001, updated and widely accepted and used. Eventually the NLED was updated by the standing committee for Drug Products Registration in 2004 and its title was changed to national list of essential medicines (NLEM), using the word 'medicine' instead of 'drug' as adopted by the WHO. Then was printed, widely distributed during year 2006 (MOH, 2007).

In developing countries both the government and communities struggle to ensure access to basic life saving medicines, especially in rural areas. There are many factors and constraints facing accessibility in low income countries:

- 1- Unstable situation due to civil wars.
- 2- The nomadic nature of some tribes.
- 3- Economic, geographic and cultural factors reduce access in the poorest parts of Africa and Asia to basic drugs lead to high morbidity and mortality observed in Africa (Foster 1991).

1.2.3.1 Health system in Sudan:

1.2.3.2 Health and Welfare:

Sudan is one of the poor nations in the world, and what wealth the country possesses is not fairly distributed. Poverty is widespread, particularly in rural areas. Outside urban areas, not enough health care is available, helping account for a relatively low average life expectancy of 57 years and an infant mortality rate of 69 deaths per 1,000 live births, low by standards in Middle Eastern but not African countries. For most of the period since independence in 1956, Sudan has experienced civil war, which has diverted resources to military use that otherwise might have gone into health care and training of professionals, many of whom have migrated in search of more gainful employment. (Sudan, 2004)

Table 1.3: Human and physical resources indicators :(WHO, 2006)

		Year
Physicians per 10000 population	5.5	2004
Dentists per 10000 population	0.80	2004
Pharmacists per 10000 population	0.20	2004
Nursing and midwifery personnel per 10000 population	8.4	2004
Hospital beds per 10000 population	7.2	2004
Primary health care units and centers	1.7	2004

Table 1.4: Selected morbidity indicators in Sudan: (WHO, 2006)

Diseases	Cases	Year
Cholera	na	2005
Malaria	1988132	2005
Poliomyelitis	27	2005
Measles	1374	2005
Pulmonary tuberculosis	20220a	2005
Diphtheria	13	2005
Tetanus	na	2005
Neonatal tetanus	94	2005
AIDS	232	2005
Meningococcal meningitis	3673	2005

na = Not available for 2000-2005 or not reported

a = New pulmonary tuberculosis cases excluding relapse

1.2.4 Reasons for supporting essential drug concept:

Since the market is open and availability of all kinds of drugs could not be achieved in addition to the scarcity of resources, the concept of essential drugs should be adopted and the selection of certain number and kinds of medicines should be supported for the following reasons:

- Selection is the key factor for rational prescribing.
- Basic health services will be accessible to every one.
- Regular supply of most drugs on essential drug list would result in a real health improvement.
- It represents Prescribers' consensus on drug treatments of first choice and its use improve the quality of care, knowledge of drug therapy, prevention of drug reaction.
- Improve effectiveness and efficacy in patient treatment, lower cost, thus essential drug concept promotes both quality of care and cost control in developing countries.
- Advantage on concentrating on procurement and logistic efforts on limited number of drugs and increasing competition leads to favorable prices plus ensuring quality.

- Drug expenditure involves spending foreign currency; selection of drugs rationalizes the utilization of resources and achieving good value for money.
- Through limited essential list, availability of drugs, drug information and education programme will further rationalize prescribing and use. (Quick, et al 1997).

1.2.5. Criteria and Basis of selection of Essential Drugs :(Quick et al 1997)

The criteria for selection as recommended by WHO (1995) is built on:

1. The proven efficacy, high safety and good quality drugs.
 2. Minimum number of drugs to treat the prevalent diseases
 3. New drugs would not be accepted unless it proved to possess a distinct advantage over the products in use.
 4. Combination products only accepted when they have a true benefit over the individual use of each component alone or if the cost is less than the components.
 5. Drug of choice and when other alternatives do not exist.
- Evaluate administrative and cost impacts of purchase, storage and distribution.
 - Locally manufactured products are superior to those imported.
6. Evaluate contraindications, interactions, adverse effects and precautions.
 7. Cost of treatment rather than unit price.
 8. List in generic names.
 9. The level of Prescribers.
 10. Cost of alternative method of treatment

1.2.6. Availability of Essential medicines:

From the reasons mentioned before the availability of essential medicines in adequate amounts, appropriate dosage forms, assured quality and affordable price is mandatory to meet the priority health care needs. The purpose of the research study is to measure the availability of the selected Key items of essential medicines. Those items are only provided by Central Medical Supplies Public Cooperation (CMSPC). Most of them

are used in casualty department and are distributed free of charge for the first 24 hours (covered by ministry of finance as an Emergency Budget). Thus their availability is an important factor for sustainable reliable supply system and matter more than affordability which is the responsibility of the government.

The price, availability and affordability of medicines are major determinants of access to treatment. Health expenditure of the world's poor is largely devoted to buying medicines so the price of essential medicines really does matter – not only to patients, but to governments who are charged with the responsibility to provide healthcare for their citizens.

Surveys undertaken using the World Health Organization/Health Action International (WHO/HAI) price measurement methodologies have exposed:

- Treatments can be unaffordable – as much as 50 days wages for 30 days supply
- Medicines can be priced at over 80 times an international reference price
- Some governments
 - Purchase expensive originator brands of medicines that have been off-patent for years.
 - Charge patients for medicines well over the procurement price.
 - Apply numerous taxes to medicines.
- In many countries the availability of medicines in the public sector is extremely low
- Often the manufacturer's price is the major determinant of the final medicine price, but sometimes the add-on costs in the supply chain can double the price
- Mark-ups applied by pharmacists and dispensing doctors can be excessive (MSH 2003).

A cross-sectional survey of the Revolving drug funds at front-line health facilities in Vietnam was designed to study the availability of selected tracer drugs, namely ampicillin 250 mg capsule, paracetamol 500 mg tablet, sulfamethoxazole–trimethoprim 400 mg tablet, Vitamin B1 100 mg tablet and vitamin C 500 mg tablet. Eighty-five percent of the district hospitals and 78% of the health centres had a regular supply of these drugs at the time of the survey. Exit interviews with district hospital outpatients revealed that 87% of outpatients could fill their prescriptions entirely at hospital pharmacies and the remaining 13% could fill them there only in part. The number of out-of-stock drugs was monitored monthly in 10 health centres and two district hospitals for 10 months via the recording and reporting system introduced in the two districts. On average, the health centres had 57 drug items of which 4 (7%) went out of stock; whereas the district hospitals had 170 items of which 10 (6%) went out of stock during the period. Generally, a stable supply of essential drugs was achieved through the RDF system. (© Oxford University Press, 2001)

1.2.6.1. Medicines are rarely available

In many countries medicines are supplied free of charge to all or to specific categories of patients. This is praiseworthy provided the medicines are available. Sadly for the sick and poor, this is rarely the case.

Asthma is a common chronic disease in developing and less developed countries. As shown in Table 1.5, salbutamol inhaler was not found in any of the public sector facilities sampled in Uganda (where medicines in the public sector are free) or Mali, and in Indonesia only 13% of the facilities sampled stocked salbutamol inhalers (originator brand only). Therefore, asthmatic patients are forced to purchase an inhaler from the private sector where it is clearly unaffordable in all three countries (days worked to purchase 1 inhaler ranged from 2 to nearly 6 days). (MSH 2003)

Table 1.5: Availability of salbutamol inhaler (public sector) and affordability (private sector)

	National Essential Medicines List	Availability Public sector facilities		Affordability Private Retail Pharmacies	
		Originator	Generic	Originator	Generic
Uganda	yes	0%	0%	5.6 days	2.0 days
Mali	yes	0%	0%	4.2 days	2.7 days
Indonesia	no	13%	0 %	4.1 days	

Availability (Evaluating Drug Prices, Availability, Affordability, and Price Components: Implications for Access to Drugs in Malaysia):

In the public sector, median availability was very low, and only 25% of the generic drugs were available. In the private pharmacies, the median availability of all surveyed medicines was 43% for lowest-price generic equivalent (LPG), 18% for most-sold generic equivalent (MSGs), and 39% for innovator brands (IBs). In dispensing doctors' clinics, the availability was 45% for LPGs, 15% for MSGs, and 10% for IBs.

The availability was also found low on the drugs, which are listed in the National Essential Drug List and the Drug Formulary of Malaysia. For 41 medicines that were found in both sources, a combined analysis showed that in the public sector, median availability was 40% for LPGs, 0% for MSGs, and 5% for IBs. In private sector retail pharmacies, median availability was 43.8% for lowest price generics, 18.8% for most sold generics and 40.6% for IBs. In the Dispensing Doctor's Sector (DDS), median availability was 45% for LPGs, 10% for MSGs, and 10% for IBs. (Ibrahim, et al .2007)

1.2.6.2 Expiry date:

Expiry date analysis examines levels of stock on hand and their expiry dates and compares this information with average rates of consumption to assess the like hood of wastages and to develop appropriate countermeasures.

1.2.6.2.1 Analysis of expiry dates:

The analysis of stock position versus expiry dates in supply system inventory to avoid or minimize losses due to wastages.

1.2.6.2.2 Expiry costs:

It is one of the components of inventory holding cost. These components include, opportunity costs, storage operating costs, supplies for material management, transport costs, deterioration and spoilage costs, expiry costs, obsolescence costs and wastage costs. Expiry costs are often 3-5% of drug inventory each year. If this ratio holds, the costs are incremental as inventory value increases.

Inventory holding cost is also known as the carrying cost, and is calculated as the percentage of average annual inventory value (the sum of the beginning inventory value for the financial year and ending inventory value for the financial year and then dividing by two). The sum of costs associated with holding inventory in the system is divided by the average annual inventory value, and the result is expressed as percentage. (Quick, et al 1997)

1.3 The economic impact of pharmaceuticals:

The economic impact of pharmaceuticals is substantial, especially in developing countries. While spending on pharmaceuticals represents less than one-fifth of total public and private health spending in most developed countries, it represents 15 to 30% of health spending in transitional economies and 25 to 66% in developing countries. In most low income countries pharmaceuticals are the largest public expenditure on health after personnel costs and the largest household health expenditure and the expense of serious family illness, including drugs, is a major cause of household impoverishment. Despite the potential health impact of essential drugs and despite substantial spending on drugs, lack of access to essential drugs, irrational use of drugs, and poor drug quality remain serious global public health problems. (WHO, 2007, Quick, et al. 2002)

Most medicines budget in developing countries are below 30\$ per person per year, with 38 countries having less than 2\$ per person per year. (Quick, et al. 2002)

1.4 The Access framework in low- and middle-income countries:

Essential medicines are only one element in the continuum of health care provision but they are a vital element. The major access challenges which can be obstacles for health improvement are:

Figure 1.1: A Framework for Access (WHO 2004c)



- **Inequitable access** - about 30% of the world's population lacks regular access to essential medicines; in the poorest parts of Africa and Asia this figure rises to over 50%.
- **Health reforms** -health sector reforms have led to insufficient public funding for health. Public medicine expenditure does not cover the basic medicine needs of the majority of the population. 50% to 90% of medicines are paid for by patients themselves.
- **Treatment costs** - high costs of treatments with new essential medicines for tuberculosis, Acquired Immunodeficiency Syndrome/Human Immunodeficiency Virus (HIV/AIDS), bacterial infections and malaria are unaffordable.

- **Globalization** - global trade agreements can threaten access to newer essential medicines.

Improving access to essential medicines is the most complex challenge for all actors in public, private and Non Governmental Organization (NGO) sectors involved in drug supply. Many factors define the level of access; include financing, prices, distribution systems, appropriate dispensing and use of essential medicines. WHO has formulated a four-part framework to guide and coordinate collective action on access to essential medicines. (WHO 2004 c)

1.4.1 Rational selection and essential medicines

- Develop national treatment guidelines based on the best available evidence concerning efficacy, safety, quality, and cost-effectiveness;
- Develop a national list of essential medicines based on national treatment guidelines;
- Use a national list of essential medicines for procurement, reimbursement, training, donations and supervision.

1.4.2 Affordable prices

- Use available and impartial price information;
- Allow price competition in the local market;
- Promote bulk procurement;
- Implement generics policies;
- Negotiate equitable pricing for newer essential medicines for priority diseases;
- Undertake price negotiation for newly registered essential medicines;
- Eliminate duties, tariffs, and taxes on essential medicines;
- Reduce mark-ups through more efficient distribution and dispensing systems;
- Encourage local production of essential medicines of assured quality when appropriate and feasible;
- Include World Trade Organization/ Trade Related Aspects of Intellectual Property Rights (WTO/TRIPS) compatible safeguards into national legislation and apply.

1.4.3 Sustainable financing

- Increase public funding for health, including for essential medicines;
- Reduce out-of-pocket spending, especially by the poor;
- Expand health insurance through national, local, and employer schemes;
- Target external funding – grants, loans, donations – at specific diseases with high public health impact;
- Explore other financing mechanisms, such as debt-relief and solidarity funds.

1.4.4 Reliable supply systems

- Integrate medicines in health sector development;
- Create efficient public-private-NGO mix approaches in supply delivery;
- Assure quality of medicines through regulatory control;
- Explore various purchasing schemes: procurement co-operatives;
- Include traditional medicines in the health care provision.

In addition to the above four factors, the following factors also affect accessibility.

1.4.5 Lack of new medicines

Global trade agreements can threaten access to newer essential medicines in low- and middle-income countries. They focus on diseases of developed countries, and neglect the prevalent diseases of developing countries (WHO 2004 c)

1.4.6 Poor quality of medicines

Quality of medicines varies greatly, particularly in low – income countries, 20% to 30% of samples collected from markets fail quality tests (WHO 2004b). 92% failed quality tests in private sector of Chad (WHO 1996). 70% of counterfeit medicines were reported in developing countries mainly from Asia, Africa. (Helling –Borda 1995; WHO 1998; Newton, et al 2001, 2002).

1.5 Economic context in Sudan:

The Gross Domestic Product GDP per capita had shown significant increase during the last five years (due mainly to increased oil revenues and the flow of foreign investments) from US\$ 395 in 2001 to US\$ 640 in 2005 and above US\$ 700 in 2006. (FMOH, 2007)

The direct share of oil in GDP was only 6.8% in 2000 and increased to 16% in 2005, while Agriculture contribution to the GDP has decreased from 46.3 % in 2000 to 39% in 2005. Furthermore, agriculture remains the main source of income for two out of three people in the north living in rural areas, and for more than 85% of those in the South. (FMOH, 2007).

The general government expenditure (GGE) has increased from 352,160 million SD (US\$ 1,371 million) in 2000 to 1,385,134 million SD (5,631 million US\$) in 2005 and estimated to reach 2,130,000 million SD (9,467 million US\$) in 2006. Fifty percent of the government budget in 2005 was from oil revenue.

Rapidly growing Federal Government revenues hold the prospect for reversing the deterioration of the health care system. Federal Government transfers to the Northern States for example in 2005 were about US\$ 28 per capita, or ten times the amount in 2000, and the 2006 budget allocates transfers equivalent to US\$ 41 per capita. At the same time, the Government has adopted a medium-term expenditure framework (MTEF) which envisions raising domestic public expenditures on the health sector to 1.5% of GDP by 2008. A crucial policy challenge is to ensure that a significant proportion of increased transfers to states, and indeed of growing government health spending, is effectively channeled towards essential health services and to reducing the financial burden on households and social inequalities in access, utilization and health outcomes. (FMOH, 2007).

Table 1.6: Government expenditure on different line items as % of GDP:

	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>
Salaries	3.5	3.8	4.2	4	5.2	4.9
Current cost	5.2	5.4	4.6	7	8.3	6.2
Capital investment	1	0.7	0.8	1	1.6	6.7
Development	1.7	2.2	3.6	4	5.8	4.9
Total Government Expenditure	11.4	12.1	13.2	16	20.9	22.7

In Sudan soon after 1973, prices of drugs started to rise sharply due to oil increase followed by the increase in consumption rapidly with expansion of health services. Banks were unable to provide foreign currency needed for the wide range of pharmaceutical imports. Considerable amounts of limited national resources of foreign currency were being wasted on pharmaceuticals of no real health needs while many vital essential items were not available most of the time. But recently and due to the improvement of the economy and increase in export especially in oil sector, foreign currency is becoming available and hence importation of medicines and raw materials for pharmaceuticals is becoming easier. (Jabir, et al 1991).

1.6 Central Medical Supplies Public Cooperation in Brief: (CMSPC, 2006)

1.6.1 A Brief historical background of the Medical Supplies:

The medical supplies came into being as central stores at Sudan Medical Services (SMS) in 1935, then the stores moved to the area of Kilo 5 south of Khartoum (South West the present Riyadh quarter); hence, it was transferred to its present site in the industrial area at south Khartoum in 1954. Nevertheless, it continued as a division affiliated to the Headquarters of the Ministry of Health under the name of the (Central Medical Supplies). Dr. Knye was the Chief of Division of Medical Supplies and Mr. Badwin was the controller of stores.

By 1957 and after independence Ustaz Mukhtar Ahmed Mukhtar was the Controller of the Medical Supplies as acting manager of the Division.

In the same year 1957, the first Sudanese professional, Dr. Elhadi Elnagar, Public Health specialist, was appointed as the Chief of the Division of Medical Supplies. Charged, against the post of the Province Health Medical Officer, in group Five, Division "A" at the Headquarters of the Ministry of Health.

1.6.2 Powers and Functions of the Medical Supplies Division:

Since its establishment and through its history, the powers and functions of the Medical Supplies Division were; selection, procurement, storage and distribution of all medical supplies, Equipments and others for public health sector.

1.6.3 The transformation of the Medical Supplies Division to a Public Corporation:

In 1981, the Ministry of Health formulated a comprehensive drug policy which has been a pioneering one, in relation to developing countries which encouraged the WHO to commend this policy and to respond to the request of the Ministry of Health in contributing in its implementation.

This drug policy document in the field of drug supply called for giving special priority for setting out a national system for drug supply, supporting and up-grading the Medical Supplies Division and to enhance its performance. Thus, the Medical Supplies Division attempted, with the donors, the implementation of this important part of the drug policy and the Government of the Netherlands pledged to support the comprehensive rehabilitation of the buildings, establishments and preparations of the Medical Supplies Division, its administrative system and development of its staff. Implementation began in 1988 pursuant to the Agreement on Dutch Aid to the Sudan. The renovation and preparation of the buildings, and the staff training was completed in 1990. In 1991 a new law was approved converting Central Medical Supplies to a delegated public corporation with an autonomous entity supervised by the minister of health. Actually, the law was issued which transformed it into a general corporation in 18/5/1991.

This law determines the autonomous nature of the corporation and the powers of the board of directors that govern the corporation and also allows for service fees that avail financial resources for running the system.

In view of the fact that the corporation is a general non-profit corporation, the Ministry of Finance approved the non-recovery of the departmental fees, allowing the corporation to keep them together with their exposition in the accounts of the corporation and utilize them for paying of the employees salaries, availing of medicines, expansion in the buildings and stores development, training, and increase of the stock subject to securing the strategic drug stock. Therefore, the corporation was able to provide most of the essential drugs, medical equipments and machineries and it succeeded in maintaining an appropriate annual strategic stock.

1.6.4 The Vision of CMSPC:

In view of the belief of the corporation that the health welfare is one of the human rights and recognizing this welfare will not be achieved except by the provision of the citizen's needs of necessary drugs and medical requirements for such health welfare. The mission of the corporation is to provide every citizen's need of effective and safe drug in the assured quality and in an easy manner and affordable cost and to supply the general health institutions at all levels with their need from the other health care requirements.

1.6.5 The Mission of CMSPC: (CMSPC, 2006)

The completion of the establishment of the most big and efficient endowment Organization capable of producing, procuring, analyzing, storing and distributing affordable and safe medicines and medical equipments that is sufficient to meet the needs of Sudan population especially excluded and poor with strong and ample self financial endowment resources capable of treating all poor patients free of charge.

1.6.6 Objectives of CMSPC (CMSPC, 2007):

1. Strive to achieve medicine security through a cost recovery system in order to ensure the continuity of the service and strategic role of the corporation.
2. Lay down and execute a central system, capable of selecting, procuring, storing and distributing of medical supplies to all health units, on federal and state levels, with high quality and reasonable price.
3. Prepare accurate statistics, to specify the type and quantity of medical supplies, in accordance with needs of all health units in the centre and states.
4. Procure, store and distribute medical supplies financed by the government to all health units at federal and state levels.
5. Promote and develop people's pharmacies.
6. Promote the concept of rational drug use.
7. Encourage researches and studies in the field of medical supply.
8. Co-ordinate between various health units, with respect to medical supplies.
9. Develop technical and administrative abilities of employees on all levels.
10. Any other such objects as the activity thereof requires.

1.7 Strategy, polices and economics of the drug and medical supply (CMSPC, 2006)

The health sector is considered as one of the social services. The Central Medical supplies Public Corporation (CMSPC) although is working within the concept of cost recovery but still it is considered as a none for profit making organization and its main role is the establishment of unique supply system capable of availing medicines to different levels of health system. This sector is affected with the overall national policies of the country, the geographical and demographic characteristic in the entire parts of the country and benefit from the international and regional polices systems and events.

1.7.1 The 25 years strategy of CMSPC 2007-2031:

CMSPC formed an expert committee to formulate its 25 years strategy. The first draft was reviewed in many meetings and the final draft was adopted by the ministry of health. The strategy called for the following;

1. Up-dating the Laws of Central Medical Supplies public corporation for its legal entity, autonomy, powers, functions and its vertical and horizontal relations, with the different federal and state organs.
2. The powers of the corporation included the following:
 - a) Provision of the need of all the health institutions in the public sector as well as a fair contribution in the private sector of essential, safe and effective medicines and medical consumables, in the assured quality, adequate quantities, in affordable cost, and to ensure its quality through the chain of its production, transportation, receipt, storage, distribution, and delivery to the stores at state and regional levels.
 - b) Provision of the need of all health institutions in the public sector as well as the fair contribution in the private sector of medical consumables, disinfectants, requirements of Surgery, X-ray, dentistry, laboratories and blood transfusion centers in affordable cost.
 - c) Undertake the duties of purchasing non-consumable medical apparatus and equipment such as x-ray equipment, operation tables, ultrasound equipment, ECG equipment, anesthetics, sterilization and dentistry equipments and other equipment earmarked for public and private hospitals from the urban to the specialized hospitals.
 - d) Assembly and maintenance of all non-consumable apparatus and equipments in public and private hospitals in all states of Sudan.
 - e) The corporation is working towards ensuring that all purchases of apparatus and medical equipment for the public are made through the CMSPC. These purchases will be subjected to the same conditions laid down for medicines and medical consumables with regards to specifications, method of purchase, storage, availability of spare parts and maintenance services for all health centers in the public sector.

3. To ensure that the laws of the ministry of finance that governs purchases and selling of medicines and medical equipments include the necessary restrictions that make it compulsory for public sector to make purchases of medical equipment and apparatus either from or through the CMSPC.
4. The corporation should have all facilities that will allow it to perform its duties in the required technical, workable and economic manners. The terms of payments should be agreed upon with the supplying agencies.

1.7.2 General Policy of CMSPC :(CMSPC, 2003)

To fulfill its roles, CMSPC appointed many committees to control and regulate its operating system. These committees are:

1.7.2.1 Drug committee:

It is headed and appointed by the General Director of CMSPC. It includes the heads of all departments of CMSPC.

1.7.2.1.1 The functions of Drug committee are:

- Determining the annual procurement schedules in accordance with the approved budget.
- Determining methods and ways for procurement (open tender, limited bidding, direct purchase, local procurement, re-ordering from last supplier, etc).
- Approval of the specifications and quantities as determined by the concerned departments.
- Handling of difficulties, problems, non-compliance and claims of any nature concerning medical supplies at different stages of procurement, supply, delivering, storing and distribution. This may be arising by CMSPC or by the suppliers or clients.

1.7.2.2 Permanent Committee for Tendering of Medical Supplies:

The following members are represented in the committee:

- Different departments in CMSPC.
- Drug Regulatory authority.
- National Drug Quality Control Laboratory.
- Specialists and consultants from all different medical specialties.
- Representative from the Ministry of Finance.
- CMSPC legal advisor.

This committee is responsible for selection of the suppliers separately for each item of medical supplies. This primarily depends on the compliance of the supplier to the declared conditions of the tender. Secondly it depends upon the best price given by the supplier.

1.7.2.3 Committee for procurement of CMSPC services:

It is appointed by the General Director of CMSPC. It is responsible for developing, and maintaining the necessary methods and systems to acquire goods other than medical supplies, furniture, stationeries, and all items necessary for daily work and for maintenance of different facilities at CMSPC that can be obtained from the local market in the Sudan.

1.7.2.4 Receiving and visual inspection committee:

It is appointed by the General Director of CMSPC. It is headed by a member from the TQM department. It is responsible for:

- Receiving of medical supplies in accordance with the procedure for inspection and receiving of products.
- Storing of each item in its specific store.
- Checking the received quantities against the purchased quantities.
- Check of medical supplies to ensure their compliance with the required specifications.

- Reporting and recording of all the details and violations, if any.
- Sampling.

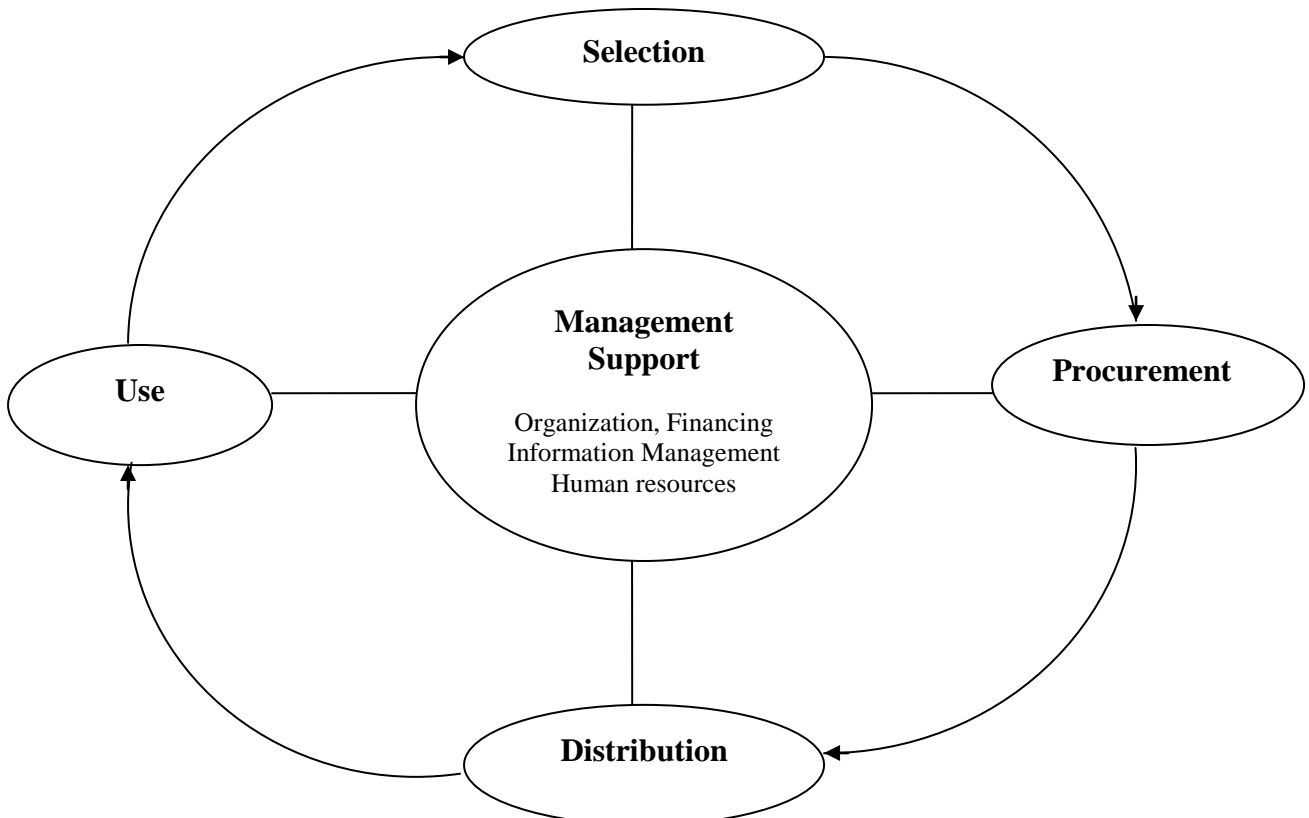
Release of products and the forwarding for taking on charge (TOC) are responsibilities of the TQM director.

1.8 Role of CMSPC in Drug Management Cycle:

1.8.1 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 (Quick, et al 1997)



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.

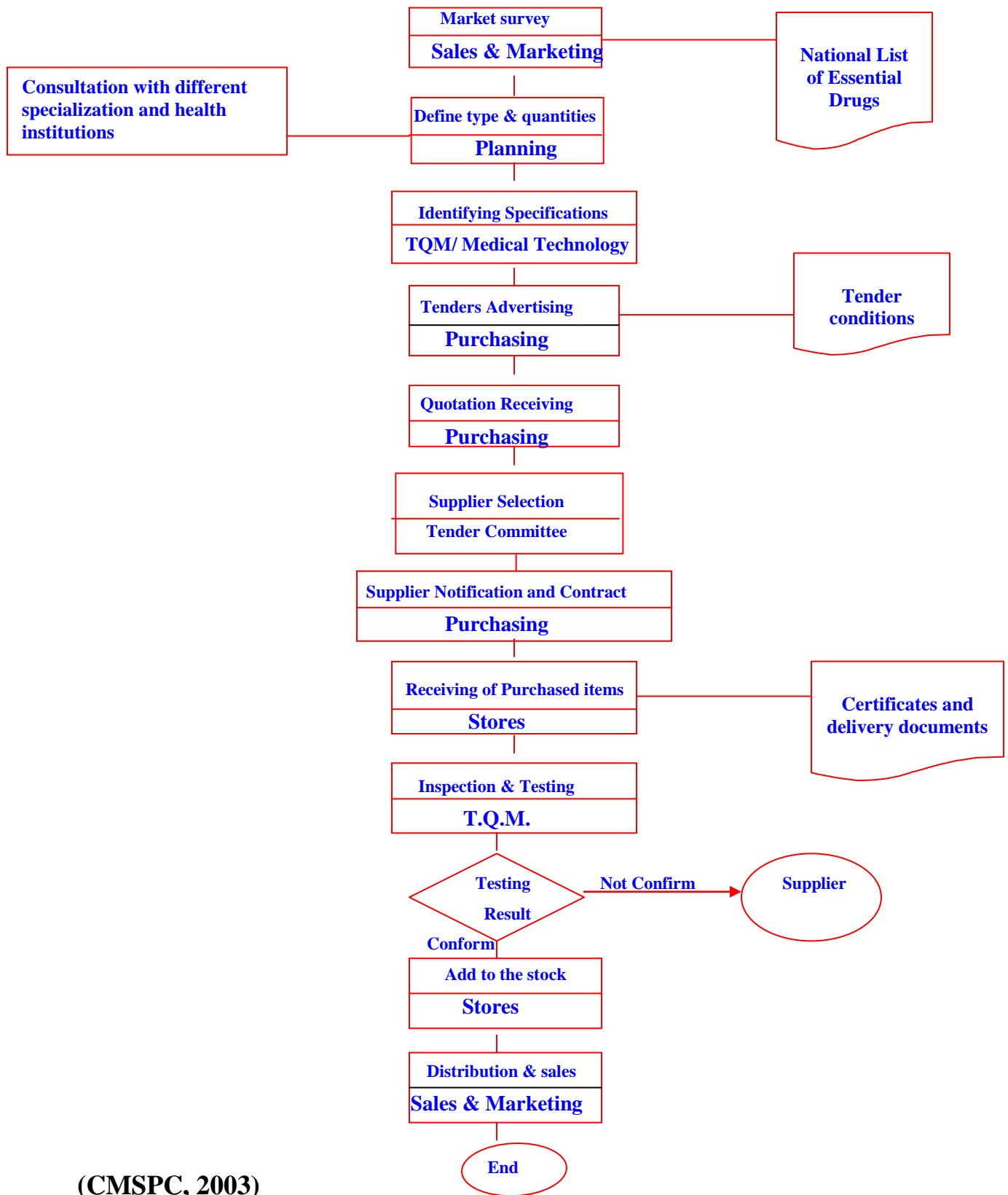
Managing drug supply aims to ensure that high quality essential drugs are available, affordable and used rationally. Its main concerns with the public and private pharmaceutical market are availability (geographic access), affordability (economic access) and rational use of drugs. Measures to improve availability include training of pharmacy aides and drug sellers, licensing provisions and incentives for whole sellers, 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.

(Quick, et al 1997).

CMSPC takes part in three basic functions of drug management cycle while the use function is done through rational use of medicines at all levels of health system.

Figure 1.3: CMSPC Main Processes related to drug management cycle





(CMSPC, 2003)

1.8.2.1 Selection and determination of the need for Medicines and Medical consumables (CMSPC,2006)

1.8.2.1.1 Selection of Medicines and Medical consumables:

Selection and determination of the list of essential drugs provided by the CMSPC is made from the national list of essential drugs in addition to all other medical consumables. Working groups comprise from specialists from different fields of medicine specializations are assigned to up-date these lists by deletion or addition. Also, the authorities concerned with the work of the national treatment protocols are contacted before the invitation for bids.

1.8.2.1.2 Determination of the needed Medicines and Medical consumables:

The determination of the quantities of items of drugs and medical consumable (dressings, disinfectants, etc) is currently made by Planning and Training department in CMSPC based on the data of past consumptions which is represented by the issued items (consumption method) taking into consideration the stock out duration .This is conducted by the monitoring of the stock level for every item continuously following the changing prescribing pattern of consumption beside the expected vertical and horizontal expansion in the health services.

1.8.2.1.3 The strategy for the selection and determination of the need for Medicines and medical consumables:

1. Creation of a mechanism for the provision of the accurate statistical information from the related bodies for the determination of their need for each medicines or medical consumables, taking into consideration the expansion in the health services, and the increase of the citizens' demand as a result of the growth of the health awareness amongst them.
2. Development of the consumption control mechanism and the determination of the need to know the state and traffic of the item and the continuous research and study for the assessment of the effectiveness of the system for the determination of the need which is applied at all times and developing it .

3. Provision of a strategic stock, and emergency stock for the life saving items in a constant manner even if they were not consumed.

1.8.2.2 Purchase of drugs and medical consumables:

The procurement department in the CMSPC undertakes the implementation of the purchase operations for all the needs of drugs and medical consumables through different financial procedures.

Purchasing department is responsible for securing the availability of the requested medical supplies. In order to achieve this, Purchasing department ensure that:

-Purchased medical supplies are clearly and adequately specified as required by Purchasing Procedures.

-Approved vendors and/or contractors are properly contacted, as mentioned in Evaluation of Suppliers Procedure.

Suppliers are evaluated and selected on basis of the following:

- Ability of the supplier to perform successfully the purchasing orders.
- Quality of the purchased products.
- Supply of the purchased product at the determined time.

The extent of control exercised on supplies depends on the type of product. A list of approved suppliers is maintained and periodically updated by purchasing department.

1.8.2.3 Purchasing Data:

Purchased orders are reviewed before sending to verify type of product ordered, quantities required, specifications, and other relevant technical data and quality assurance requirements.

Purchasing process is performed according to Local Purchasing Procedure and External Purchasing Procedure.

1.8.2.4 Verification of Purchased Product:

Purchased products are verified for conformance with requirements specified in purchase orders according to Receiving and Inspection Procedure and Testing Procedure. (CMSPC, 2003)

1.8.2.5 Procurement polices:

Various methods are followed in CMS procurement:

1.8.2.5.1 Tenders:

1.8.2.5.1.1 International tender: For drugs with specified packaging and transport conditions, and for equipment. Payment is through the bank of Sudan and other commercial banks.

1.8.2.5.1.2 Limited tender: is done through limited tender for certain suppliers.

1.8.2.5.1.3 Direct supply: when there is only one supplier for a certain drug or in cases of emergency.

1.8.2.5.1.4 Re-supply: based on an old tender, maintaining the old price.

1.8.2.5.2 Protocol:

Is an agreement between the government of the Sudan and another country. The two countries exchange their products with payment in foreign currency, (bilateral commercial agreement) i.e. only the products and the suppliers in those countries are involved.

1.8.2.5.3 International Aids:

CMS is the sole body responsible for receiving & distributing medical supplies donated to the government of the Sudan. (CMSPC, 2003)

The strategy calls for the continuous up-dating of the system and procedures of purchase, loading, clearance, delivery, receipt, and it works for the achievement of the following :-

- 1) Tighten the control over the supply cycle, through the control of the loading system or quantities control system (just in time), so as to prevent the occurrence of gaps or surplus in the stock taking into consideration the storage capacity.
- 2) Contraction for a supply period of two years or more for the life-saving drugs to fulfill continuous flow of these items without interruption, so as to minimize the gaps, because of the difficulty in finding immediate supply sources for many of these drugs during the critical situation, specially those drugs manufactured at request, like serums, vaccines and insulin's, this will contribute to the reduction and stability of the prices of these drugs.
- 3) Finding a third independent and internationally recognized party to conduct the inspection process prior to the loading of the imports so as to solve the problems related to the non- conformity with the required specifications and how to compensate or replace them.
- 4) Computerization of the cost of each item of drugs and medical consumables starting from their purchase, supply, until their issuance and distribution.

1.8.2.3 Clearance, storage, delivery and transport of drugs and medical consumables. (CMSPC, 2006)

Most of the corporation imports from drugs and medical consumables arrive through the Seaport and some arrive through Air Port and after their clearance; they are transported to the main stores of the corporation in Khartoum, also, some large- size products, like (intravenous solutions) are temporarily stored in the corporation's stores in ports Sudan. The requirements of the states and the teaching hospitals are issued from the central stores in Khartoum.

Some negative aspects had become evident in some stages of the mentioned system of supply. This requires that the strategies of clearance, storage, delivery, distribution, and transportation of the drugs and medical consumables should include the procedures which allow for the achievement of the required efficiency in all the stages of the drug supply system.

1.8.2.3.1 Clearance Strategy:

1. Coordination and agreement with the responsible authorities for clearance at the port of arrival, for a system that spare the corporation the losses which can arise from the delay in the clearance of the corporation's consignments.
2. To seek with the custom authorities for the creation of a custom office specialized in the field of drugs and medical consumables in Khartoum Air Port and Port Sudan, and to work for the designation of a custom area concerned with medical supplies imported by sea.

CMS applies a strict receiving, inspection and testing activities in order to ensure conformity of delivered products to the specifications. Quality Control department is responsible for performing the internal testing activities.

1.8.2.3.1.1 Receiving, Inspection and Testing:

Total Quality Management (TQM) department is responsible for verifying the incoming medical supplies before taking on charge. This section has the full responsibility of assuring their conformance to specified requirements, in accordance with CMS specifications.

All the incoming medical supplies are kept in the specified store and identified with the yellow labels. After completion of inspection and testing procedures, TQM changes the labels with the green/red color according to the results of the inspection and testing. After being accepted, the incoming products are adequately identified and kept in the right stores location correctly.

In case of nonconformity, the Drug Committee is responsible for handling the issue with the supplier and legal advisor. The non-conforming deliveries are recorded and statistically treated to help in evaluation of the suppliers.

1.8.2.3.1.2 Inspection and Test Records:

Inspection and testing records are established to provide evidence that the product has been inspected and tested. TQM department is responsible for controlling and maintaining the testing records .These records identify clearly whether the product has passed or failed the specified inspection and/or tests. TQM director is responsible for the release of the product.

When the product is released then it is passed to Stock control section in Storage and transportation department. The information of the product including quantity and price will be added to current stock through a computerized program which links all the relevant departments together.

1.8.2.3.1.3 Control of quality records:

CMSPC maintains its quality records in order to demonstrate conformance to specified requirements, and the effective operation of the quality system.

CMSPC makes sure that all the quality records are legible, stored and retained in such a way that they can be easily retrievable and that prevent damage, deterioration or loss.

The quality assurance department is responsible for identifying, collecting, organizing, maintaining, assessing, storing and disposing quality records according to “Control of Quality Records Procedure No. P-02”. (CMSPC, 2003)

1.8.2.3.1.3.1 Control procedures:

The Quality Control Department takes the following measures:

- Calibration, inspection, measuring and test of equipment that can affect product quality. They are listed in a calibration plan, which shows both frequency of calibration and procedures to be used.
- Identification of each instrument by a unique number. In addition a label showing calibration status is attached to the equipment.
- Performing calibration periodically.
- Keeping and maintaining records of calibration according to Procedure No. P-11.
- Store of the instruments carefully and safely when not in use to maintain the accuracy and fitness for use.

Only trained personnel handle and use instruments.

1.8.2.3.2 Storage and transport strategy:

Adequate and secure storage areas are provided as follows:

1. Two stores for general medicines
2. Store for cold items.
3. Store for I.V. fluids.
4. Store for medical consumables.
5. Store for general medical equipment supplies.
6. Store for specialized medical equipment supplies.

The total storage area is 30065 m³; out of it the cold storage area represents 1290 m³.

Appropriate provisions are made for receipt, and dispatch from these stores.

The strategy calls for the following:-

1. To oblige all the health facilities to provide storage area prepared in accordance to the requirements of the good storage practices (GSP), which guarantee that, the temperature degree will not exceed 30° according to the requirements for the storage of different drug products and humidity not to exceed 65%.
2. To conduct urgent studies on the national level so as to know how much the quality of drugs is affected during their transport from the headquarters of the central medical supplies in Khartoum and until their arrival and storage in the different states. The study should ensure the consequences of the transportation upon the drugs quality, the harm to the patients and the financial and economic losses.
3. To study the possibility of transporting all the drug products by air to the nearest air port to the site of the consignee and the actual cost for the implementation of this which might be of a lesser cost if we took into consideration the receipt of all the drug consignment in Khartoum air port instead of Port Sudan, and the actual costs of clearance and transport from Port Sudan to Khartoum including the consequences and effects on the drug quality and efficacy, as a result of their subjection to the harsh climatic conditions in summer in port Sudan during their stay for clearance and then during their transporting to Khartoum.
4. Since the CMSPC is actually a specialized body, both technically and practically, in the field of drug supply, it should be fully responsible for ensuring the drug quality and efficacy until its arrival to the regional stores or to the stores of the health ministries in the states.
5. The corporation assumes the responsibility of transporting the requirements of the states ministries of health from drugs through the means which ensure their non-subjection to temperature degrees that exceed 30°. And the corporation shall under take the studies and adopt the necessary procedures which achieve this.
6. Establishment of regional stores as branches to the CMSPC in the states so as to bring their stock nearer to their customers in the state.
7. To design model and standard stores for the storage of drugs, dresses, disinfections, and medical consumables on the level of the state store and hospital store.
8. Preparation of a guide in the field of drug supply to work according to it in the states.

1.8.2.3.3 Delivery through revolving drug project:

- In July 2002 the CMSPC established the revolving drug system project, as a means, and strategic target which ensure that people throughout the nation have access to medicines which is safe, affordable and of assured and required quality. This project was established with the purpose of delivering the drugs to all the health units in the different parts of the country starting from primary health care units up to the specialized hospital in the public sector, which in turn assist in the safety of arrival, storage, and distribution of drugs and medical consumables in the states CMSPC helps in the establishment of medical supplies stores in the different states to secure a national strategic stock of essential and vital medicines to be distributed in all parts of the country and also trucks and vehicles needed to transport medicines and supervise their distribution. The staff was trained by CMSPC and each state was stocked by reasonable amount of medicines.
- The project succeeded in covering 19 states with training, continuous support and guidance. These states are:
Sinar, Elqadarif, Blue Nile, Elgazera, Red Sea, Kasala, Northern, White Nile, North Kordufan, West Darfur, South Kordufan, River Nile, North Darfur, Bahr Eljabel, South Darfur, Upper Nile, West Bahr Elgazal and Unity state.
- In this year (2006), the project requirements were prepared in four southern states as a preliminary step for the start of work in these states.
- The average percentage of coverage of health facilities at all levels in these states in year 2006 was 71.3%. The projects succeeded in establishment of good storage facilities and good chain of distribution. It attracted hundreds of pharmacists and other health and financial professionals to join.

1.8.2.3.4 Delivery through the popular Pharmacies

The main purpose behind the establishment and continuation of the popular pharmacies, had been and is still, to avail vital medicines to the community and to limiting of the increase in drug prices, in the private pharmacies. Currently, the corporation owns 12 popular pharmacies. These pharmacies had been and they are still

one of the means for the distribution of the drug, accessibility and availability to the citizens in affordable prices.

1.8.2.3.5 Direct delivery system:

The drug policy had recommended a feasibility study of a direct delivery system under which the successful companies in tenders are asked to deliver the awarded orders directly to the states and hospitals; nevertheless, this system has its negative aspects. The most serious and risky one among these is leaving the issue of the national drug security and the guarantee of the quality of the public sector's drugs and medical consumables to the importers and distributors in the private sector.

1.9. Aims and Objectives of the research:

1.9.1 Aim:

To study the availability of Essential medicines (those procured by Central Medical Supplies public corporation only) in the previous five years in CMSPC and at some federal health facilities to explore the strengths and weaknesses in order to draw recommendations to insure the optimum level of availability of medicines at different health facilities in the country .

1.9.2 Specific Objectives

- To measure the availability of Key items of essential medicines in the previous five years in CMSPC and current availability at federal level of public sector health facilities in Khartoum State and CMSPC.
- To estimate the duration of stock out for the same Key items in CMSPC
- To measure the percentage of drug expiry of Key items at federal level of public sector in Khartoum State and CMSPC.
- To determine the obstacles facing the continuous supply of essential medicines.

CHAPTER 2

2. Methodology:

2.1 Research Design:

The study was conducted in the national capital (Khartoum state) in the three main federal teaching hospitals (Khartoum, Omdurman and Khartoum North) and the main public supplier (Central Medical Supplies Public Cooperation). The samples chosen are indicative rather than fully representative. The three main teaching hospitals are located in the three largest cities in Sudan.

Study area:

The population of Khartoum (state) is about 7 million (**Sudan, 2007**) and represents 20% of the total population thus offers greater opportunity to cover a 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 rather better services, 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 (**Mohammed, N.K.et al 2006**). The small size of sample is because of the limited time.

Access to medicines was measured in terms of availability and stockout duration of essential medicines in three main federal teaching hospitals (public sector) in Khartoum state and Central Medical Supplies Public Cooperation.

Fifty seven key items of essential medicines of those provided and procured by CMSPC only (out of sum of 115 items) were selected. Most of these items are used in casualty department. These items were selected pharmacologically and distributed over twelve pharmacological groups **named** diagnostic agents, sera and immunoglobulin, plasma fraction, vaccines, anti-thrombic drugs, vascular shock, general and local anesthetics, muscle relaxant, medical consumable, parenterals, preoperative medication and blood bags. Each group is completed from the second group, those procured by CMSPC and Private sector, (sum of 385items).Appendix 1

Selection of items based on frequently ordered and needed ones monthly so as to measure their average availability at the time of visit.e.g. Seasonal items were excluded. Items used in specialized hospitals (Cytotoxics, Antituberculosis, etc) were excluded.e.g. (Dialysis drugs, etc)

Items ordered directly from pharmacies were excluded e.g. pyridostigmine tabs. Most medical consumable were excluded except Absorbent gauze, Cotton, Plaster of paris size 6 and 8 inches and orthopedic cotton pads size 6 and 8 inches.

Retrospective data to measure the **availability** and **stockouts** of the key items in the previous five years was taken from document review in Planning and Training department in CMSPC (The main public supplier).The availability and stockouts were measured in terms of months in the previous years. The data sheet for collection of data includes Description of the selected fifty seven items, their pharmacological groups, successive five years starting from 2002 up to 2006; availability of all items was recorded in number of months available within the whole year. Appendix 2

On sight observation by check list of current availability of the key items of essential medicines and percentage of medicines expired at public health facility in Khartoum state covering the main three teaching hospitals (Khartoum, Omdurman and Khartoum north) was taken, which is the basic measure of access to essential medicines, using survey form 1 of Level II core indicators to gather information about the current availability (WHO 2003). The data sheet for collection of data of current availability includes:

Name of facility, Region, Date of collection of data, investigator, Description of items, Group, Availability at time of visit [B] (If yes=1 and no=0).

Expired medicines on shelves[C] (yes=1 and no=0).

[B1] is the sum of key medicines available B.

The percentages of key medicines available in stock [B2] =B1 divided by total number of medicines in the list (57) and multiplied by 100. Appendix 3

The percentages of medicines expired per public health facility [C2] = C1 (sum number of expired medicines [C]) divided by total number of available medicines in the list (57)

and multiplied by 100 using survey form 1 of Level II core indicators to gather information about the current availability (WHO 2003) Appendix 3.

The national indicator for public health facility in Khartoum state was calculated as the sum of percent availability in the selected public health facility (total sum of percentages in the three teaching hospitals) divided by the number of public health facility sampled. (3)

In addition current availability of the key items of essential medicines and percentage of medicines expired in CMSPC was taken in a similar way using survey form 13 of Level II core indicators to gather information about the current availability (WHO 2003). Appendix 4.

Stockout duration in CMSPC for the selected key item in year 2006 was measured using survey form 14 of Level II core indicators to gather information about the current availability (WHO 2003). The data sheet for collection of data includes:-

The name of studied indicator (Average stock duration and Adequate record keeping), Name of facility, Region, Date of collection of data, investigator, Description of items.

Records cover at least 6 month within the last 12 month [B] (yes=1, no=0)

The number of days out of stock = [C].

The number of days covered by the review = [D].

The equivalent number of days per year [E] = $C \times 365 / D$.

[B1]= sum of B

[B2]=%adequate records= $B1/57 \times 100$.

[E1] =sum of E.

[F] =The average number of stockout days= $E1/B1$. Appendix 5.

The purpose was to measure availability of these Fifty seven key medicines of essential medicines in public health facilities and Central medical supplies public corporation.

Physical availability is a basic measure of access to essential medicines. The selected key essential medicines were listed and their availability was identified during the time of the visit.

Interviewing by Standardized, self administered Questionnaire was carried out in the three main teaching Hospitals (Khartoum, Omdurman and Khartoum north) at federal level in Khartoum state with the senior pharmacist and was relevant to the selected key items. Level I core indicators (WHO 2003). It contains nineteen questions covering source of purchases of medicines, allocated budget by facility, and mechanism of drug financing, percentages of availability of selected items generally and in casualty department, other option of supply during shortages, affordability, expiration, stockout duration, etc Appendix 6.

2.2 Data analysis:

Data were analyzed using SPSS version 10.0 and presented descriptively (minimum, maximum and median percentages). Kruskal–Wallis test was carried out. Significance level chosen was 0.05.

Kruskal–Wallis test is a non-parametric test (distribution-free) used to compare three or more independent groups of sampled data.

The same test was used in study carried out in Malaysia by the title ‘Are essential medicines in Malaysia accessible, affordable and available?’

Cross tabulation was carried out for the analysis of the questionnaire using SPSS version 10.0.

Data gathered from document review (retrospective data), prospective current availability and Standardized, self administered Questionnaire have been analyzed by SPSS version 10.0.

2.3 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.

CHAPTER 3

3. Results:

In the three main teaching hospitals in Khartoum state, the average percentage of current availability of key medicines was 96.97% using survey form 1 core indicator (WHO 2003) with a minimum of 93% and a maximum of 100%.

In Central Medical Supplies Public Corporation, the average current availability was 89.3% using survey form 13 core indicator(WHO 2003), and 84.9% in the last five previous years for duration availability of 10-12 month. The same duration availability was 73.3% in year 2002 and 90.6% in 2006. (Table 3.8)

The average percentage of medicines expired in Khartoum state was 0% using survey form 1 core indicator (WHO 2003)

The average percentage of medicines expired in CMSPC was 0% using survey form 13 core indicator.

In CMSPC the average number of stockout days was 20.6 and 91% adequate records for the selected items of availability records covering at least 6 month within the last 12 month using survey form 14 core indicators.

3.1 Level II: Core indicator results:

Summary of the Level II core indicator results:

Table3.1: Public sector facilities and Central warehouse results:

Indicators	Public health facilities(n=3)	Central warehouse supplying public sector (n=1)
Access		
Availability of key medicines	96.97%	89.3%
Average stockout duration	-	20.6 days
% of expired drugs	0%	0%

n=3 (main teaching hospital in Khartoum state). n=1(main CMSPC).

3.2 Test for availability in public health facilities:

Crosstabs - table 3.2:

region * case Crosstabulation

Count		case			Total
		available	not available	not ordered	
region	omdurman	44	1	12	57
	khartoum north	51		6	57
	khartoum	53	4		57
Total		148	5	18	171

NPar Tests

Kruskal-Wallis Test – table 3.3:

Ranks

case	N	Mean Rank
frequencies available	148	97.50
not available	5	3.00
not ordered	18	14.50
Total	171	

Table 3.4: Test of significance for availability:

Test Statistics^{a,b}

	frequencies
Chi-Square	64.325
df	2
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: case

3.3 Test for Expiry of medicines in public health facilities:

Crosstabs – table 3.5:

region * case Crosstabulation

Count		case		Total
		not expired	not orderd	
region	omdurman	45	12	57
	khartoum north	51	6	57
	khartoum	57		57
Total		153	18	171

NPar Tests

Kruskal-Wallis Test – table 3.6

Ranks

case	N	Mean Rank
frequencies not expired	153	95.00
not orderd	18	9.50
Total	171	

Table 3.7: Test of significance for expiration

Test Statistics^{a,b}

	frequencies
Chi-Square	52.334
df	1
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: case

3.4 Test for availability in CMSPC:

Table 3.8: Year * availability duration Crosstabulation

year * avialability duration Crosstabulation

Count		avialability duration				Total
		new or delete	4-6	7-9	10-12	
year	2002	12	5	7	33	57
	2003	7	4	4	42	57
	2004	6	3	5	43	57
	2005	4		5	48	57
	2006	4	3	2	48	57
Total		33	15	23	214	285

The number of new items or deleted ones was subtracted from total each year in the calculation of percentage of availability duration.

NPar Tests

Kruskal-Wallis Test- table 3.9

Ranks

	availability duration	N	Mean Rank
frequency	4-6	15	13.53
	7-9	23	23.39
	10-12	214	145.50
	Total	252	

Table 3.10: Test of significance for availability

Test Statistics^{a,b}

	frequency
Chi-Square	103.573
df	2
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: availability duration

3.5 Results from Questionnaire at federal level in Khartoum state:

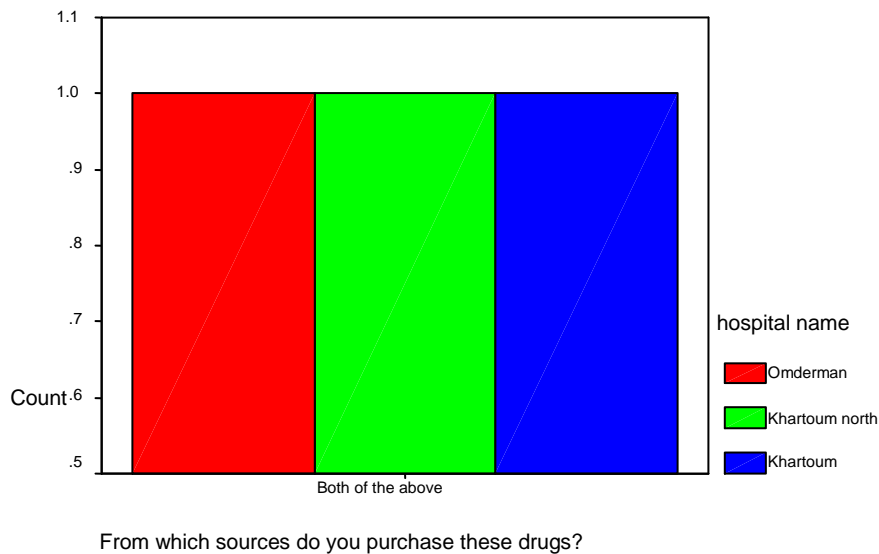
Crosstabs- table 3.11:

(Table 3.11.1): Source of purchase of drugs

(1) From which sources do you purchase these drugs? * hospital name Crosstabulation

Count		Hospital name			Total
		Omderman	Khartoum North	Khartoum	
From which sources do you purchase these drugs?	Both of the above	1	1	1	3
Total		1	1	1	3

Figure 3.1: Source of purchase of drugs



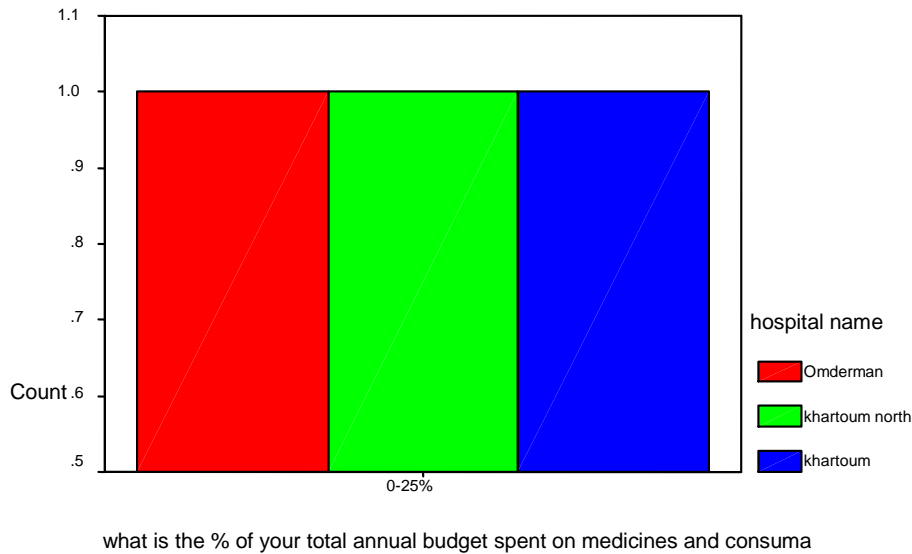
(Table 3.11.2): % of medicines and consumable out of total annual budget

(2)What is the % of your total annual budget spent on medicines and consumable? * hospital name Crosstabulation

Count

	Hospital name			Total
	Omderman	khartoum north	khartoum	
what is the % of your total annual budget spent on medicines and consumable?	1	1	1	3
Total	1	1	1	3

Figure 3.2: % of medicines and consumable out of total annual budget

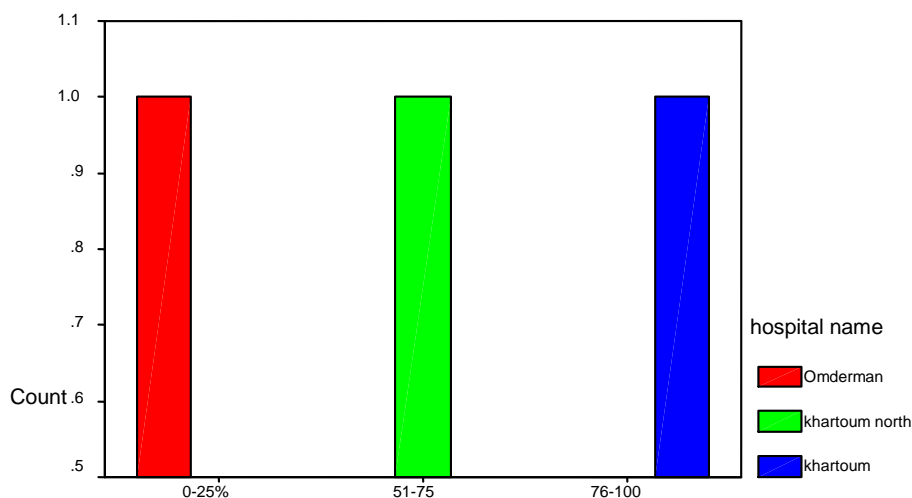


(Table 3.11.3): % of your total annual budget spent on medicines and consumable from CMSPC

(3)What is the % of your total annual budget spent on medicines and consumable from CMSPC? * hospital name

Count	hospital name			Total
	Onderman	khartoum north	khartoum	
what is the % of your total annual budget spent on medicines and consumable from CMSPC? 0-25%	1			1
51-75		1		1
76-100			1	1
Total	1	1	1	3

Figure 3.3: % of your total annual budget spent on medicines and consumable from CMSPC



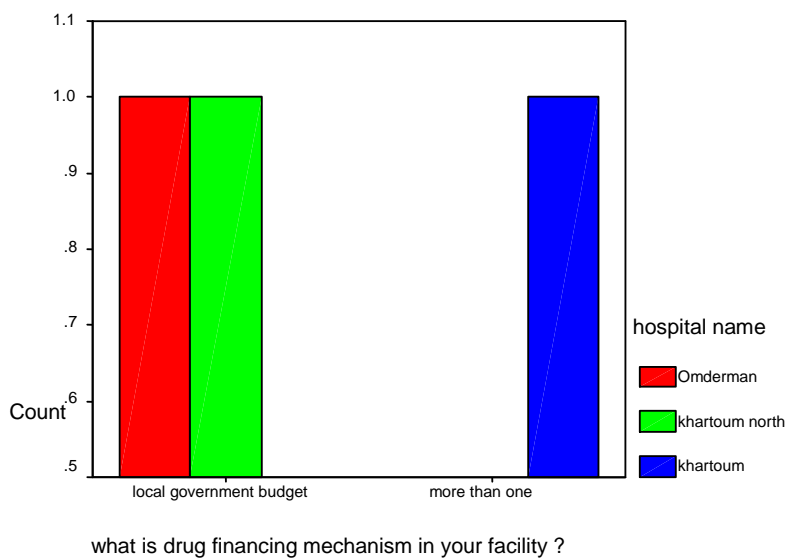
what is the % of your total annual budget spent on medicines and consumable from CMSPC?

(Table 3.11.4): drug financing mechanism

(4) What is drug financing mechanism in your facility? * hospital name Crosstabulation

Count		hospital name			Total
		Onderman	khartoum North	khartoum	
what is drug financing mechanism in your facility ?	local government budget	1	1		2
	more than one			1	1
Total		1	1	1	3

Figure 3.4: drug financing mechanism

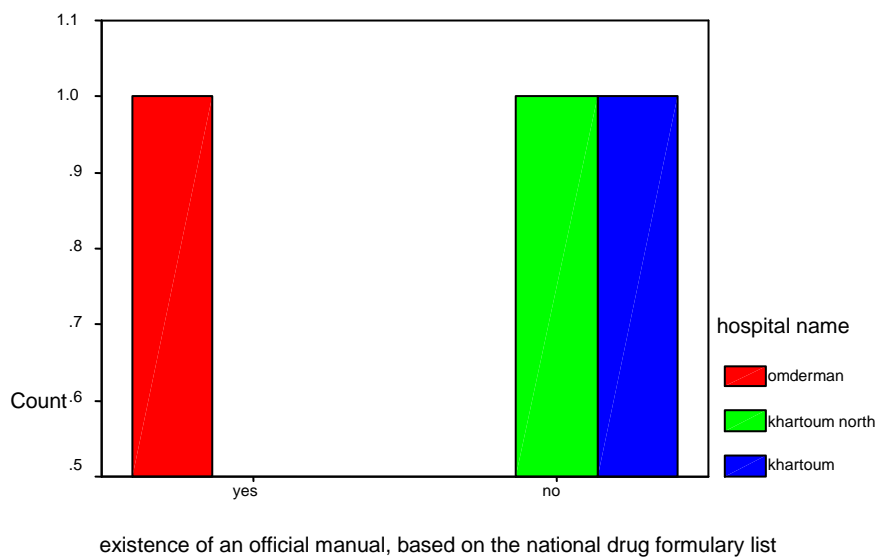


(Table 3.11.5): Existence of an official manual national drug formulary list

(5) Existence of an official manual, based on the national drug formulary list, providing basic drug information to Prescribers, revised and published within the last five years? * hospital name Crosstabulation

Count		hospital name			Total
		Omderman	khartoum north	khartoum	
existence of an official manual, based on the national drug formulary list , providing basic drug information to prescribes , revised and published within the last five years?	yes	1			1
	no		1	1	2
Total		1	1	1	3

Figure 3.5: Existence of an official manual national drug formulary list



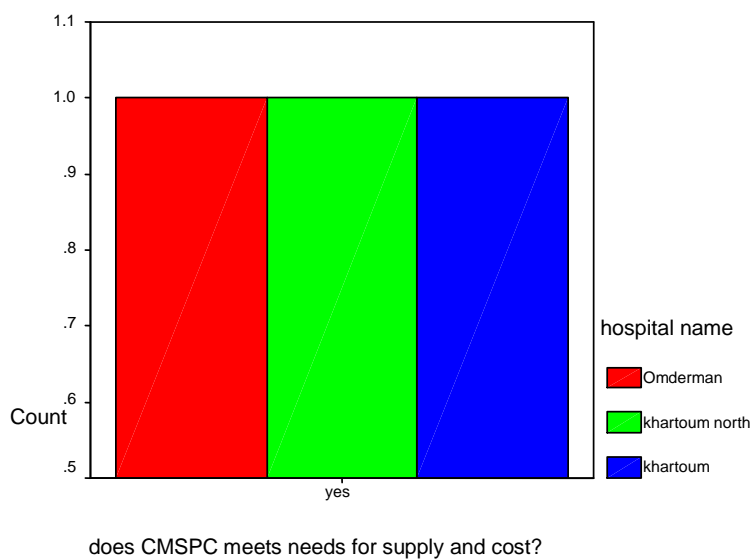
(Table 3.11.6): Needs for supply and cost in CMSPC

(6) Does CMSPC meets needs for supply and cost? * hospital name Crosstabulation

Count

	hospital name			Total
	Onderman	khartoum north	khartoum	
does CMSPC meets needs for supply and cost? yes	1	1	1	3
Total	1	1	1	3

Figure 3.6 Needs for supply and cost in CMSPC:



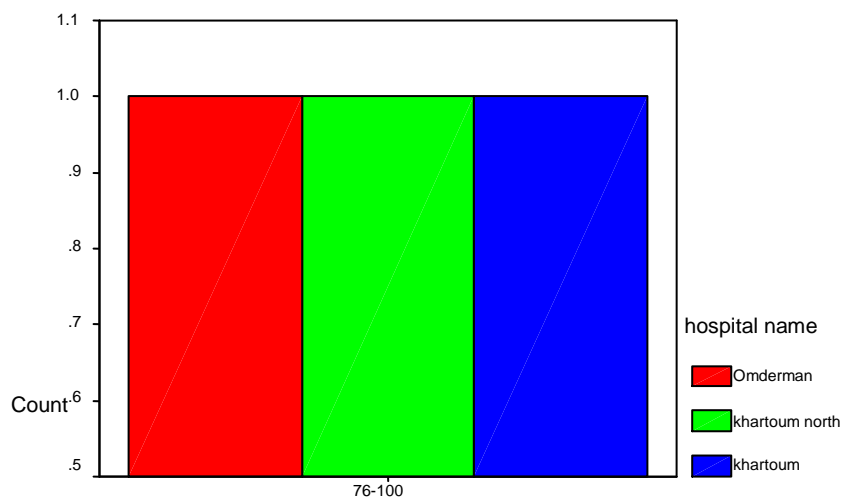
(Table 3.11.7): percentages of number of items supplied by CMSPC from the list of vital items attached

(7) Please specify the percentages of number of items supplied by CMSPC from the list of vital items attached?

Count * hospital name Crosstabulation

	hospital name			Total
	Omderman	khartoum north	khartoum	
please specify the percentages of number of items supplied by CMSPC from the list of vital items attached?	1	1	1	3
Total	1	1	1	3

Figure 3.7: percentages of number of items supplied by CMSPC from the list of vital items attached



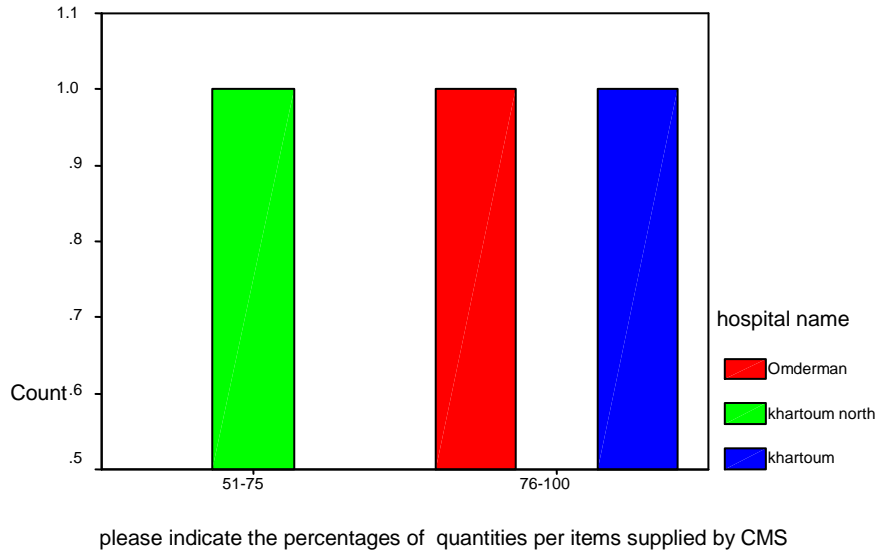
please specify the percentages of number of items supplied by CMSPC from the list of vital items attached ?

(Table 3.11.8): percentages of quantities per items supplied by CMSPC from the original quantities ordered

(8)Please indicate the percentages of quantities per items supplied by CMSPC from the original quantities ordered? * hospital name Crosstabulation

Count		hospital name			Total
		Onderman	khartoum north	khartoum	
please indicate the percentages of quantities per items supplied by CMSPC from the original quantities orderd?	51-75		1		1
	76-100	1		1	2
Total		1	1	1	3

Figure 3.8: percentages of quantities per items supplied by CMSPC from the original quantities ordered



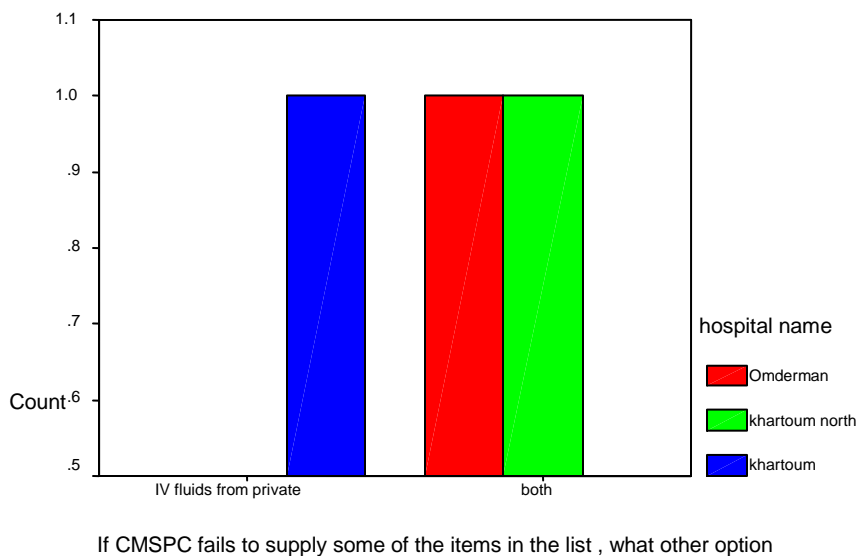
(Table 3.11.9): Other options of supply in case of CMSPC failure

(9) If CMSPC fails to supply some of the items in the list, what other options do you have? *
hospital name Crosstabulation

Count

		hospital name			Total
		Onderman	khartoum north	khartoum	
if CMSPC fails to supply some of the items in the list , what other options do you have?	IV fluids from private sector			1	1
	both	1	1		2
Total		1	1	1	3

Figure 3.9: Other options of supply in case of CMSPC failure

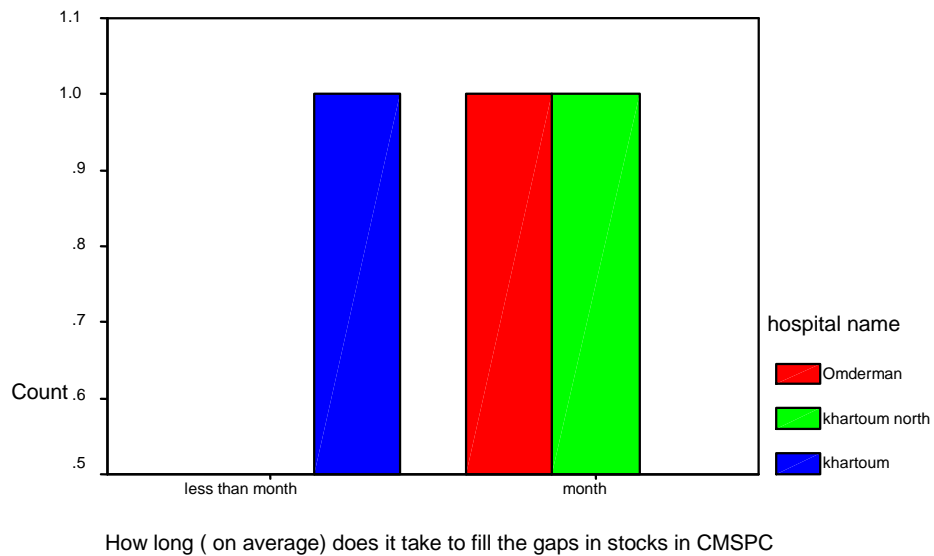


(Table 3.11.10): Average time to fill the gaps in stocks in CMSPC

**(10) How long (on average) does it take to fill the gaps in stocks in CMSPC ? * hospital name
Crosstabulation**

Count		hospital name			Total
		Onderman	khartoum north	khartoum	
how long (on average) does it take to fill the gaps in stocks in CMSPC ?	less than month			1	1
	month	1	1		2
Total		1	1	1	3

Figure 3.10: Average time to fill the gaps in stocks in CMSPC

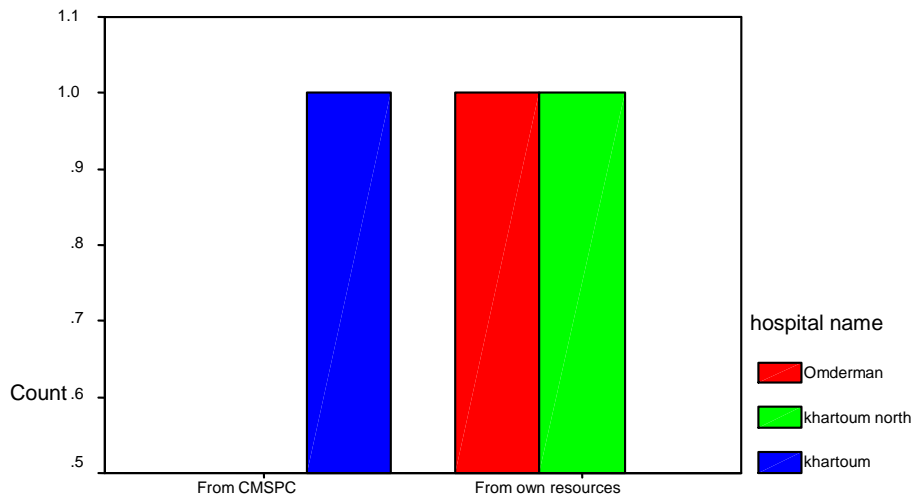


(Table 3.11.11): the possible arrangements to fill the gap during financial constrains

(11) If there are financial constraints what are the possible arrangements that can be made to fill the gap? * hospital name Crosstabulation

Count		hospital name			Total
		Omderman	khartoum north	khartoum	
if there are financial constraints what are the possible arrangements that can be made to fill the gap?	from CMSPC			1	1
	from own resources	1	1		2
Total		1	1	1	3

Figure 3.11: the possible arrangements to fill the gap during financial constrains



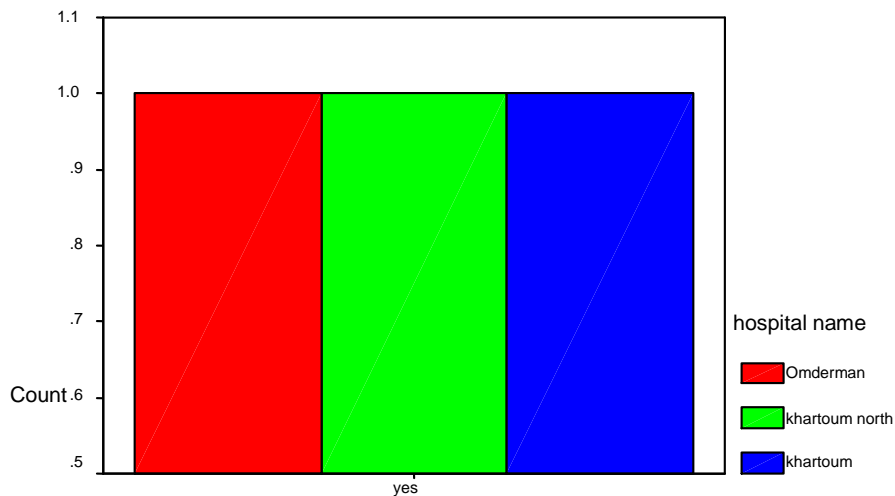
If there are financial constraints what are the possible arrangements that can be made to fill the gap?

(Table 3.11.12): Quantities supplied for casualty department from those items enough for 24 hours

(12) Are the quantities supplied for casualty department from those items enough for 24 hours? * hospital name Crosstabulation

Count	hospital name			Total
	Omderman	khartoum north	khartoum	
Are the quantities yes supplied for casualty department from those items enough for 24 hours?	1	1	1	3
Total	1	1	1	3

Figure 3.12: Quantities supplied for casualty department from those items enough for 24 hours



Are the quantities supplied for casualty department from those items enough for 24 hours?

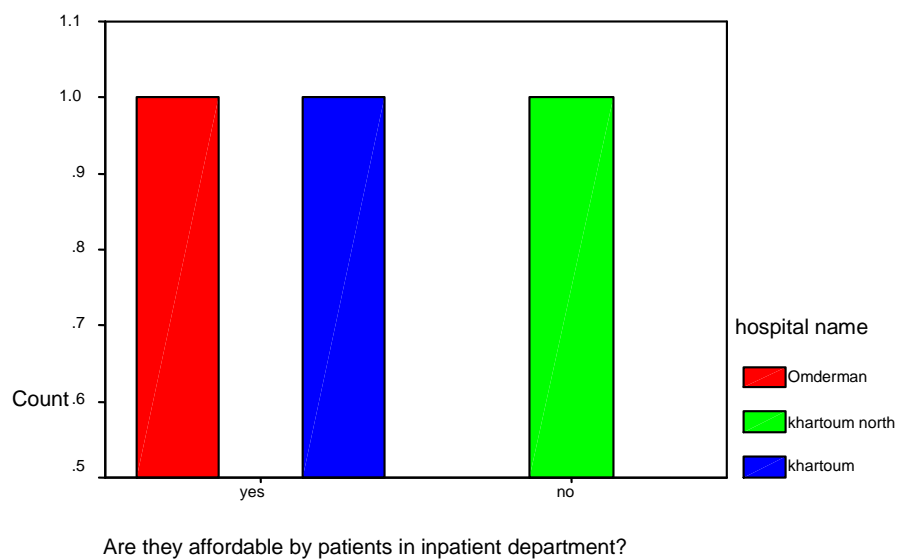
(Table 3.11.13): Affordability by patients in inpatient department

**(13) Are they affordable by patients in inpatient department? * hospital name
Crosstabulation**

Count

		hospital name			Total
		Onderman	khartoum north	khartoum	
Are the affordable by patients in inpatient department?	yes	1		1	2
	no		1		1
Total		1	1	1	3

Figure 3.13: Affordability by patients in inpatient department

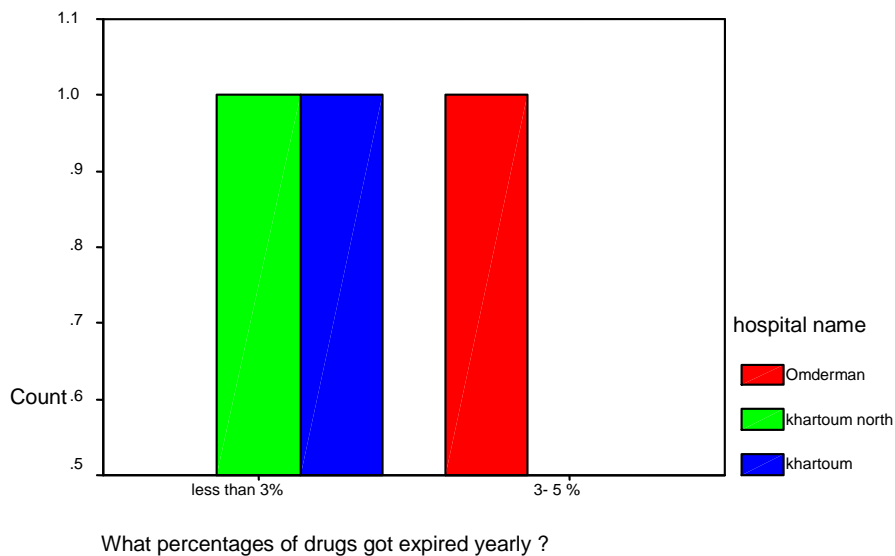


(Table 3.11.14): Percentages of drugs got expired yearly

(14) What percentages of drugs got expired yearly ? * hospital name Crosstabulation

Count		hospital name			Total
		Omderman	khartoum north	khartoum	
What percentages of drugs got expired yearly ?	Less than 3%		1	1	2
	3- 5 %	1			1
Total		1	1	1	3

Figure 3.14: Percentages of drugs got expired yearly



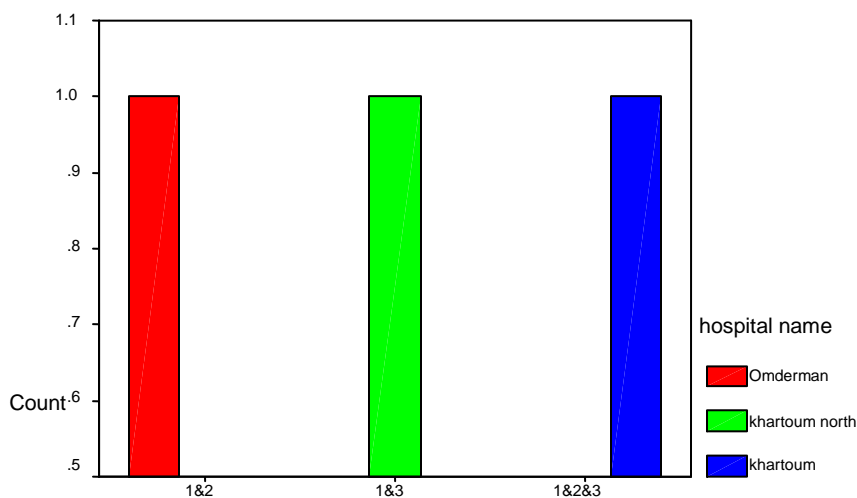
(Table 3.11.15): Improvement in access to medicines in a facility

(15) Is the improvement in access to medicines for a facility passed on to patients due to *
hospital name Crosstabulation

Count

		hospital name			Total
		Omderman	khartoum north	khartoum	
Is the improvement in access to medicines for a facility passed on to patients due to	1&2	1			1
	1&3		1		1
	1&2&3			1	1
Total		1	1	1	3

Figure 3.15: Improvement in access to medicines in a facility



Is the improvement in access to medicines for a facility passed on to patients due to:

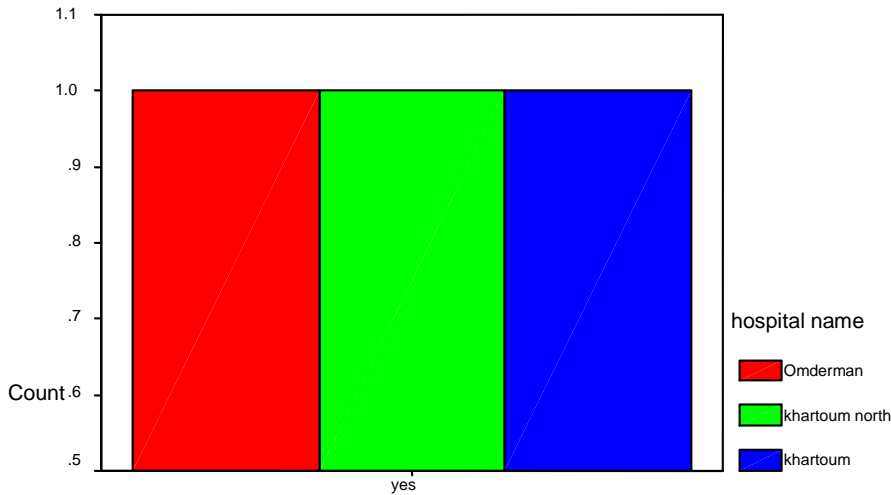
(Table 3.11.16 ii): Presence of pharmaceutically trained person per facility for quantification of drug needs

(16 ii) Do you have a pharmaceutically trained person per facility for quantification of drug needs? * hospital name Crosstabulation

Count

	hospital name			Total
	Omderman	khartoum north	khartoum	
Do you have a pharmaceutically trained person per facility for quantification of drug needs ?	1	1	1	3
Total	1	1	1	3

Figure 3.16 ii: Presence of pharmaceutically trained person per facility for quantification of drug needs



Do you have a pharmaceutically trained person per facility for quantification of drug needs?

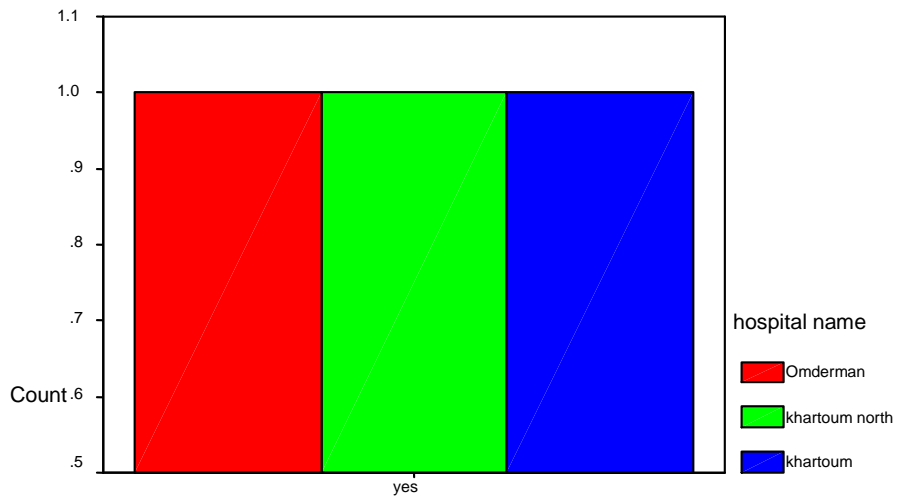
(Table 3.11.16 iii): Presence of pharmaceutically trained person per facility for drug store management

(16 iii) Do you have a pharmaceutically trained person per facility for drug store management? * hospital name Crosstabulation

Count

	hospital name			Total
	Omderman	khartoum north	khartoum	
Do you have a pharmaceutically trained person per facility for drug store management ? yes	1	1	1	3
Total	1	1	1	3

Figure 3.16 iii: Presence of pharmaceutically trained person per facility for drug store management



Do you have a pharmaceutically trained person per facility for drug store management

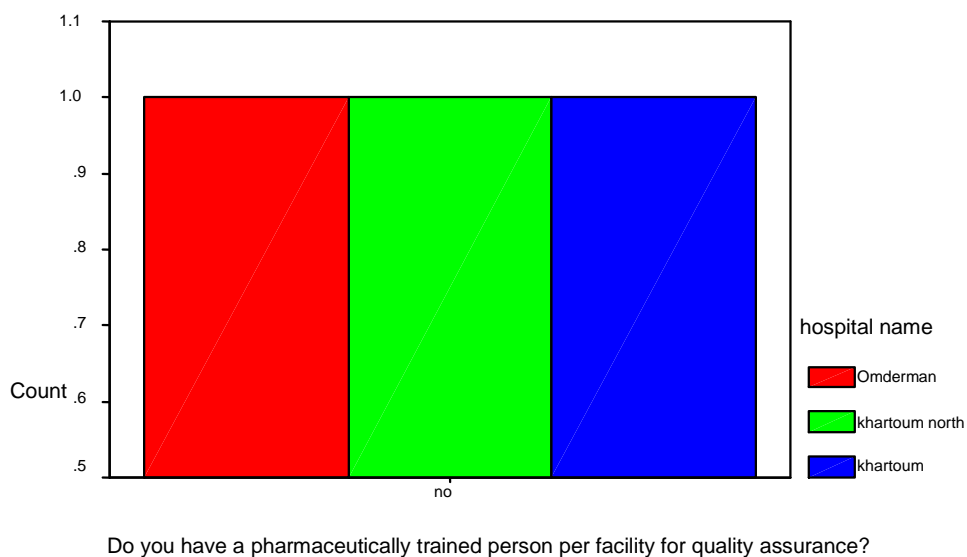
(Table 3.11.16 iv): Presence of pharmaceutically trained person per facility for quality assurance

(16 iv) Do you have a pharmaceutically trained person per facility for quality assurance? * hospital name Crosstabulation

Count

	hospital name			Total
	Onderman	khartoum north	khartoum	
Do you have a pharmaceutically trained person per facility for quality assurance? no	1	1	1	3
Total	1	1	1	3

Figure 3.16 iv: Presence of pharmaceutically trained person per facility for quality assurance



(Table 3.11.16 v): Presence of pharmaceutically trained person per facility for unit Costing

(16 v) Do you have a pharmaceutically trained person per facility for unit costing ? *
hospital name Crosstabulation

Count

	hospital name			Total
	Omderman	khartoum north	khartoum	
Do you have a pharmaceutically trained person per facility for unit costing ?	1	1	1	3
Total	1	1	1	3

Figure 3.16 v: Presence of pharmaceutically trained person per facility for unit Costing



(Table 3.11.16 vi): presence of pharmaceutically trained person per facility for record and data management

(16 vi) Do you have a pharmaceutically trained person per facility for record and data management? * hospital name Crosstabulation

Count

	hospital name			Total
	Omderman	khartoum north	khartoum	
Do you have a pharmaceutically trained person per facility for record and data management? no	1	1	1	3
Total	1	1	1	3

Figure 3.16 vi: presence of pharmaceutically trained person per facility for record and data management

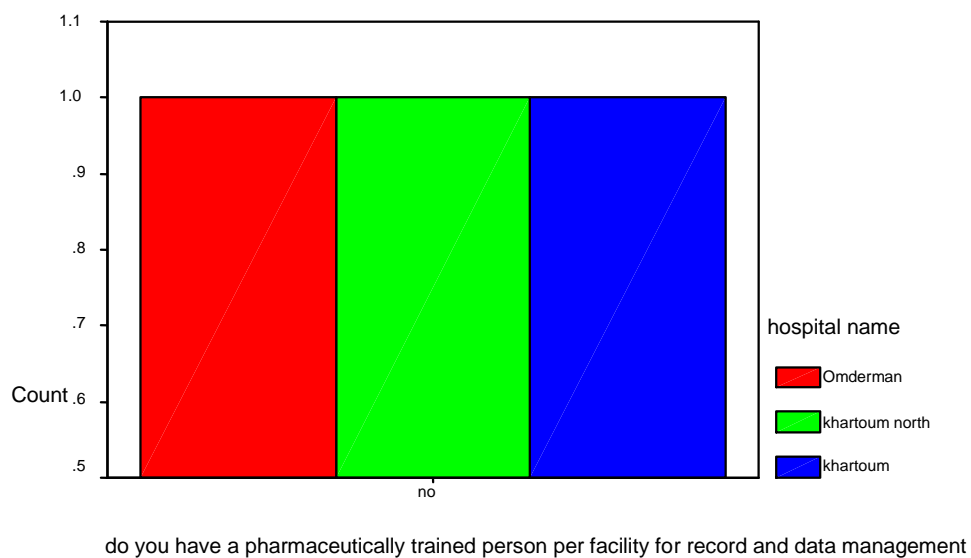


Table 3.11.17: Method used for quantification

(17) Which method used for quantification? * hospital name Crosstabulation

Count		hospital name			Total
		Omderman	khartoum north	khartoum	
Which method used for quantification?	conumption method	1	1	1	3
Total		1	1	1	3

Figure 3.17 :Method used for quantification

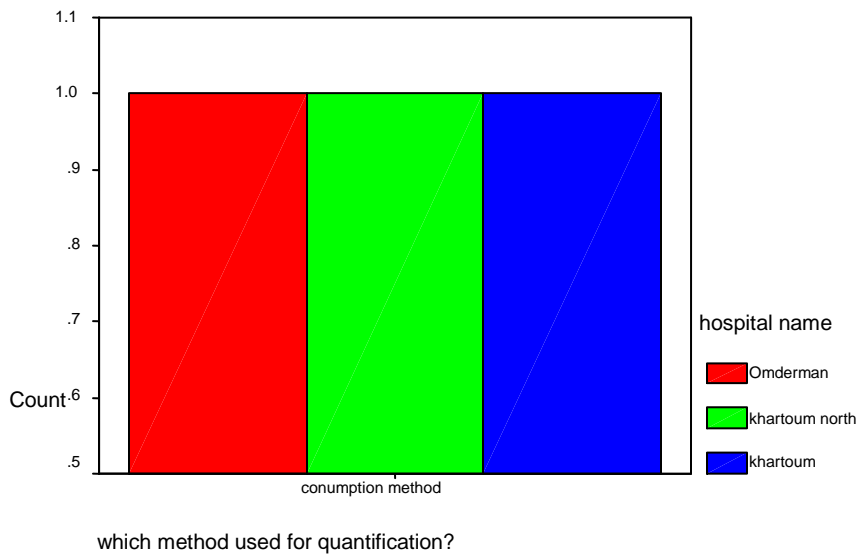


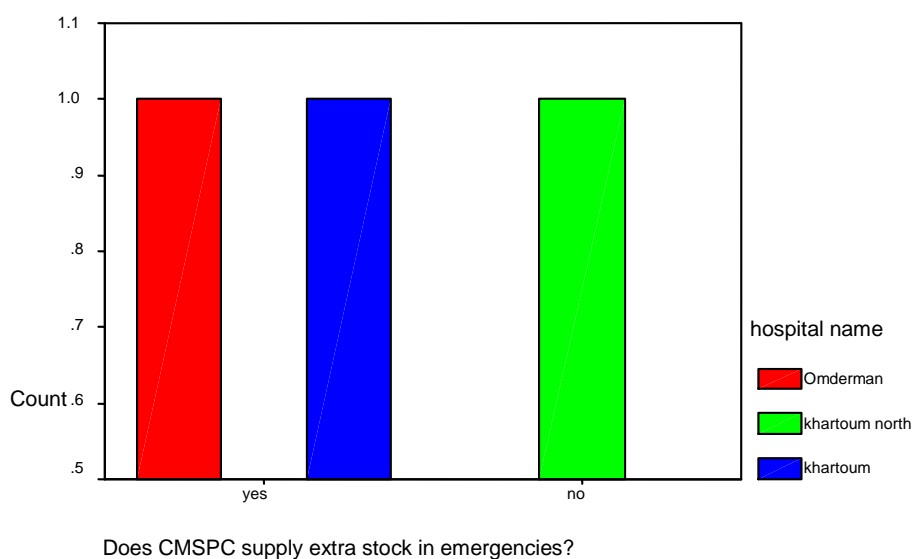
Table 3.11.18: stock in emergencies by CMSPC

(18) Does CMSPC supply extra stock in emergencies? * hospital name Crosstabulation

Count

		hospital name			Total
		Onderman	khartoum north	khartoum	
Does CMSPC supply extra stock in emergencies?	yes	1		1	2
	no		1		1
Total		1	1	1	3

Figure 3.18: stock in emergencies by CMSPC



CHAPTER 4:

Discussion:

In terms of accessibility, with reference to results before, Table 3.1, the three federal public health facilities (main teaching hospitals) located in Khartoum state was found to have a high percentage of availability of selected key medicines (96.97%). Significant value was found 0.00 (P-value is < 0.05) using SPSS, Kruskal-Wallis test. (Table 3.4) which proves that there were significant difference between the three main teaching hospitals in terms of availability of the selected key medicines.

A similar study was carried out in Malaysia in public health clinics, district drug stores and private retail pharmacies to assess the pharmaceutical sector with a research title ‘Are essential medicines in Malaysia accessible, affordable and available?’ (Ibrahim, et al 2005). The average availability was found to be 95.4% in public health clinics and agreed with WHO Action Programme on Essential Medicines that the level of accessibility of essential medicines to the population in Malaysia was between 70 and 95 %.(Antezana, 1992).

Another study was carried in Ghana and the survey was conducted according to the WHO “Operational Package for Monitoring and Assessing the Pharmaceutical Situation in Countries – (Working Draft November 2002).

The results for Public sector facilities in Ghana were as follows :(MOH, 2002)

Indicator	Median	Average
Access		
Availability of key drugs	78.6%	73.9%
% of expired drugs	0%	3.7%

In Sudan, the average percentage of availability of essential drugs and other drugs at revolving Drug fund (RDF) health facilities (1996-1999) was 97.25% (Mohammed, 2000).

RDF is solely derived from sales of drugs at the health facilities. The Revolving Drug Fund (RDF) together with the primary health care project Comprehensive Child Care (CCC) makes up the KCCCP which is a joint health programme between the SCF (UK) and MOH (KS). RDF at its initiative was to supply drugs to health centers as a precondition of the quality of health care. (Mohammed, 2000)

The current availability percentage of federal public health facilities in Khartoum state compared with Malaysia and Ghana was found to be high. It's also similar to that of RDF health facilities in Sudan. This might prove the sustainable supply system of selected key items provided by CMSPC only as they are considered strategic items with top priority. In addition most of them are used in casualty department and paid for by government.

There was no expiration in the key items of essential medicines at the time of the visit at federal facilities in Khartoum state (Table 3.1) significant value was 0.00 (P-value < 0.05) using SPSS, Kruskal-Wallis test. (Table 3.7) which proves that there were significant difference between the three main teaching hospitals in terms of not expired items of the selected key medicines.

The common quantification method used is past consumption in all public facilities which is not reliable in some items. Complete absence of morbidity method which is more reliable in assessing needs leads to wrong estimation of the right quantities needed. This absence is due to unreliable morbidity data.

It was observed that not all the selected key items were ordered by all the public health facilities in the survey form 1 of Level II core indicators to gather information about the current availability (WHO 2003).(Appendix 1) Some hospitals use other concentrations or sizes or alternatives e.g. (Intravenous fluids, Albumin 22% solution, plaster of Paris size 6 inch, orthopedic padding size 6 inch, triple blood bags,) while others are not used in their relevant units (Factor VIII fraction, factor IX fraction, antiscorpion, anti snake

venom, morphine tabs).Some of the items (anesthetics and muscle relaxant) were newly added to the list of medicines in CMSPC, and are still not introduced in some public health facilities. This variation may be due to the absence of standard treatment guidelines (STGs) and also some diseases are catered for by some specialized centers like hemophilia.

In the national Public supplier, CMSPC the duration of availability per months was grouped into four categories (0-3month, 4-6month, 7-9month and 10-12 month) and then analyzed using SPSS.The new items added to or deleted items from the list were subtracted from the total number of the selected fifty seven items each year. The average availability of the items for duration of 10-12 month in the previous five years was 84.9% .This was calculated by dividing the sum total of items available (214) in previous five years for duration of (10-12) month over the difference between the total sum of selected items (285) and the total number of new or deleted items (33) within the five years.

(Table 3.8) and significant value was 0.00 (P-value is < 0.05). (Table 3.10) which proves that there were significant difference between the previous five years (2002-2006) in terms of availability of the selected key medicines.

The yearly average availability duration was 73.3%, 84%, 84.3%, 90.6% and 90.6% successively starting from year 2002 calculated as shown above yearly for the same duration. (Crosstab, table3.9). The stockout duration percentage was decreasing successively from 26.9% to 9.4%.

There were no items with minimum duration of 0-3 month availability in all successive years because all were newly added items to or deleted from the original list.

The current availability in CMSPC was found to be 89.3% with 0% of expired drugs. (Table 3.1)

The average stock-out duration in CMSPC was 20.6 days. (WHO 2003) (Table 3.1)

However in Malaysia, average percent availability of key medicines for the public district drug stores in the country was 89.2% with a minimum of 76.9%, a maximum of 100.0%. The average stock-out duration was 32.4 days with a minimum of 9.9 days and a maximum of 61.6 days. (Ibrahim, et al 2005).

In the study of Ghana the result was as follows: (MOH,2002)

The results for Warehouses supplying public sector:		
Indicator	Median	Average
Access		
Availability of key drugs	82.2%	82.2%
Average stock out duration	50.7 days	39.3 days
% of expired drugs	0%	0%

The current availability percentage of CMSPC compared with Malaysia and Ghana was found to be high and average stockout duration was less than that of Ghana.

There was no expiration as well as Ghana.

The questionnaire result gave a range of yearly expiration of 0 - 3% (Table 13.14 and figure 3.14), which is acceptable according to Quick, et al 1997 p.229 who stated ‘the expiry costs are often 3-5% of drug inventory each year.’

From the questionnaire the public health facility agreed on purchasing their drugs both from private sector and government stores. (Table 13.1,figure3.1).The percent of annual budget for medicines in all facilities out of the total facility budget ranges between 0-25percent which should be increased by the influence of senior pharmacist in hospital committee. (Table 13.2, figure 3.2).

100 percent of the facilities depend totally on Local government budget which is directly transferred to CMSPC, and agreed that CMSPC meets their needs for the selected key items and the quantities supplied for casualty department were enough for the

estimated and specified 24 hours. (Table 13.4, 13.6, and 13.12, figure 3.4, 3.6 and 3.12). This ensures the fair distribution of government budget and proves that CMSPC complies with the functions (selection, procurement and distribution) of drug management cycle.

Some Intravenous fluids, cotton and plaster of paris are purchased from private sector (Table 13.9, figure 3.9).

The gap of shortages in stock in CMSPC used to be filled within a month by 66 percent of the facilities and they use their own resources if they had any financial constrains. (Table 13.10 and 13.11, figure 3.10 and 3.11). While 33 percent of the facilities take less than a month to fill the gap and usually contact CMSPC and make the suitable arrangement of payment. (Table 13.10 and 13.11, figure 3.10 and 3.11).

Medicines are affordable in inpatient department in 66 percent of the facilities. (Table 13.13 , figure 3.13). Pubic health insurance should cover the cost of medicines for inpatient in inpatients department in all public health facilities regardless of the patient state or assigned centre for receiving the prescribed drugs. In addition it must cover all range of essential medicines.

100 percent of the facilities agreed on having a pharmaceutically trained person on quantification of drug needs and drug store management (Table 13.16ii and 13.16iii, figure 3.16ii and 3.16iii), but there is clear weakness in all facilities of a pharmaceutically trained person in quality assurance, unit costing and record and data management. (Table 13.16iv, 13.16v and 3.16vi, figure 13.16iv, 13.16v and 3.16vi). Consumption method is the only method used in all facilities but morbidity method should also be used to avoid expiration of drugs and improve estimation of drug needs every year. (Table 13.17, figure 3.17).

CMSPC supplies extra stock in emergencies in 66 percent of the facilities, and this should be increased. 33 percent of health facilities do not resort for CMSPC in emergencies. (Table 13.18, figure 3.18). This necessitates that the federal ministry of health should have emergency funds to cover emergencies in hospitals.

Conclusion:

- The present study of current availability of essential medicines, those provided by CMSPC, in the context of selected list in public sector at federal level was found to be 96.97% at public health facilities and 89.3% at CMSPC which reflected that the majority of the population had access to essential medicines in federal hospitals in Khartoum state.
- The average availability of essential medicines in CMSPC in the previous five years was 84.9% and increasing across the five years as follows (73.3%(2002),84%(2003),84.3%(2004),90.6%(2005) and 90.6%(2006).
- Stock out duration in CMSPC in the context of selected list was found to be less than a month (20.6 days).
- Percent of expiration at public health facilities and CMSPC was 0% for the selected items.
- Minimum percent of annual budget is allocated for medicines in all facilities out of the total facility budget.
- Medicines are purchased both from private sector and Government stores.
- Public health facilities at federal level depend mainly on Government budget.
- There is clear weakness in all facilities of pharmaceutically trained personnel in quality assurance, unit costing and record and data management.
- Affordability to medicines at inpatient department is 66% at federal hospitals in Khartoum state.

Recommendation:

- This study should be extended to all the states at all levels of health care with relevant key items list.
- Strengthen the national health insurance scheme to improve (financial) access to drugs especially in inpatient department through a good reporting and recording system of patients within all states.
- Inclusion of people working in informal sector in the national health insurance system to guarantee their access to medicines.
- Extend current, or establish innovative, funding mechanisms to cover unaffordable treatments (especially for chronic conditions) and to improve the availability of medicines;
- Investigate the reasons for the variations in availability in public health facilities starting from federal level (to implement the practice of STGs)
- To minimize stockout duration through exchange of information between all sectors of supply and promotion of rational use at all levels of health and early awareness of pattern of consumption.
- Improve supplier performance to minimize the obstacles facing expected delivery time.
- Strengthening and enhancing the local production of medicines especially the production of life saving drugs because most of these medicines are imported.
- Establishment of an emergency fund in Central medical supplies to provide extra stock in case of emergencies.
- Strengthening and organizing the planning and statistics departments in hospitals to avail reliable morbidity and consumption data to guarantee the optimum supply.
- To improve the performance of drug committee in hospitals towards better engagement in drug policies and the issuance of drug formularies adjusted to the needs of the hospital.
- Conduction of intensive courses in drug use to guarantee the best usage of essential medicines.

References:

- Antezana, F.S. Essential medicines: Action for equity. *World Health* 1992; 45(2): 7–8.
- Central medical supplies public corporation (CMSPC) 2003, *Quality Manual*, QM-01-Unpublished.
- Central medical supplies public corporation (CMSPC) 2006, *Quarterly Strategy 2007-2031*, Medical Supply in Sudan.
- Central medical supplies public corporation (CMSPC) 2007, "Central Medical Supplies Public Corporation Warrant of Establishment 2007" – Unpublished
- Federal Ministry of health (FMOH), 2007. *5-year Health Sector Strategy: 2007-2011*, DRAFT 2-5-2-2007, Sudan.
- Foster, S., 1991. Supply and use of essential drugs in Sub-Saharan Africa: some issue and possible solutions. *Social Science & Medicine*, 32(11), 1201-1218.
- Geest, S., et al, 1990. "Planning for essential drugs: Are we missing the cultural dimension?" *Health Policy and Planning* 5:182-185.
- Helling-Borda, M., 1995. The role and experience of the World Health Organization in assisting countries to develop and implement national drug policy. *Australian Prescriber*, 20(Supp., 1), 34-38.
- Hogerzeil H.V., 2004, The concept of essential medicines: lessons for rich countries. *British Medical Journal*; 329: 1169-72. Drugs and Medicines Policy, World Health Organization. [online]. Available at: <http://www.essentialdrugs.org/edrug/archive/1999o8/msg00105.php> [Accessed May 2007]
- Hogerzeil, 2006, Essential medicines and human rights: what can they learn from each other? *Bull World Health Organ* vol.84 no.5 Geneva May 2006. Bulletin of the World Health Organization. [Online]. Available at: http://www.scielosp.org/scielo.php?script=sci_arttext&pid=S0042-96862006000500016&lng=en&nrm=iso&tlng=en 1) [Accessed May 2007]
- Ibrahim M.I.M. and Saleh, K., 2005. Are essential medicines in Malaysia accessible, affordable and available? Research article. *Pharm World Sci* (2005) 27: 442–446
- Ibrahim M.I.M., et al, (2007) Evaluating Drug Prices, Availability, Affordability, and Price Components: Implications for Access to Drugs in Malaysia. *PLoS Med* 4(3): e82 doi:10.1371/journal.pmed.0040082
- Jabir, M.H., and Komen, J., 1991. *Sudan National Formulary*. Sudan Medical Council.

Management Sciences for Health (MSH) 2003. International Drug Price Indicator Guide, *Medicines: too costly and too scarce* [Available at] <http://www.haiweb.org/medicineprices>, [Accessed may 2007]

Ministry of health (MOH), 2007. *National List of Essential Medicines, Fifth List 2007*, Republic of Sudan, Federal Ministry of Health, General Directorate of Pharmacy.

MOH, 2002. Republic of Ghana. *An assessment of pharmaceutical sector in Ghana, November, 2002*. [Available at] <http://search.live.com/results.aspx?srch=105&FORM=AS5&q=The+World+Health+Organization+in+collaboration+with+Health+Action+International+%e2%80%93+Africa%2c-Ghana+2002> [Accessed July 2007]

Mohammed, G.K., 2000. *Management of revolving drug fund: experience of Khartoum state-Sudan*. Msc.Thesis Dissertation. The school of Pharmacy, University of Bradford: UK.

Mohammed, N.K.et al, 2006. *Traffic Jams Analysis Using Case study Khartoum*, <http://www.gisdevelopment.net/application/urban/sprawl/mm017pf.htm>

Newton, P.N., et al., 2001. Fake artesunate in Southeast Asia. *The Lancet*, 357, 1948-1950.

Newton, P.N., et al, 2002. Murders by fake drugs- time for international action. *British Medical Journal*, 324,800-801.

Oxford University Press, 2001, *HEALTH POLICY AND PLANNING*; 16(1): 98–106, Revolving drug funds at front-line health facilities in Vientiane, Lao PDR [Online]. Available at <http://heapol.oxfordjournals.org/cgi/reprint/16/1/98.pdf> [Accessed July 2007]

Quick, J.D., et al., 1997. *Managing Drug Supply: Selection, Procurement, Distribution and Use of pharmaceuticals* 2nd ed. West Hartford, CT: Kumarian Press.

Quick, J.D. et al, 2002. Access to Essential Drugs: Twenty-five years of essential medicines. *Bulletin of the World Health Organization*, [Online]. Available at: http://www.sdchealth.ch/priorities_in_health/pro_poor_health_service/provision_of_essential_drugs [Accessed May 2007]

Quick, J.D. et al, 2007. Twenty-five years of essential medicines *Bulletin of the World Health Organization*, [Online]. Available at: http://www.scielosp.org/scielo.php?script=sci_arttext&pid=S0042-96862002001100014&lng=e&nrm=iso [Accessed May 2007]

Sudan, 2004. Country Profile: Library of Congress – Federal Research Division [Accessed on June 2007]

Sudan2007,<http://www.fco.gov.uk/servlet/Front?pagename=OpenMarket/Xcelerate/ShowPage&c=Page&cid=1007029394365&a=KCountryProfile&aid=1020687852749-Khartoum> state Sudan\Country Profiles Foreign & Commonwealth Office.htm

WHO 1996, Comparative analysis of international drug policies. Report of the second workshop. *Drug Action Programme*, World Health Organization, Geneva, June 1996.

WHO 1997, *Public-Private Roles in the pharmaceutical sector*, implication for equitable access and rational drug use, Health Economics and Drugs. Action Programme on Essential Drugs (DAP) Series No.5, World Health Organization, Geneva, Switzerland

WHO 1998, *Report of international Workshop on Counterfeit Drugs*. World Health Organization, Geneva. WHO/DRS/CFD/98.1.

WHO 2001, *Constitution of the World Health Organisation, 43rd edition* WHO Basic Document: Geneva

WHO 2002, The Selection of Essential Medicines, *WHO policy perspective on medicines* Number 4. World Health Organisation, Geneva.

WHO 2003, *Operational Package for Monitoring and Assessing Country Pharmaceutical Situations*, working draft June 2003.

WHO 2004a, *The world Medicines Situation*. World Health Organisation, Geneva. WHO/PAR/2004.5.

WHO 2004b, *WHO Medicine Strategy: countries at the core 2004-2007*. World Health Organisation, Geneva. WHO/PAR/2004.5.

WHO 2004c, Equitable access to essential medicines: a framework for collective action. *WHO policy Perspective on Medicines No 8*. World Health Organization, Geneva. WHO/EDM/2004.4. [Online]. Available at: <http://www.google.com/search?hl=en&q=Equitable+access+to+essential+medicines%3A+a+framework+for+collective+action> [Accessed May 2007]

WHO 2006, *Sudan\WHO EMRO - COUNTRY PROFILES* [Available at]: <http://www.emro.who.int/sudan/WorldHealthReport2006.htm>. [Accessed June 2007]

WHO 2007, Health System Delivery, *Health System Resource guide*, <http://www.eldis.org/healthsystems/delivery/> [Accessed may 2007]

