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**Evaluation of Direct observed treatment short-course
(DOTS) strategy in National Tuberculosis Control
Programme-Sudan**

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Environmental Health (MPEH), (Public Health)

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Dedication

To my:-

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Abstract

This study was conducted during the period February 2000-february 2006 In the National Tuberculosis Control Programme in Sudan. The objectives was study the effectiveness of DOTS strategy (outcome) in Sudan (1996-2003), to evaluate the follow up system in these strategy treatment results, to detect the case finding-detection rate and to identify problems facing the DOTS to achieve their objectives. In addition, the study was designed to compare between the different states in Sudan.

The sample was Detected from all tuberculosis patients new smear-positive cases reported to the DOTS units in all states covered by DOTS strategy (22 states out of 26 states) from (1996-2003). It was selected by cohort analysis of reports and records from case finding and treatment results.

Various data analysis demonstrated those eight years after introduction of DOTS strategy in Sudan. It has been possible to achieve treatment success rate of 80% for new smear-positive TB patients, except in year 2002(80%). These results are below the WHO recommended 80%, the case detection rate in the range (58% in 1996 to 35,75 in 2003). This result is also below the WHO recommended 70% also.

The study reflected that there are some adverse factors such as social stigma, poverty, co-infection with HIV that may affect TB control. Also, there were few problems that faced the achievement of the DOTS strategy objectives such as low expansion of TB services, insufficient political commitment, turn over of staff, instability of population in some areas, illiteracy, unfavorable socio-economic factors and wars.

The comparison between 22 states out of 26 states reflected that there were factors interfering with TB control such as the centralization of DOTS services in some states, absence of political support, difficulties in transportation in most states of the study.

The recommendations are concentrated on the need for more political commitment, reduction of defaulter rates to raise treatment success rate. In addition, expansion of the DOTS centers to cover all population, promotion of monitoring system and need for regular international evaluation and supervision of the programme.

ملخص الدراسة

أجريت هذه الدراسة في الفترة ما بين فبراير ٢٠٠٥ – فبراير ٢٠٠٦م في البرنامج القومي لمكافحة الدرن في السودان لدراسة فعالية استراتيجية المعالجة القصيرة الأمد تحت الإشراف المباشر. في الفترة من ١٩٩٦ حتى ٢٠٠٣ بغرض تقييم أداء برنامج مكافحة الدرن في باكورة نتائج العلاج والبحث عن الحالات والمشاكل التي تحد من تحقيق أهداف الإستراتيجية وأيضاً مقارنة بين الولايات التي طبقت فيها الإستراتيجية.

تم أخذ العينة من كل حالات مرضى الدرن الإيجابية اللطاخة الذين تم تسجيلهم في وحدات معالجة الدرن بالولايات. وتم تحليل العينة بالتحليل الأترابي (الجموعي) لنتائج العلاج والبحث عن الحالات

التحليلات المختلفة للمعلومات أوضحت بعد ثمانية سنوات من دخول استراتيجية المعالجة القصيرة الأمد تحت الإشراف المباشر في السودان . لم تستطع تحقيق معدل نتائج العلاج لأكثر من ٨٠% وهذه النتائج أقل من توصيات منظمة الصحة العالمية ٨٥% . أيضاً معدل البحث عن الحالات في المدى ما بين (٥٧% في ١٩٩٦م الى ٣٥,٧% في ٢٠٠٣م) وهي أقل من توصيات منظمة الصحة العالمية ٧٠% .

عكست الدراسة أن بعض العوامل مثل الفقر والإصابة بالإيدز قد تؤثر على مكافحة الدرن، إضافة الي قلة التوسع في خدمات الدرن، ضعف الدعم الحكومي ، عدم ثبات الكادر الصحي ، عدم إستقرار السكان في بعض المناطق إضافة الي الأمية وعوامل إجتماعية وإقتصادية وظروف الحرب.

للمقارنة بين الولايات التي طبقت فيها الإستراتيجية أوضحت الدراسة أن بعض العوامل التي تؤثر في مكافحة الدرن متمثلة في مركزية خدمات استراتيجية المعالجة قصيرة الامد تحت الإشراف المباشر وضعف الدعم الحكومي وصعوبة المواصلات في معظم الولايات . وركزت التوصيات على الدعم الحكومي للإستراتيجية وتقليل معدل السواقط والتوسع في الإستراتيجية لتشمل كافة السكان وترقية وتحسين نظام المتابعة والتقييم والإشراف العالمي المنتظم للإستراتيجية.

List of abbreviation

ARI	Annual Risk of Infection
AIDS	Acquired Immunodeficiency Syndrome
BCG	Bacille Calmette Guerin (Tuberculosis Vaccine)
CHW	Community Health Workers
Cu-rate	Cure rate
Co-rate	Complete rate
DOTS	Direct Observed Treatment Short-course
DOT	Direct Observed Treatment
Def-rate	defaulter rate
Det- rate	Detection rate
Fai -rate	failure rate
FMOH	Federal Ministry of Health
HIV	Human Immunodeficiency Virus
NTP	National Tuberculosis Control Programme
NGO	Non-governmental Organization
PTB	Patient of Tuberculosis
SCC	Short Course chemotherapy
TBMU	Tuberculosis Management Unit
WHO	World Health Organization

Chapter one

Introduction

Justifications

Objectives

Introduction

Tuberculosis is a communicable systemic disease caused by *Mycobacterium tuberculosis*. Most infections are caused by inhalation of droplet nuclei containing virulent human strains of tuberculi bacillus, occasionally *Mycobacterium bovine* and *Mycobacterium African* through ingestion of unpasteurized cows' milk is less common. **(Asma EL Sony, et al, ۲۰۰۰)**

Tuberculosis is world wide but it is particularly common in Africa and Asia, The prevalence of tuberculosis increase with poor socio-economic condition, inadequate nutrition and over crowding if left untreated. A person with smear-positive pulmonary tuberculosis will infect on average between (۱-۱۰) people annually. **(Asma EL Sony, et al, ۲۰۰۰)**

There were about (۸) million new cases of tuberculosis in the world with three million deaths, the global outbreak is growing and becoming more dangerous. Someone in the world is newly infected with TB every second each year, more people are dying with TB, and nearly ۱% of the world population is infected with TB each year. **(WHO, ۲۰۰۰)**

TB occurs in at least one third of HIV-positive individuals of ۲۴ million HIV-positive individuals globally, ۹۰% in the developing world up to (۸) million infected with the TB and HIV globally. **(Harries, ۱۹۹۸)**

The problem of TB in Sudan was experienced for many years ago but the pool of infection at that time was restricted in few states such as, Eastern, Blue Nile, Upper Nile and few parts of Gazira and Khartoum.

TB is the major health problem in Sudan, estimated number of positive pulmonary tuberculosis patients were ۲۷۳۰۶ in ۲۰۰۱ with incidence of ۸۶ per ۱۰,۰۰۰ population **(WHO, ۲۰۰۲)**. One of the main problems, in the

management of TB patient is non compliance with treatment and high rate of defaulting where high TB prevalence is coupled with limited resources (**WHO, 2002**)

Wide spread misuse of antibiotics combined with poor health care system in parts of Africa , Russia and East Europe has led to emergence of drug resistant TB (**Asma EL Sony, et al, 2000**)

In 1993 WHO declared a new strategy for treatment of TB called DOTS (Direct Observed Treatment Short -Course) to prevent TB resistant treatment and to care for relapsing cases for treatment of TB.

In Sudan DOTS was introduced in 1996 and sputum conversion achieved 80% to 90% in different states. The programme has achieved 72% of population coverage by DOTS strategy by December 1998. There were 130 centers in 37 provinces of 22 states (**Asma EL Sony, et al, 2000**)

Justifications

The best indication of the extent of TB problem in Sudan is the average Annual Risk of Infection (ARI), which is the proportion of population likely to be newly infected over a period of one year. The (ARI) is derived from studies of prevalence of TB positively. In many parts of the world TB was still out of control. TB control programmers failed as they were unable to cure sufficient numbers of TB patients the important reasons for this failure are:

١. Reliance and special TB cases facilities with poor access for many TB patients in these facilities was frequently not supervised and directly observed.

٢. Uses of inadequate and non-standardized anti-TB treatment regimes

٣. Absence of comprehensive management information system resulting in the inability to carryout rigorous evaluation of treatment outcome of TB patients who were put on treatment (**AsmaELSony, et al, ٢٠٠٠**).

In response to the above problem WHO has adopted a new strategy and frame work of effective TB control namely, (DOTS) Direct Observed Treatment Short-course.

The countries facing a significant burden of TB have implemented DOTS and want to evaluate progress in controlling TB. Those countries would benefit from the evaluation of the program (**WHO, ١٩٩٨**).

Objectives

General objective:-

To Evaluate Direct Observed Treatment Short-course (DOTS) strategy (outcome) in (National Tuberculosis control Program- Sudan (١٩٩٦ - ٢٠٠٣

Specific objectives:-

١. To evaluate the follow up system in this strategy:
 - A. Treatment success rate
 - B. Death rate
 - C. Default rate
٢. To assess case finding- detection rate
٣. To identify the problems facing DOTS to achieve their objectives
٤. To compare between the different states in Sudan

Chapter two

Literature review

Definition:-

Tuberculosis is the disease caused by microorganism called Mycobacterium tuberculosis. The microorganism usually enters the body by the inhalation through the lungs. The Microorganisms spread from the initial location in the lungs to other parts of the body via blood stream. (WHO, २००३)

Tuberculosis is a social disease with medical aspects. It has been described as a parameter of a social welfare. The social factor such as poor quality of life, housing overcrowding, population explosion, under nutrition, lack of education and lack of awareness, are causes of illness. All these factors are interrelated and contribute to the occurrence and spread of the disease, (Park, २००२).

Nevertheless, tuberculosis is not considered an important predisposing factor, it is important to understand that there is a difference between infections with TB bacilli and having TB diseases. Someone who is infected with TB bacilli has the TB bacteria in his/her body, but the immune system protects him/her from spreading the disease to other people. Someone with TB disease is sick and at risk of death. If not properly treated, he/she can spread the disease to other people and die within months or few years (WHO, २००५).

Case definition:-

Tuberculosis cases could be classified into ० groups:

१. New case: Patient who had never been treated for TB and who had taken anti-tuberculosis drugs for less than four weeks.
२. Relapse: Patient who had been declared of any form of TB in the past by a physician, after one full course of chemotherapy and has become sputum smear -positive.
३. Treatment failure: A patient who had treatment and remained or became, smear-positive for months

- ξ. Treatment after defaulting: A patient who interrupts treatment for 3 months or more and return to the health services with smear-positive sputum.
- ο. Chronic case: A patient who remained or became again smear-positive after completing fully supervised treatment regimens.
- ϒ. Case detection: activity of identifying infected case mainly among adults attending the health facility for any reason with cough for 3 or 4 weeks or more through sputum smear examination.
- ϕ. Annual Risk of Infection (ARI): defined as the probability of acquiring new tuberculosis infection over a period of one year (**NTP-2000/WHO-2002/WHO/2003/WHO-report-2005**).

History of Tuberculosis:-

2400BC was the first (official) recognition of the existence of the pathological signs of tubercular decay found in fragments of the spinal column from Egyptian mummies of that period. 460BC Hippocrates identified phthisis (Greek word meaning consumption) as the most widespread disease of the times and is almost always fatal.

1943: Discovery of streptomycin.

1944 :Start of the chemotherapy following streptomycin p amino salicylic acid(1949) ionized.(1952) pyrazinamide (1954)cycloserine (1955) ethambutol (1962) and rifampicin (1963)are Introduces as anti TB agents combined chemotherapy progressively becomes a key component of therapeutic process as a means to avoid bacterial drug resistance in the industrialization countries .

1998: WHO declared tuberculosis a global emergency?

1995: WHO launched the Dots strategy (**WHO/ int, 2005?**)

Global Situation of TB:-

Tuberculosis is the most frequent cause of death from any infectious agent ,About one third of the world population is infected, with about (8)million new cases Tuberculosis is a leading cause of death in the age (10-44) especially in women ,where it is responsible for (10%) of deaths.

Tuberculosis cause about one- third of all AIDS related deaths in Africa In 1993 WHO declared tuberculosis to be global emergency (Roger 2004). WHO estimated that one-third of world population is was infected by Mycobacterium tuberculosis world wide. In 1990 there were about (8000000) new cases of TB with (3) million deaths. These deaths comprise (50%) of all available adults deaths in the developing countries. (50%) of these TB cases were in the economically productive age (15-45) years (NTP, 2003).

Tuberculosis remains world-wide public health problem despite the fact that the causative organism was discovered more than 100 years ago every year. There was about (8) millions people developed TB world wide during the year 2000. About 1.6 million people died of this disease and the global burden of tuberculosis is lost was about (30-40) million .The problem of TB is acute in developing countries which accounts for about (90%)of TB cases in south- east region, western specific and Africa (Park -2002). WHO in 2001 estimated that every year TB kills (1.8) million (WHO-2003).The national institute of Allergy and Infectious Disease estimated that there were (5) million people infected with TB world-wide yearly (NIH, 2003).

Tuberculosis is an increasing a major world –wide problem especially in Africa , where the spread associated with (AIDS) it is estimated that about one pillion people will become newly infected and over (100) million will become sick , and (36) million will die world –wide between now and (2020) if control is not further strengthened. Each year there are more than (8-10) million cases and close to (5) millions cases deaths attributed to TB 100, 000 of these deaths occur among children (ALA, 2003).

It is estimated that (31) millions people world wide are HIV infected, one third of them are duly infected with Mycobacterium tuberculosis and HIV. (70)% of TB /HIV daily infected people live in sub-Saharan Africa and (20) %in Asia (NTP-2000).

The largest number of cases occurs in the South-East Asia region which accounts for (33)% of incident cases globally .However the estimated incidence per Capita in the sub-Saharan Africa is nearly twice that of the South- East Asia ,at (300) cases per (1000000) population. Its estimated that two million deaths resulted from TB in 2002.The highest number of estimated deaths is in the South-East Asia Region but the highest mortality per capita is in the African region, where HIV has led to rapid .Increases in the incidence of TB and increase in the likelihood of dying from TB (WHO, 2005).

Situation of Tuberculosis in Sudan:-

The World Bank categorizes put Sudan among countries of estimated annual risk of Infection (ARI) (10%) % which give an incidence of 90/1000000 smear positive cases. That put the Sudan among the highest prevalence rate countries of TB in the East Mediterranean region. All cases in Sudan are estimated to be about 40000 (NTP, 2003). The estimated average incidence of all forms of TB is twice the incidence of pulmonary smear positive cases on 180/1000000 in a population of 27,899,000. In 1998 the total new cases detected. the detection rate average (43,6%).This finding represents. the country average and was influenced by the very low reporting from war zones in Southern Sudan.

The case finding in the regions. summary reported by NTP during the years 1997 up to 2002 is as follows, in the year 1997 there were (10830) new cases ,(1682) relapses and (2048) extra pulmonary TB. In 1998, There were (10820) pulmonary TB new cases, (1600) relapses and (3442) extra pulmonary TB. In the year 1999 there were (14070) pulmonary TB new cases, (2109) relapses and (3092) extra pulmonary TB. In the year 2002 there were (8990) pulmonary TB new cases, (1408) relapses and (4223) extra pulmonary TB (NTP, 2003).

Epidemiology of Tuberculosis:-

The principles epidemiology variables used to describe the magnitude trend and impact of tuberculosis are:

- Incidence (including incidence of smear positive cases).
- Prevalence (Including prevalence of smear positive in all cases)
- Notification.
- Mortality (Including case fatality in smear positive and other cases
(Roger Detel, 2004/Kumar, 1998)

TB among refugees and migrants:

According to UNHCR there were an estimated (30) million refugees and needy people in 2003. Many refugees originate from countries with high TB incidence rates. Poor nutrition and health means that refugees are particularly at high risk of developing TB. Untreated TB spreads quickly in crowded refugee camps and shelters. It is difficult to treat mobile population, as treatment takes at least six months and should ideally be supervised.

In many Western European countries and in the United State (USA) over (20) % TB cases notified in 2001 were among people who were not born in the country or were not citizens of the country (WHO, 2005).

Co-infection (HIV/AIDS and TB): -

World wide, the number of people infected with both HIV and tuberculosis is rising. The estimated (10%) activation of dormant TB infection over the life span of a infected person has increased to (10%) in one year. if HIV infection is super imposed. the opportunistic infection most frequently kill HIV-positive people. (30-35) times more likely to develop TB than people infected only with (Park, 2002).

In 1999 (10)% of all cases of TB were HIV related, rising to (20)% in Africa , and to (60) % in some regions of Southern Africa .In the same year, around (3) millions died of AIDS and TB. The risk of developing TB after infection

or re-infection is much higher approaching (100) %in patient with AIDS. **(Green Wood et al, 2002).**

WHO and its international partners have formed the TB/HIV working group, which develops global policy on the control of HIV-related TB, advises on how those fighting against TB and HIV can work together **(WHO, 2005).**

Pathogenesis of TB: -

Human tuberculosis is divided into primary and post primary forms with quite different pathological features.

Primary tuberculosis:-

The site of the initial infection is usually the lungs following the inhalation of the bacilli. These bacilli are engulfed by alveolar macrophages. in which they replicate to form the initial lesion or Cohn Focus .Some bacilli are carried in phagocytes cells to the Hilo lymph nodes where additional foci of infection develop to Cohn Focus together with enlarged haler lymph nodes from the primary complex. In addition, bacilli are seeded by further lymphatic haemategenous dissemination in many organs and tissues, including other parts of the lungs (**Green Wood et al, 2002).**

Post primary tuberculosis:

In many individuals, the primary complex resolves and the only evidence of infection is a conversion to tuberculosis reactivity after an interval of months. Years or reactivation of dormant foci of tuberculosis bacilli or exogenous .Re infection may lead to post primary tuberculosis which differs in several aspects from primary disease **(David, et al, 2002).**

Infectious agent:-

Causative agent:

Mycobacterium tuberculosis organism described by kack in the year 1882 (Robison 1980) .The term tubercle –bacillus designed to species of the

family Mycobacterium order actinomycetales. M. tuberculosis and M. avium are the most obvious. Three other species, M. microti pathogen for rodents and M. africanum (Man Deland et al, 1995).

The bacilli are gram positive though they do not stain readily. These organisms resist decolorization by 5% sulphuric acid and absorbent alcohol for ten minutes and hence, these are called acid alcohol fast (Rajesh Rattan, 2004). Available culture methods are either solid or liquid media; a sample of sputum or tissue requires initial liquefaction, recontamination most commonly using N-acetyl Lysine as

A mucolytic in (1%) sodium hydroxide solution (Mandle et al, 1995).

Source of infection: -

There are two sources of infection, human and bovine. The most common source of infection is human whose sputum is positive for tubercle bacilli and who has never received treatment or not been treated fully. Bovine source of infections is usually infected milk (Park, 2002).

Types of Tuberculosis: -

Tuberculosis is divided into two categories, the first pulmonary tuberculosis which affects the lungs. The second is extra pulmonary tuberculosis which can be divided into three groups based on pathogenesis:-

The first comprised superficial mucosal foci that are due to spread infection in pulmonary secretions via the respiratory and gastrointestinal tracts. The second comprise foci established contagious spread (such as sub-pleural focal) into the pleural space (Man dell& et al, 1995).

The most common extra pulmonary tuberculosis includes tuberculosis of lymph nodes, pleura, pericardium, kidneys, bones, joints, larynx, skin, intestines, peritoneum and eyes (Abram, 1995).

Mode of transmission:-

M. tuberculosis is transmitted between an infected patient and susceptible contacts via droplet nuclei that are expelled by coughing, sneezing and other forceful respiratory activities (**Small, et al, 1991**).

Environmental factors also affect the concentration of droplet nuclei in the air. The volume of air common to the source and the contact is one such factor. The smaller the room, the more concentrated the droplet nuclei are the amount of outside air ventilated into a room is another factor, since fresh air conditioning systems increase the concentration of droplet nuclei (**Robert et al, 1998**).

Diagnosis: -

Diagnosis of tuberculosis rests mainly on the identification of tubercle bacilli either by sputum smear microscopy or by culture. Direct sputum smear examination should be done for all tuberculosis suspects, especially in patients having cough lasting for more than three weeks or for all patients treated for tuberculosis, even extra-pulmonary cases (**NTP, Sudan 2000/Kumar, 1998**).

The tuberculosis test: -

Tuberculosis test was discovered by von Disquiet in 1907. There are three main tests currently in use. The Mantoux intradermal test, the beef, and the tine multiple puncture test.

There are two major antigens-The old tuberculin (OT) and the purified protein derivative (PPD). The dose of PPD is Tuberculin unit (TU) or (°) TU or (200) TU. In most countries used (1,0) tu. The test is carried out by injecting intra-dermal on the flex surface. The TU of PPD in 0.1 ml. The result of the test is read often after 48 hours (**Park, 2002**).

Treatment of Tuberculosis: -

Standard Treatment Regimens

Aims of Treatment:-

The aims of treatment of TB are the following:

To cure the patient of TB.

To prevent death from active TB or its complications.

To prevent relapse of TB

To render TB no longer a primary health care problem.

Treatment Regimens:-

At the moment, Sudan NTP is using three types of standard regimens these are:

- The 12 month regimen for new smear-positive pulmonary TB and new extra pulmonary TB who are not severely ill ,or for new smear positive –patients who are unable to come daily for direct observed treatment .
- The 6 month short–course chemotherapy for new cases of smear positive pulmonary tuberculosis and severely ill smear negative and extra pulmonary patients, who come daily for directly observed treatment in the first two months of their treatment.
- The 6 month short–chemotherapy for treatment of smear positive relapses failure cases and treatment after default.

The chemotherapeutic regimens are based on standardized combination of (7) essential anti TB drugs:

- Rifampicin (R)
- Isoniazid (H)
- Pyrazinamide (P)
- Ethambutol (E)
- Streptomycine (S)
- Thiocentazone (T)

Anti-tuberculosis drugs: -

There are new twelve or thirteen drugs active against M. tuberculosis of which six are considered to be essential. Anti tuberculosis drugs should satisfy the flowing criteria: highly effective , free from side effects, easy to administer and responsibly cheap.

Prevention Measures: -

General Measures:

The best way to prevent TB is to ensure that all sputum-positive TB cases will be cured. The most important measures are:-

- * Legislation (e.g. free contact examination)
- * Health education.
- * Good ventilation in health clinics.
- * Ensuring hospitalized patients are kept in a separate ward for the first two weeks of treatment.
- * Particular care must be made to separate infectious TB patients from HIV-positive individuals.
- * Good nutrition.
- * Pasteurization or sterilization of milk.

Specific Measures:-

A number of specific measures can be taken to help prevent the occurrence of disease. The most important of these measures are described in the following two paragraphs:

(1)INH chemoprophylaxis :

A six months course of preventive treatment with INH in daily dosage of 5mg/kg body weight is usually effective to prevent progressive form. Chemoprophylaxis for HIV should be given to certain high risk groups e.g.:

- * Infants of mothers with TB
- * Child contact under 5 years who have symptoms suggestive of TB.
- * Immune-compromised patients.

(2)BCG VACCINATION:

BCG is alive attenuated strain of bovine tubercle bacilli first produced by Calmette and Guine. It is given by intra- dermal injection to a population that is considered to be essentially non-infected (children) to protect them

from developing tuberculosis, especially severe forms of the disease e.g. TB meningitis and military tuberculosis (NTP-Sudan -2000).

The duration of protection by BCG vaccine from (10-20) years. The first prospective control trial of BCG showed to be (80%) effective over an observation period of 20 years in different parts of the world (Park, 2002).

Control of Tuberculosis:-

Objective of TB control:

- * To reduce mortality, morbidity and disease transmission.
- * Reducing the incidence of the disease.
- * To prevent the development of the drug resistance or other complications by the disease.
- * To treat patients.

Tuberculosis control means reduction in the prevalence and incidence of disease in the community. The WHO defines that tuberculosis control is said to be achieved when the prevalence of natural infection in the age group (15-45) years is of the order of 1%, since tuberculosis is an infectious disease. The basic principles of prevention and control are the same as for any other infectious disease. The control measures consist of accurate component – namely case finding and treatment and preventive component, namely BCG vaccination, these are the two fundamental components of a national tuberculosis program.

The first step in the tuberculosis control program is early detection of sputum positive cases. This should be an intensive ongoing program for the purpose of tuberculosis control program. A case is defined by WHO as a patient whose sputum is positive for tuberculosis bacilli and such cases are the target of case finding. All other sufferers from tuberculosis whose sputum is positive for tuberculosis bacilli are the target of case finding. All other sufferers from tuberculosis whose sputum is negative but who show suggestive shadows in chest X-rays are reckoned as suspects (Park, 2002).

(DOTS) Direct Observed treatment Short-Course:--

In 1993 WHO declared TB a global emergency. In many parts of the world TB was and is still out of control. TB control program failed as many countries were unable to cure sufficient number of TB cases. The reasons for this failure are many but the most important are the following:--

- * Reliance on special TB care facilities with poor accesses for many TB patients, and the treatment in these facilities was frequently not supervised or directly observed.

- * Use of an adequate and non-standardized anti-TB treatment regimen.

- * Absence of comprehensive management information system, resulting in the ability to carry out a rigorous evaluation of treatment outcome of the TB patients who were put on treatment.

In response to these problems WHO has adopted a new strategy and framework for effective TB control.

What is DOTS:-

DOTS (directly observed treatment short course) means that all TB patients who are eligible for short course treatment have to be given their drugs under the direct supervision of health workers whenever taking a combination of medication which includes rifampicin.

The elements of WHO direct observed Therapy short-course (DOTS)

are:-

- * Government commitment to tuberculosis control
- * Case detection focusing on patient with symptoms who self report to health services.
- * Use of sputum smears microscopy
- * Standardize administration of the course treatment.
- * Direct observation of the chemotherapy for at least two months.
- * Adequate supplies of treatment.
- * Good record and information system (**Roger et al, 2002/WHO/int, 2005**).

Organizational principles at the DOTS strategy :--

The organizational principles at the dots strategy are the following:

- * Availability of diagnosis and treatment network that is based on existing health facilities and integrated with primary health care.
- * Good program management based on accountability and supervision of health care workers.
- * An inbuilt monitoring system for case detection of new TB cases and relapsed cases, followed by a full short analysis of treatment outcome of these cases .In 1991,WHO proposed an effective tuberculosis control strategy with two goals to be achieved by the year 2000. Successful treatment of 80%of cases and detection of 90%.

That effective health intervention. Is recommended as effective TB treatment.

It

Should be part of essential package of clinical services that are available in PHC (NTP, 2000).

WHY DOTS:--

Essential elements of anti-TB and anti-leprosy treatment, like all other anti-biotic treatment, should contain the right combination of drugs and the correct dose for the full course of the treatment without interruption. The treatment has to be taken for a number of months if patients are to be permanently cured, Failure to comply with any of the above requirements results in the development and spread of drugs resistant strains. With well organized DOTS service, successful treatment (cure and treatment completion) rate of above 80% has been achieved in many countries. With DOTS is not only possible to cure particularly all TB patients, but also to prevent the emergence of drugs resistant strains. In Ethiopia there has been a study conducted in a population covered by DOTS that reached 90% in 2001. and the population of patients treated with short course chemotherapy

increased from 7% in 1994 to 50% in 2001. Treatment success for smear-positive TB rose from 38% to 37% in 2000, defaulter rate declined from 38% to 18% and treatment failure declined from 6% to 1%. Four years after introduction of DOTS in the zone, it has been possible to achieve treatment success rate of 73% in 2000, for new PTB-positive, fairly well towards the WHO/ IUATLD recommended 80%. This is confirmed in the findings of other studies. That the DOTS strategy works well. In resource constrained setting with low over all health coverage increased coverage by SCC improved access to care through the most likely played a significant role in improving the treatment outcome (**Estifanos B Shargie, 2000**). DOTS services are given in accredited institution including hospital, health centre, health station and designated NGOs clinics For the delivery of DOTS service, responsible officer must follow certain and test feasibility in a few centers before expanding the service to all of the unit selection criteria include :-

- * Distance from the nearest hospital or health center.
- * Size of population served by the center.
- * Health services personnel available (nurse is preferable).
- * Satisfactory performance in other health program.

ADMINSTRATING DOTS:--

The following arrangements are suggested for the delivery of DOTS in a given health unit:

- A. separate, spacious, and well –ventilated room equipped with drawers.
- B. Create a pigeon hole drugs shelf per patient.
- C. Water and drinking cups should be readily available.
- D. Give health education before starting drug administration and encourage question and discussion.
- E. Call each patient in turn and give him / her tablets to be swallowed in front of you.

F. Mark the x in the treatment card when the patient swallows the tablets. In order to ensure that treatment is not interrupted during the intensive phase, agreement has to be made for supervised treatment during weekends and holidays (**NTP, २०००**).

DOTS: is it Effective:--

DOTS Is the internationally recommended TB control. It is inexpensive strategy that could prevent millions of TB cases and deaths, over the coming decade. Since its introduction in १९९१, more than १२ million patients have received treatment under the DOTS strategy.

By the end of २००२ all of the countries with the highest number of TB cases, which together have १०% of the world estimated incident cases, had adopted the DOTS strategy, and १९% of the global population is living in parts of the country where the strategy had been implemented by August २००३. In २००१, the global DOTS expansion plan was published. The two pillars of the plan are the development of medium-term (at least ० year) plan for TB control in all countries (NICCs). All the २२ countries with the highest number of cases had formulated plans by the end of २००३, and all but two had NICC that met regularly (**WHO, २०००**). The DOTS strategy can be successfully implemented in phases in large countries with high TB burden; this success is to be through decentralization. In Bangladesh there was a study conducted to assess the success of the DOTS. The study showed that high cure rate can be maintained despite rapid expansion of coverage, with proper implementation of the strategy and regular monitoring of reports on case finding, sputum smear conversion and treatment outcome. Case detection need to be further increased by informing and involving the community in TB control efforts through social mobilization (**Kumaresan, JA, et al, १९९१**).

As DOTS is found effective in enhancing patients. There have been a number of studies conducted to assess the effectiveness of DOTS. In a

study in South Africa (1998), patients were assigned into either DOT or self supervised. DOTS patients were asked to attend the clinic to take medication under supervision of clinic nurse in 2 days a week schedule during the first 3 months of treatment. Supervised patients were required to visit the clinic once a week or send a family member to collect drugs. Treatment success rate among new patient was 89% in DOT and 86% in self supervision. In a study in Pakistan (2001), patients were assigned to either DOT by CHW or DOT by family members, or self administration. Treatment success rates were 77% in DOT by CHW, 72% in DOT by family members, and 70% in self administration. They concluded that direct observation of treatment did not give any additional improvement in cure rates. The above studies in (South Africa & Pakistan) have serious problems, their treatment success rate were too low in all, (86-89% in South Africa and 72-77% in Pakistan). The low rates indicate poor conduct, in both studies, and essential components of TB control were not implemented appropriately. **(Aseita, 2003/4)**

Monitoring and Evaluation (M&E):-

M&E is the collective use of the social sciences and epidemiological research methods to assess and eventually improve the implementation of programs or components of programs. The overall purpose of M&E is to measure program effectiveness, identify problem areas, gather lessons learned and improve overall performance. M&E activities are used to assess progress design. Number of different methods or approaches are available for tracking changes and measuring program performance of M&E (process, outcome, and impact) **(WHO/ HTM/ TB/ 2004. 344)**. Monitoring is the routine tracking of program using input, process and outcome data that are collected on a regular ongoing basis. Monitoring is used to assess whether or not planned activities are carried out according to schedule or not.

Process evaluation: is used to measure the quality and integrity of program information and to assess coverage.

Outcome and impact evaluations: Measure program results and the effect on the target population. Outcome evaluation measures the extent to which started objectives are achieved or unachieved with respect to the programs goals (WHO/HTM/TB/2004).

Indicators for Global Reporting:-

The indicators described in this section are based on data reported by NTPs. Data are used to monitor progress in DOTS expansion and achievement at national and Global levels of the WHO target for TB control treatment success of at least 80%. National data reported to WHO allow comparison between countries, monitoring trends in TB cases reporting and age/sex distribution of pulmonary smear-positive cases and comparisons of the results of DOTS with other strategies in routine conditions. WHO request results on these indicators as a means to encourage their adoption and for intercountry comparisons (WHO/CDS/TB/2004, WHO/HTM/TB/2004, 231).

Indicators for program outcomes:--

The indicators in this section are routinely calculated by TB control programs at districts, regional and national levels. They are based on data from the TB register and quarterly reports on TB case registration, smear conversion, detection and treatment outcomes. They are used to monitor progress towards achievement of the national targets for case detection and treatment outcome and monitor program quality and effectiveness.

Treatment outcome indicators are calculated with cohort analysis Cohort analysis is the key management tool for evaluating the effectiveness of the TB control program. Cohort analysis is conducted on a regular basis as apart of routine reporting (Enarson, 2004/WHO/CDS/TB/98, 203).

Indicators:--

* **Cure rate:** It is the percentage of TB cases that were registered in specified period and were cured. (WHO/HTM/TB/2004) High cure rate can be quickly achieved. In China project a high cure rate was achieved and maintained during rapid DOTS expansion. As programme rapidly increases, both geographical coverage and the number of patients, it can be difficult to maintain high quality treatment and case management that result in high cure. Low cure rate and increasing drug resistant can develop unless the program maintains the essential training, supervision and quality control activities. The political and financial commitment permitted every one with infectious TB also the use of DOT was important to ensure a high cure rate. Other elements of DOTS were equally important. (... Chen, X, et al, 2002)

* **Treatment completion rate:** It is the percentage of TB cases registered in a specified period that completed treatment. This indicator measures the success of the NTP in ensuring that TB patients who cannot be classified as cured actually complete their course of treatment.

* **Treatment success rate:** The percentage of a cohort of TB cases registered in a specified period that successfully completed treatment, whether with bacteriologic evidence of success (“cured”) or without (“treatment completed”). The cohort of new smear-positive cases successfully treated is calculated using the following numerator and denominator: For new smear-positive cases, there is a target of 80% treatment success, based on the assumption of what can be reasonably achieved assuming the baseline proportion of unfavorable outcomes (death and failure and default) to be about 20%. The 80% level formally became a global target via the World Health Assembly Resolution of 1991 (originally 80% cure, later 80% success). It is arguable that populations with high HIV prevalence or with a preponderance of older adults may have difficulty reaching the 80% target because of higher percentages of death outcomes. This indicator relies on accuracy and effort in the determination of treatment outcomes at the facility level. In a program

where there is no mechanism for treatment facilities to communicate with each other, for instance, the success rate may be low because of a preponderance of unknown outcomes related to transferring patients.

Death rate: the percentage of TB cases registered in specified period that died during treatment, irrespective of causes. This indicator should be considered in the context of HIV prevalence, since a high proportion of HIV-associated TB will result in greater number of deaths. In the event of the excess TB mortality (more than 5%) in areas of low HIV prevalence, death of patient should be reviewed to determine whether this deaths could have been prevented /or whether programmatic interventions are warranted. More death among patients of TB on SCC was an indication of policy that severely sick patients and that co infected with HIV be priority for treatment by SCC since that group is more likely than others to die (**Estifanos B Shargie &Bernt, 2005**). In Malawi there has been a study conducted in 2001 the study showed that there was high death rate during treatment possibly related to co infection with HIV. TB patients were a highly mobile population (**Paul M. Kelly, 2001**).

***Treatment failure rate:** the percentage of TB registered in specified periods that were treated failures. This indicator measures one of the possible outcome indicators for patients. No NTP can achieve a 5% treatment failure, but the goal is to attain the lowest failure rate possible. When treatment failure rate exceeds 3%, case management should be reviewed to determine whether these failure could have been prevented /or whether program intervention are warranted. A study conducted in Ethiopia (2005) showed high proportion of failure among high proportion of family patients. It suggested the emergence of multi drugs resistant TB (MDR-TB). Earlier studies have shown that MDR has so far been below 1%. (**Stifanos B Shargie & Bernt-2005**).

*** Default rate:** the percentage of TB cases registered in a specified period that interrupted treatment for more than 3 consecutive months .this indicator is one

of the possible outcome indicators for patients. It is very difficult to achieve a default rate less than 5 or 3%. If the default rate is high (more than 10%) the success target of 80% is not achievable, and the cause of this defaulting need to be determined in order to take remedial action **(WHO/THM/TB, 2004)**. A study conducted in Ethiopia (2000) showed that the group of defaulters seems refractory to conventional approach of treatment supervision. Social and cultural factors might play role, and need to be explored **(Stifanos B Shargie & Bernt 2000)**.

***Case detection rate:** the percentage of TB cases detected (diagnosed and reported to the national health authority) among the total number of TB cases estimated to occur country wide each year. Reasons for low TB cases detection rate country wide included limited access or utilization of health facilities, insufficient clinic supervision. Incomplete disease reporting with a given information system and incomplete implementation of DOTS **(WHO, 2004)**. With proper implementation of DOTS strategy and regular monitoring of reports on case finding, sputum conversion and treatment outcome, case detection needs to be further increased by informing and involving the community in TB control efforts through social mobilization (... **Kurmaresan, JA, etal, 1998**).

Chapter three

Methods and Materials

METHODOLOGY

Type of the study: -- the study is a retrospective descriptive analytical study

Study area: - National Tuberculosis Control Program (NTP) - Sudan.

Sudan is the largest country in Africa and the Middle East. It has an area of about 2,7 million square kilometers. The country is composed of 26 states, 112 provinces and 114 localities constituting the federal republic. Sudan extends from great oriented desert in the north into forest in the south. It is classified from north to south into poor savannah to equatorial desert (34)%, semi desert shrubs (20)%, wood land / forest (30)%, agricultural land (4)%, and swamp and wet land (1) %.

Climatic conditions in Sudan favors the spread of infectious diseases .it is hot and dry in the North with short rain season while it is tropical in the South with long rain season. The average temperature for hottest months is about 38°C and for coldest months is 21°C. However the biological environment comprises the fauna and flora of the country which varies from area to another depending on many factors such as, the existence of animals, population density and socio – economic demographical factors. The characteristic of the biological environment does affect the human health.

The environmental sanitation effort (garbage& waste collection, vector control, food safety... etc) are insufficient particularly in slums and rural areas. This is aggravated by lack of awareness of the population and the overwhelming poverty.

The public health facilities in Sudan range from high specialized centers, university teaching hospitals to rural hospitals, health centers and dispensaries. In addition public health private sectors and non governmental organizations (NGOs) play an important role in the health system (for peripheral health units see appendix).

Population under the study: -

The population under this study includes the records and reports of the (NTP) on (DOTS strategy). Total coverage of records between (1996 to 2003) were collected from annual reports in additional quarterly reports of case finding & treatment results for all TB patients and New positive cases .

Sampling: -

Covers all TB patients, new positive cases reporting to the DOTS units in all states covered by DOTS strategy (22 states out of 26 states) from (1996 to 2003).

Data collection:--

Data will be collected from records and reports such as: -

1. Case detection depends on the quarterly reports of case finding which is classified the detection of (New smear-positive cases , relapse cases , New smear-negative cases and extra pulmonary cases)
2. Cohort analysis depends on classifying the treatment outcome into (cured, completed treatment, death, failure, defaulter and transferred out).
3. The data came to the NTP centre through reports issued by states on quarterly bases according to the flow of reports which depend on define report calendar. The data been registered in standardized district register books found in Tuberculosis management units (TBMU)

Methods of data collection:-

The data of this study was collected directly by:

1. from records & reports of NTP point view (1996 to 2003)
2. In depth interview for NTP staff.

Data analysis:-

Data analyzed by computer

Indicators of the study: -

The indicators handled by this study were:

$$1. \text{ Case Detection Rate} = \frac{\text{Number of new TB cases detected}}{\text{Estimated number of news TB cases country wide}} \times 100$$

$$\text{Case Detection Rate} = \frac{\text{Actual detection}}{\text{Estimated number}} \times 100$$

$$\text{Estimated number} = \text{ARI} \times \text{Population}$$

$$\text{Estimated number} = \frac{90 \times \text{Population}}{100,000}$$

Were ARI = Annual Risk of Infection. (See abbreviation)

$$2. \text{ Evaluation Rate} = \frac{\text{Number of evaluated}}{\text{Number of registered}} \times 100$$

$$3. \text{ Cure Rate} =$$

$$\frac{\text{Number of new smears – positive pulmonary TB cases Registered in specific period that was cured}}{\text{Total number of smears – positive pulmonary TB Cases registered in the same period.}} \times 100$$

$$4. \text{ Treatment completion Rate} =$$

$$\frac{\text{Number of new smears – positive pulmonary TB cases Registered in specific period that completed treatment \& Did not meet the criteria for cure or failure}}{\text{Total number of smears – positive pulmonary TB Cases registered in the same period.}} \times 100$$

$$5. \text{ Death Rate} =$$

$$\frac{\text{Number of new smears – positive pulmonary TB cases Registered in specific period that died during treatment, Irrespective of causes}}{\text{Total number of smears – positive pulmonary TB Cases registered in the same period.}} \times 100$$

٦. Failure Rate =

$$\frac{\begin{array}{l} \text{Number of new smears – positive pulmonary TB cases} \\ \text{Registered in specific period that are smear-positive } \rho \text{ months or} \\ \text{Later after initiating treatment} \end{array}}{\begin{array}{l} \text{Total number of smears – positive pulmonary TB} \\ \text{Cases registered in the same period.} \end{array}} \times 100$$

٧. Default Rate =

$$\frac{\begin{array}{l} \text{Number of new smears – positive pulmonary TB cases} \\ \text{Registered in specific period that interrupted treatment for more} \\ \text{Than } \gamma \text{ (tow) consecutive months} \end{array}}{\begin{array}{l} \text{Total number of smears – positive pulmonary TB} \\ \text{Cases registered in the same period.} \end{array}} \times 100$$

٨. Treatment success rate = Cured rate + Treatment Completion rate

$$\rho. \text{ DOTS Coverage} = \frac{\begin{array}{l} \text{population living in the area of management} \\ \text{Units implementing the DOTS strategy} \end{array}}{\text{Total population}} \times 100$$

Chapter four

Results

Results

The information which was collected from the NTP- Sudan records and reports (1996 to 2003) overview point gives the following:-

Table (1) shows the treatment results-New cases by state in the year 1996. The table shows that the success rate was above the expected rate in Blue Nile 86,4%, Gazira 80,2%, and Khartoum SCC 83%. In Gadarif, Khartoum, Red sea and W. Kordofan the success rate was in the range of (80-83) % and did not pass 80% in the rest of the states. The table also shows the death rate is high (7-8) % in Bahr Gazal, Upper Nile and S. Kordofan State. The death rate doesn't pass the 8% in the rest of the states.

The table shows the failure rate is more than 4% in Upper Nile, Sinnar and Gazira states but the failure rate did not pass 4% in the rest of the states. The table shows the defaulter rate to be more than 9% in state where the success rate is less than target rate 80% in Bahrgazal, Upper Nile, Sinnar, Red sea and W.kordofan in Khartoum & Khartoum SCC the defaulter rate is higher 66,6&77,4% where the success rate decreased to 33,3 and 13,6%.

Table (2):- shows the treatment results-- New cases by state for the year 1997. The table illustrates the success rate to be above the expected rate in White Nile rate 88,3% but in Bahrgazal ,Upper Nile ,Blue Nile ,Gazira ,Khartoum SCC , Gadarif , Kassala , Red sea , Nahr AL Nile , and N. kordofan. The success rate in range (60-83) % and did not pass 80% in Northern State.

The table shows the death rate in Bahralgazal, White Nile .Kassala Red sea and Northern State is more than 0%. The failure rate in Bahrgazal, Khartoum and N. Kordofan in the range of (0-14) %. The defaulter rate is high in states where success rate is low (W. Bahrgabal 39,3%, Khartoum federal 36,3%, Red sea 27,3% and Northern 0%). in N .Bahrgazal, Gadarif and N .Kordofan the defaulter in the range (10-10) %. In White Nile the defaulter is less than 2% where success rate is 88,3% .The transferred out rate is less than

٤% except in Khartoum SCC. Gadarif, Kassala, Red sea and in the Northern state is more than ٤%.

Figure (١): shows the (treatment success, death, failure, defaulter and transferred-out) rates during the year ١٩٩٨. The Figure shows that the success rate has decreased when the defaulter and failure rate increased. The success rate is above the target rate (٨٥) % in Kassala (٩٤) % and N. Kordofan (٨٩) % but the success rate did not pass (٤٥) % in Sinnar, Khartoum Federal and S .Kordofan State where defaulter rate is more than (٣٦) %. The failure rate is high in Bahrgazal, Upper Nile and S. Korodfan the Figure shows the total success rate not to pass than (٦٧,٥) % but the defaulter rate about ٢٠%, death rate about ٥%, and failure rate is less than death rate. Figure (٢) illustrates the (treatment success, death, failure, defaulter and transferred-out) rates during- ١٩٩٩. The figure illustrates the relationship between the success rate and death, failure and defaulter rates. The success rate has decreased when the other rates increased. Success rate is above ٨٥% in Gazira , Khartoum-Federal, Kassala and N.kordofan, but the success rate is in the range of (٦٠-٧٠)% in N.Bahrgazal , Blue Nile , White Nile and W. Kordofan , the death was found to be in the range of (٠-٥,٥)% and defaulter in the range of (٢٣-٤٠)% .

Figure (٣): demonstrates success rate against defaulter rate in ١٩٩٩. The figure demonstrates negative relationship between the success and defaulter rates. The defaulter rate increased. The success rate decreased with the same percentage if we put a line in (٥٠) the success rate curve is typically the defaulter rate (mirror image).

Table (٤): shows that there are high success rates achieved in different states in (٢٠٠٠). The success rate is above ٨٥% in Alwihda, White Nile ٩٠%, Khartoum-SCC ٩٠?% , Nahr Anile ٨٨%, N.Kordofan ٨٩% and W .Kordofn ٩٥%. In Bahrgazal, N&W.Bahrgazal, Upper Nile, Gongly, Gazira, Khartoum, Khartoum-Federal, Kassala, Northern and S. Kordofan the range is (٧٠-٨٤) % but in the Blue Nile the rate is ٦٠%, Red sea ٦٩% and ٤٢% in Sinner.

The death rate in N&W. Bahrgazal, Upper Nile, Gongly, Blue Nile, Gazira, Sinnar, Red sea and S.Kordofan is in the range of (0-10) % but did not pass 5% in the rest of the states. Failure rates in Alwihda are 4,6%, Bahrgazal 0%, and S.Kordofan 0% but in other states it did not pass 5%. The defaulter rate is above 10% in states where the success rate does not reach 80% (W.Bahrgazal, Gongly, Blue Nile, Sinnar, Khartoum, Kassala and Red Sea).

The total success rates during 2000 were 80,7%, defaulter was 9,3%, failure rate did not pass 5% while death rate is less than 5%.

Figure (ε): Shows the treatment success, death, failure and defaulter rates during -2001. The success rate reached 100% in N.Bahrgazal State and above the 80% in Khartoum-SCC, White Nile, Gongly, Khartoum Federal, Nahr Anile, N. Kordofan and N. Darfur). In Bahrgazal, W.BahrGazal, Upper Nile, Blue Nile, Gazira, Khartoum, Gadarif, Kassala, Red Sea, S&W. Kordofan the range was (70-85) %. In Sinnar the success rate was 78%.

The death rate is low. Except in N.Darfur 10%. The failure rate did not pass 5% but the defaulter rate increased in states where the success rate decreased. Figure shows that the success rate is affected by defaulter more than death rate. In Sinnar, the success was 80%, defaulter 14% and death was 2%. In N .Darfour the success was 80%, death 10%, and defaulter was 2%.

Figure (ο): illustrates the success, death, failure and defaulter rates during- 2002. In the figure, most of states reached the target treatment success rate (80%) except the states where the defaulter rate is more than 10%. This is clear in W.Bahrgazal, Blue Nile, Red Sea and S .Kordofan where the defaulter rates were (22 , 12 , 12 & 10)% .

Figure (ϕ): Shows the success rate against defaulter rate during- 2002. The figure confirmed the existence of strong relationship between the success rate and defaulter rate in different states.

Very remarkable In Sinnar State, there is decrease of defaulter rate from 17% in 2001 to 10% in 2002. At the same time, there is an increase in the success rate from 68,3% in 2001 to 82,8% in 2002.

Figure (V): demonstrates the success, death, failure, and defaulter and transferred-out rates during-2003. The figure demonstrates that in states where a defaulter rate is low or less than 5%, the success rate is above 88%. In W.Bahrgazal, the success rate was 80,9%, Khartoum-SCC 86%, ALwihda 80% but the success rate is less than 60% in Sinnar, Red Sea State while defaulter in Sinnar is 23%. And the Red Sea is 10%. The figure shows the defaulter rate increasing in states where death rates are zero. In (S.Kordofan 32% and W.Kordofan 22%). The figure also still confirmed strong relationship between success and defaulter rates in different states very remarkable that in 2003. The decrease of defaulter rate from 10% in 2002 to 22% in 2003 decreased the success rate from 82,8% in 2002 to 59,0% in 2003. In S.Kordofan state, in 2003 the increased of defaulter rate from 10% in 2002 to 32% in 2003 and the success rate decreased from 81% in 2002 to 61% in 2003.

Table (Z): illustrates the treatment results of new cases by states from 1996 to 2003. The success rate is above than the target rate of (80) % in the year 2002 (80,3) %. In years 1999, 2000, 2001 and 2003 the success rates were 80,0, 80,7, 82,3 and 81,0%. In year 1999 was 71,7%, in 1997 was 70% and passed 70% in year 1998. The death rate reached above 0% in 1998 0,8% and 0% in 1999. The death rate did not pass 0% in the following years. The failure 2,3% in 1996, 2,7% in 1998, and 3,9% in 1997. It did not pass 3% in the following years. The defaulter rate was increased when success rate decreased. The defaulter rate was above 20% in 1998. The success rate was 60,2% while the defaulter rate was 17% in 1996 and 16,9% in 1997. The success rate was 71,7% and 70% but was not pass 10% in years when success rate was above 80%.

Table (٥): demonstrates the case finding-detection rate during ١٩٩٦. the detection rate passed the target rate in BahrALgazel ١٩٢,٨% White Nile ٩٥% , Gazira ١٤٣% , Gadarif ١٢٧% and Nahr Anile ٧٤% , but in Khartoum it was ٦٧% , Red Sea ٦١% , Kassala ٥٤% , ٤٩% in Blue Nile and Sinnar , ٣١% in N.Kordofan. It did not pass the ٢٠% in the rest of the states. The total Detection rate in general during ١٩٩٦ was ٥٨,٩% (less than the target rate).

Table (٦): Shows the case finding-detection rate during ١٩٩٧. The detection rate was above ١٠٠% in Bahr ALgabl ٣١٣% and Gadarif ١٠٩% but the detection rate reached the target rate in Khartoum ٩٠% and Red Sea ٧٠,٧% , in Blue Nile, White Nile and Kassala in the range of (٣٠-٥٠) %. The detection rate did not pass ٣٠% in the rest of states. The table shows that during ١٩٩٩ the detection rate increased in Bahr ALgabl, Khartoum, and Red Sea than in the previous year of ١٩٩٦.

Figure (٨): Compares the detection rate with the target rate during ١٩٩٨. The curve is above the target rate of (٧٠) % line in Bahr ALgabl, Khartoum, Red Sea and Nahr Anile states, in Kassala, Gazira, and White Nile the detection rate is in the range of (٣٠-٥٠) % and did not pass ٣٠% in the rest of the states.

Figure (٩): Compares the detection rate with the target rate during-١٩٩٩. The detection rate as well, passed the estimated number (expected) in Bah ALgabl ١٦٦% , White Nile ١٧٧% , Khartoum ١٠٩% and Red Sea ١٣٦% . The detection rate in these states passed the detection rate during ١٩٩٨, while in Gazira, Blue Nile, Northern & Kassala where it is still far beyond the expected (٣٠-٤٠) and did not pass ٣٠% in the rest of the states.

Table (٧): Shows the case finding-detection rate during- ٢٠٠٠. In the table the detection rate is above the target rate ٧٠% . In Bahr ALgabl ١٠٣% , White Nile ١٠٩% , Khartoum ٩٩% , Red Sea ١٠٥% and Nahr Anile ٨٠% . In the Gazira, Sinnar, Gadarif, Northern and N.Kordofan, the detection rate is in the

range of (30-60) %, and did not pass 30% in the rest of the states. The total detection rate during 2000 was 50% which is less than the target rate.

Figure (10) compares the detection rate with the target rate during-2001. Figure shows that only four states achieved the target rate. Bahrgabl 86%, White Nile 109%, Khartoum 80% and Red Sea 83%. In Nahr Anile 60%, Blue Nile 32% and N.Kordofan about 30%. The detection rate in the rest of States was less than 30%.

Figure (11) compares the detection rate with the target rate during-2002. In the Figure the detection rate did not pass the target rate, except in Khartoum 48% and Red Sea 87%. However, the detection rate in the White Nile, Blue Nile, Gazira, Nahr Nile and N.Kordofan is in the range of (30-64) % and passed 30% in the rest of the states. The figure shows that during 2002 the detection rate came down in Bahr ALgabl and White Nile compared with the previous year 2001.

Table (8): Shows the case finding-detection rate in 2003. The table shows that the detection rate became less than in the previous year 2002. In Khartoum it is from 47% to 46%, White Nile from 64% to 53% and Red sea from 86% to 40%. The detection rate in Gazira, Sinnar, Kassala, Nahr Nile, N.Kordofan range between (30-50) % and dose not pass 30% in the rest of the states. The total detection rate during 2003 was 30,7%.

Table (9): Shows the case finding-detection rate from 1996 to 2003. The table shows that the detection rate did not pass the target rate. It was (58,9% , 49% , 43% , 54,5% , 50,5%) in the years 1996, 1997, 1998, 1999 and 2000 consecutively. In 2001, 2002 & 2003 it ranges between (30-37) %.

Figure (12): Compares treatment success rate with detection rate from 1996 to 2003. The figure shows that the success rate was 70% in 1996, 69% in 1997 and about 60% in 1998. The success rates increased in 1999 80%. In 2000 it was 80,7%, in 2001 was 84,2% and reached the target rate in 2002 80,3%. The success rate in 2003 was 81,0%. The detection rate was not stable

in 1996 57%. In 1997 it was 49% in 1999, 54%, 2000 and 49%, in 2001, 2002 & 2003 was less than 40%. Figure (13): Shows the treatment success rate against default rate during-1996. The figure shows the negative relationship between the success rate and defaulter rate. The defaulter rate increased where the success rate decreased. In Bahr ALgazel the success rate was 72% and the defaulter was 10%, In Upper Nile the success was 72% the defaulter rate was 16% in Blue Nile the success was 86,5% the defaulter was 3,9%. If we draw a line in 50%, the success rate curve is typically the defaulter rate “mirror image”. This indicates a strong relationship between success rate and defaulter rate.

Interview-results: - the information collected by interview-sheet from the NTP staff in Sudan gave the following:-

There are 22 state out of 26 state covered by the DOTS strategy according to WHO recommendation in 1996. The staff in TBMU where DOTS was applied, included, physician, medical officer, medical assistant, lab-technician, nursing staff, register and CHW. The staff was trained on diagnosis, recording & reporting system, health education, training of personnel & supervision. Any TBMU had sufficient laboratory facilities, there are constraints facing recording & reporting system like turn over of the staff, the strategy of incentives not full filled.

There are many surveys conducted with patients to know the reasons behind interrupted treatment (defaulters) the surveys showed that there are many reasons for that: the culture and occupations of the patients , long term of treatment , mobile population in conflict areas , socio-economic factors etc .

The reasons for high deaths among TB cases especially in Southern and Western states are HIV , poverty , wars , nutrition.....etc . The detection rate is less than the target rate in many states. The intervention to increase the

detection rate like to reactivate the centers, training of personnel and motivation for the health personnel.

There are many constraints facing DOTS strategy to achieve their objectives like political commitment which is very weak in many states, turn over of the staff, lack of incentives for motivation, instability in some areas of the West, East and South regions.

Table (١) shows the treatment results-new cases by states-١٩٩٦

state	cured	completed	died	failure	defaulted	Transferred	total	cu rate	com rate	success rate	death rate	fai rate	def rate	trans rate
BAHRALGABAL	٣١٤	٣٤٨	٥٨	٦٤	٩٩	٣٩	٩٠٨	٣٤,٥٨١٥	٣٨,٣٢٦	٧٢,٩٠٧٤٨٩	٦,٣٨٧٦٧	٧,٠٤٨٥	١٠,٩٠٣	٤,٢٩٥١٥٤
UPPER NILE	٢١	٥٦	١٠	١٦	٢١	.	١٢٤	١٦,٩٣٥٤٨	٤٥,١٦١٣	٦٢,٠٩٦٧٧٤٢	٨,٠٦٤٥٢	١٢,٩٠٣	١٦,٩٣٥	.
BLUE NILE	١١٩	٩٨	٤	٧	١٠	١٣	٢٥١	٤٧,٤١٠٣٦	٣٩,٠٤٣٨	٨٦,٤٥٤١٨٣٣	١,٥٩٣٦٣	٢,٧٨٨٨	٣,٩٨٤١	٥,١٧٩٢٨٣
GAZIRA	٤٠٠	٥٧٠	١٣	٨٦	٤٠	٣٠	١١٣٩	٣٥,١١٨٥٣	٥٠,٠٤٣٩	٨٥,١٦٢٤٢٣٢	١,١٤١٣٥	٧,٥٥٠٠	٣,٥١١٩	٢,٦٣٣٨٨٩
SINNAR	٢٠	٩	١	٥	٧	٥	٤٧	٤٢,٥٥٣١٩	١٩,١٤٨٩	٦١,٧٠٢١٢٧٧	٢,١٢٧٦٦	١٠,٦٣٨	١٤,٨٩٤	١٠,٦٣٨٣
KHARTOUM	٢	.	.	.	٤	.	٦	٣٣,٣٣٣٣٣	.	٣٣,٣٣٣٣٣٣	.	.	٦٦,٦٦٧	.
KHARTOUM_FED	٦٩	٢٨	٣٠	٢٧	٥٥١	٧	٧١٢	٩,٦٩١٠١١	٣,٩٣٢٥٨	١٣,٦٢٣٥٩٥٥	٤,٢١٣٤٨	٣,٧٩٢١	٧٧,٣٨٨	٠,٩٨٣١٤٦
KHARTOUM_SCC	١٢٦	٩١	٧	٩	١٤	١٣	٢٦٠	٤٨,٤٦١٥٤	٣٥	٨٣,٤٦١٥٣٨٥	٢,٦٩٢٣١	٣,٤٦١٥	٥,٣٨٤٦	٥
GADARIF	٩٥٣	٣١٧	٤١	١٧	٧٤	٦٤	١٤٦٢	٦٥,١٨٤٦٨	٢١,٦٨٢٦	٨٦,٨٦٧٣٠٥١	٢,٨٠٤٣٨	١,١٦٢٨	٥,٠٦١٦	٤,٣٧٧٥٦٥
KASSALA	١٧١	٣٤	١٢	٢	٢٠	٢	٢٤١	٧٠,٩٥٤٣٦	١٤,١٠٧٩	٨٥,٠٦٢٢٤٠٧	٤,٩٧٩٢٥	٠,٨٢٩٩	٨,٢٩٨٨	٠,٨٢٩٨٧٦
RED SEA	١٢٩	١٠٤	٩	٨	١١٦	١٧	٤١٣	٣١,٢٣٤٨٧	٢٥,١٨١٦	٥٦,٤١٦٤٦٤٩	٢,١٧٩١٨	١,٩٣٧	٢٨,٠٨٧	٤,١١٦٢٢٣
NORTHERN	.	٤	.	.	٢	٢	٨	.	٥٠	٥٠	.	.	٢٥	٢٥
S.KORDOFAN	١٥	١٠	٢	١	٣	.	٣١	٤٨,٣٨٧١	٣٢,٢٥٨١	٨٠,٦٤٥١٦١٣	٦,٤٥١٦١	٣,٢٢٥٨	٩,٦٧٧٤	.
W.KORDOFAN	٣٦	٣٦	.	٤	١٠	.	٨٦	٤١,٨٦٠٤٧	٤١,٨٦٠٥	٨٣,٧٢٠٩٣٠٢	.	٤,٦٥١٢	١١,٦٢٨	.
TOTAL	٢٣٧٥	١٧٠٥	١٨٧	٢٤٦	٩٧١	١٩٢	٥٦٨٨	٤١,٧٥٤٥٧	٢٩,٩٧٥٤	٧١,٧٢٩٩٥٧٨	٣,٢٨٧٦٢	٤,٣٢٤٩	١٧,٠٧١	٣,٣٧٥٥٢٧

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Table (٢) shows the treatment results-new cases by states-١٩٩٧

state	cured	completed	died	failure	defaulted	transferred	total	cu_rate	com_rate	success rate	death rate	fai_rate	def rate	trans_rate
BAHRALGABAL	٦٢٥	٦٢٩	١٠٢	١١٠	١٨٢	٥١	١٦٨٧	٣٧,٠٤٨	٣٧,٢٨٥	٧٤,٣٣٣١٣٦	٦,٠٤٦٢٣٦	٦,٥٢٠٠	١٠,٨٤٨	٢,٠٢٣١٢
W.BAHRALGAZAL	٥٤	٢٢	٣	٢	٥٢	١	١٢٥	٤٠	١٦,٢٩٦	٥٦,٢٩٦٢٩٦	٢,٢٢٢٢٢٢	١,٤٨١٥	٣٩,٢٥٩	٠,٧٤٠٧٤
UPPER NILE	٣٠	٤٧	٣	٣	١٧	٠	١٠٠	٣٠	٤٧	٧٧	٣	٣	١٧	٠
BLUE NILE	٢٦٢	١٢٤	٢٠	١٦	٣٨	٤	٤٦٤	٥٦,٤٦٥٥	٢٦,٧٢٤	٨٢,١٨٩٦٥٥	٤,٣١٠٣٤٥	٣,٤٤٨٢	٨,١٨٩٧	٠,٨٦٢٠٧
WHITE NILE	١٠٣	٤١	٩	٥	٣	٢	١٦٣	٦٣,١٩٠٢	٢٥,١٥٢	٨٨,٣٤٣٥٥٨	٥,٥٢١٤٧٢	٣,٠٦٧٥	١,٨٤٠٥	١,٢٢٦٩٩
GAZIRA	٤٥٤	٢٧٨	٢٣	٣١	٨٥	٢٩	٨٩٩	٥٠,٥٠٠٦	٣٠,٩٢٢	٨١,٤٢٣٨٠٤	٢,٥٥٨٣٩٨	٣,٤٤٨٢	٩,٤٥٤٩	٣,٢٢٥٨١
KHARTOUM	٤٩	٣	٤	١٩	٥٦	٣	١٢٤	٣٦,٥٦٧٢	٢,٢٣٨٨	٣٨,٨٠٥٩٧	٢,٩٨٥٠٧٥	١٤,١٧٩	٤١,٧٩١	٢,٢٣٨٨١
KHARTOUM_FED	٣٨٩	٥٠	٤٣	٢٣	٣٨٥	١٩٢	١٠٦٢	٣٦,٦٢٩	٤,٧٠٨١	٤١,٣٣٧١	٤,٠٤٨٩٦٤	٣,١٠٧٢	٣٦,٢٥٢	١٨,٠٧٩١
KHARTOUM_SCC	٢٢٢	١١٧	١٦	٢١	٣٧	١٨	٤٤١	٥٢,٦٠٧٧	٢٦,٥٣١	٧٩,١٣٨٣٢٢	٣,٦٢٨١١٨	٤,٧٦١٩	٨,٣٩	٤,٠٨١٦٢
GADARIF	٤٨٦	٢٥٧	٢٤	١٠	٩٨	٥١	٩٢٢	٥٢,٦٥٤٤	٢٧,٨٤٤	٨٠,٤٩٨٣٧٥	٢,٦٠٠٢١٧	١,٠٨٢٤	١٠,٦١٨	٥,٥٢٥٤٦
KASSALA	١٩٢	١١	١٥	٥	٢٦	١١	٢٦٠	٧٣,٨٤٦٢	٤,٢٣٠٨	٧٨,٠٧٦٩٢٢	٥,٧٦٩٢٣١	١,٩٢٣١	١٠	٤,٢٣٠٧٧
RED SEA	٢٧٩	٧٤	٢٠	١٤	١٥٨	٣٦	٥٧٩	٤٨,١٨٦٥	١٢,٧٨١	٦٠,٩٦٧١٨٥	٣,٤٥٤٢٣١	٢,٤١٨	٢٧,٢٨٨	٦,٢١٧٦٢
NAHR ALNILE	٩٦	٢	١٠	٣	٣١	٣	١٤٤	٦٦,٦٦٦٧	١,٣٨٨٩	٦٨,٠٥٥٥٥٦	٦,٩٤٤٤٤٤	٢,٠٨٢٣	٢١,٥٢٨	٢,٠٨٢٣٣
NORTHERN	٢	٢	١	٠	٧	٢	١٤	١٤,٢٨٥٧	١٤,٢٨٦	٢٨,٥٧١٤٢٩	٧,١٤٢٨٥٧	٠	٥٠	١٤,٢٨٥٧
N.KORDOFAN	٩٦	١٧	٨	٨	٢٤	٤	١٥٧	٦١,١٤٦٥	١٠,٨٢٨	٧١,٩٧٤٥٢٢	٥,٠٩٥٥٤١	٥,٠٩٥٥	١٥,٢٨٧	٢,٥٤٧٧٧
TOTAL	٣٣٤٩	١٦٥٤	٣٠١	٢٨٠	١٢٠١	٤٠٧	٧١٢٦	٤٦,٩٩٦٩	٢٣,٢١١	٧٠,٢٠٧٦٩	٤,٢٢٣٩٦٩	٣,٩٢٩٣	١٦,٨٥٤	٥,٧١١٤٨

Table (٣) shows the treatment results-new cases by states-٢٠٠٠

state	cured	completed	died	failure	defaulted	transferred	total	cu_rate	com_rate	success rate	death rate	fai_rate	def_rate	trans_rate
ALWIHDA	٧١	٨	١	٧	٥	٠	٩٢	٧٧,١٧٣٩١	٨,٦٩٥٦٥٢	٨٥,٨٦٩٥٦٥	١,٠٨٦٩٦	٧,٦٠٨٧	٥,٤٣٤٨	٠
BAHRALGABAL	٢٢٧	٢٥٤	٢٦	٢٩	٢٣	١٢	٥٧٧	٣٩,٣٤١٤٢	٤٤,٠٢٠٨	٨٣,٣٦٢٢١٨	٤,٥٠٦٠٧	٥,٠٢٦	٥,٧١٩٢	٢,٠٧٩٧٢٣
N.BAHRALGAZAL	١١	٦	٢	١	١	١	٢١	٥٢,٣٨٠٩٥	٢٨,٥٧١٤٣	٨٠,٩٥٢٣٨١	٩,٥٢٣٨١	٤,٧٦١٩	٤,٧٦١٩	٤,٧٦١٩٠
W.BAHRGAZAL	١٠٦	٣٩	١٣	٠	٣٦	٤	١٩٨	٥٣,٥٣٥٣٥	١٩,٦٩٦٩٧	٧٣,٢٢٢٣٢٣	٦,٥٦٥٦٦	٠	١٨,١٨٢	٢,٠٢٠٢٠٢
UPPER NILE	١٨٥	١٥٥	٣٥	١٢	٣٩	٨	٤٣٢	٤٢,٨٢٤٠٧	٣٥,٨٧٩٦٣	٧٨,٧٠٣٧٠٤	٨,١٠١٨٥	٢,٧٧٧٨	٩,٠٢٧٨	١,٨٥١٨٥٢
GONGLY	١٢	١١	٣	٠	٣	٠	٢٩	٤١,٣٧٩٣١	٣٧,٩٣١٠٣	٧٩,٣١٠٣٤٥	١,٠٣٤٤٨	٠	١,٠٣٤٥	٠
BLUE NILE	٣٥	٤٤	٧	٦	٣٠	٨	١٣٠	٢٦,٩٢٣٠٨	٣٣,٨٤٦١٥	٦٠,٧٦٩٢٣١	٥,٣٨٤٦٢	٤,٦١٥٤	٢٣,٠٧٧	٦,١٥٣٨٤٦
WHITE NILE	١٥٥٨	٣٩١	٤٨	٦٢	٩١	١٥	٢١٥٩	٧٢,١٦٣٠٤	١٨,١١٠٢٤	٩٠,٢٧٣٢٧٥	٢,٢٢٣٢٥	٢,٨٧١٧	٤,٢١٤٩	٠,٦٩٤٧٦٦
GAZIRA	٤٣٢	٤١٤	٥١	٠	٩٤	١٢	١٠٠١	٤٣,١٥٦٨٤	٤١,٣٥٨٦٤	٨٤,٥١٥٤٨٥	٥,٠٩٤٩١	٠	٩,٣٩٠٦	١,١٩٨٨٠١
SINNAR	١٢١	٣٠	٢٨	٣	٦٠	١٧	٣٥٧	٣٣,٨٩٣٥٦	٨,٤٠٣٣٦١	٤٢,٢٩٦٩١٩	٧,٨٤٣١٤	٠,٨٤٠٣	١٦,٨٠٧	٤,٧٦١٩٠
KHARTOUM	١٤٥٨	٦١٤	٨٦	١٨	٣٤٦	٢٠٧	٢٦٦٤	٥٤,٧٢٩٧٣	٢٣,٠٤٨٠٥	٧٧,٧٧٧٧٨	٣,٢٢٨٢٣	٠,٦٧٥٧	١٢,٩٨٨	٧,٧٧٠٢٧
KHARTOUM FED	٥١٢	٧٦٠	٨٧	٣٨	١٧٨	٢٥١	١٧٣١	٢٩,٥٧٨٢٨	٤٣,٩٠٥٢٦	٧٣,٤٨٣٥٣٦	٥,٠٢٦	٢,١٩٥٣	١,٠٢٨٣	١٤,٥٠٠٢٩
KHARTOUM SCC	٦٥٠	٨٤	١٨	٥	٣٤	٢٢	٨١٠	٨٠,٢٤٦٩١	١,٠٣٧٠٣٧	٩٠,٦١٧٢٨٤	٢,٢٢٢٢٢	٠,٦١٧٣	٤,١٩٧٥	٢,٧١٦٠٤٩
GADARIF	٣٣٩	٢٢٠	٣٣	٦	٥٧	٣٥	٦٨٤	٤٩,٥٦١٤	٣٢,١٦٣٧٤	٨١,٧٢٥١٤٦	٤,٨٢٤٥٦	٠,٨٧٧٢	٨,٣٣٣	٥,١١٦٩٥٩
KASSALA	٢٧٨	٤٨	١٠	١	٥٤	٩	٣٩٤	٧٠,٥٥٨٣٨	١٢,١٨٢٧٤	٨٢,٧٤١١١٧	٢,٥٣٨٠٧	٠,٢٥٣٨	١٣,٧٠٦	٢,٢٨٤٢٦٤
RED SEA	٣٥٦	١٧٧	٤٠	٢٤	١٢٣	٥٣	٧٦٤	٤٦,٥٩٦٨٦	٢٣,١٦٧٥٤	٦٩,٧٦٤٣٩٨	٥,٢٣٥٦	٣,١٤١٤	١٦,٠٩٩	٦,٩٣٧١٧٣
NAHR ALNILE	٤٠٤	١٩٨	٢٢	٩	٣٩	١١	٦٨٣	٥٩,١٥٠٨١	٢٨,٩٨٩٧٥	٨٨,١٤٠٥٦	٣,٢٢١٠٨	١,٣١٧٧	٥,٧١٠١	١,٦١٠٥٤٢
NORTHERN	١٢٤	٤٠	٩	٨	١٤	٤	١٩٨	٦٢,٦٢٦٢٦	٢٠,٢٠٢٠٢	٨٢,٨٢٨٢٨٣	٤,٥٤٥٤٥	٤,٠٤٠٤	٧,٠٧٠٧	٢,٠٢٠٢٠٢
N.KORDOFAN	٣٩٨	٨٠	١٩	٧	٢٦	٥	٥٣٤	٧٤,٥٣١٨٤	١٤,٩٨١٢٧	٨٩,٥١٣١٠٩	٣,٥٥٨٠٥	١,٣١٠٩	٤,٨٦٨٩	٠,٩٣٦٣٣
S.KORDOFAN	١٣	١	١	١	١	٢	١٩	٦٨,٤٢١٠٥	٥,٢٦٣١٥٨	٧٣,٦٨٤٢١١	٥,٢٦٣١٦	٥,٢٦٣٢	٥,٢٦٣٢	١,٠٥٢٦٣٢
W.KORDOFAN	٥٤	١٥	١	٠	٢	٠	٧٢	٧٥	٢٠,٨٣٣٣٣	٩٥,٨٣٣٣٣٣	١,٣٨٨٨٩	٠	٢,٧٧٧٨	٠
TOTAL	٧٣٤٤	٣٥٨٩	٥٤٠	٢٣٧	١٢٦٦	٦٧٦	١٣٥٤٩	٥٤,٢٠٣٢٦	٢٦,٤٨٩٠٤	٨٠,٦٩٢٣٠٢	٣,٩٨٥٥٣	١,٧٤٩٢	٩,٣٤٣٩	٤,٩٨٩٢٩٨

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Table (ξ) shows the treatment results-new from (1997 to 2003)

year	cured	completed	died	failure	defaulted	transferred	total	cu rate	com rate	success rate	death rate	fai rate	def rate	trans rate
1996	2370	1700	187	246	971	192	5688	14,70	29,98	71,73	3,29	4,32	17,07	3,38
1997	3349	1704	301	280	1201	407	7126	47,99	23,21	70,2	4,22	3,93	17,80	0,71
1998	3710	1847	494	402	1730	329	8494	43,78	21,73	60,41	0,82	4,73	20,43	3,99
1999	7022	4044	771	298	1110	083	13127	40,87	34,72	80,49	0,04	2,27	8,47	4,44
2000	7344	3089	004	237	1277	776	13049	04,2	27,49	80,79	3,99	1,70	9,34	4,99
2001	7721	3081	494	80	872	472	12100	04,7	29,08	84,27	4,08	0,7	7,12	3,82
2002	7434	2130	377	77	803	272	10000	74,02	21,24	80,27	3,70	0,77	7,99	2,71
2003	3138	174	140	02	480	201	0104	70,88	20,74	81,02	2,81	1,01	9,41	4,87

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Table (°) demonstrates the case finding – Detection Rate – 1996

STATE	POPULATION	NEW CASES	ARI	ESTIMATED	DET. RATE	TARGET %
BAHRALGABAL	498000	864	0.0009	448,2	192,771.084	70
UPPER NILE	1347000	137	0.0009	1212,3	11,300.8331	70
BLUE NILE	566000	201	0.0009	0.9,4	49,2737002	70
WHITE NILE	1320000	1139	0.0009	1192,0	90,01377778	70
GAZIRA	300000	388	0.0009	270	143,703703	70
SINNAR	1052000	47	0.0009	946,8	4,97408907	70
KHARTOUM	4130000	2000	0.0009	3717	77,2080418	70
GADARIF	1293000	1402	0.0009	1163,7	120,477787	70
KASSALA	1320000	742	0.0009	1188	04,040404	70
RED SEA	674000	372	0.0009	606,6	71,320423	70
NAHR ALNILE	818000	046	0.0009	736,2	74,1747291	70
N.KORDOFAN	1370000	387	0.0009	1233	31,3878713	70
S.KORDOFAN	1020000	33	0.0009	918	3,09477124	70
W.KORDOFAN	1026000	168	0.0009	923,4	18,1937322	70
TOTAL	16739000	8876	0.0009	10060,1	08,9176308	70

Table (٦) shows the case finding – Detection Rate – ١٩٩٧

STATE	POPULATION	NEW CASES	ARI	ESTIMATED	DET.RATE	TARGET%
BAHRALGAZAL	٢١٥.٠٠٠	٦٥	٠,٠٠٠٩	١٩٣٥	٣,٣٥٩١٧٣١٢٧	٧٠
BAHRALGABAL	٥١٣.٠٠٠	١٤٤٨	٠,٠٠٠٩	٤٦١,٧	٣١٣,٦٢٣٥٦٥١	٧٠
UPPER NILE	١٣٨٦.٠٠٠	١٦٠	٠,٠٠٠٩	١٢٤٧,٤	١٢,٨٢٦٦٧٩٤٩	٧٠
BLUE NILE	٥٨٢.٠٠٠	٢٦٦	٠,٠٠٠٩	٥٢٣,٨	٥٠,٧٨٢٧٤١٥	٧٠
WHITE NILE	١٣٦٣.٠٠٠	٤٧٢	٠,٠٠٠٩	١٢٢٦,٧	٣٨,٤٧٧٢١٥٢٩	٧٠
GAZIRA	٣.٨٨.٠٠٠	٧٥٤	٠,٠٠٠٩	٢٧٧٩,٢	٢٧,١٣.١.٩٣٨	٧٠
SINNAR	١.٨٢.٠٠٠	٩٢	٠,٠٠٠٩	٩٧٣,٨	٩,٤٤٧٥٢٥١٥٩	٧٠
KHARTOUM	٤٢٥.٠٠٠	٣٤٤٣	٠,٠٠٠٩	٣٨٢٥	٩٠,٠١٣.٧١٩	٧٠
GADARIF	١٣٣.٠٠٠	١٣١٦	٠,٠٠٠٩	١١٩٧	١.٩,٩٤١٥٢.٥	٧٠
KASSALA	١٣٦.٠٠٠	٥٥١	٠,٠٠٠٩	١٢٢٤	٤٥,٠١٦٣٣٩٨٧	٧٠
RED SEA	٦٩٣.٠٠٠	٤٤١	٠,٠٠٠٩	٦٢٣,٧	٧٠,٧٠٧.٧.٧١	٧٠
NAHR ALNILE	٨٤٢.٠٠٠	٥١٦	٠,٠٠٠٩	٧٥٧,٨	٦٨,٠٩١٨٤٤٨١	٧٠
NORTHERN	٥٤٦.٠٠٠	٥	٠,٠٠٠٩	٤٩١,٤	١,٠١٧٥.١.١٨	٧٠
N.KORDOFAN	١٣٩٨.٠٠٠	٣.١	٠,٠٠٠٩	١٢٥٨,٢	٢٣,٩٢٣.٦٤٧	٧٠
S.KORDOFAN	١.٥٠.٠٠٠	١.٤	٠,٠٠٠٩	٩٤٥	١١,٠٠٥٢٩١.١	٧٠
W.KORDOFAN	١.٥٦.٠٠٠	٧٥	٠,٠٠٠٩	٩٥٠,٤	٧,٨٩١٤١٤١٤١	٧٠
TOTAL	٢٢٦٨٩.٠٠٠	١٠٠٠٩	٠,٠٠٠٩	٢٠٤٢٠,١	٤٩,٠١٥٤٣.٨٧	٧٠

Table (Y) shows the case finding – Detection Rate – ٢٠٠٠

STATE	POPULATION	NEW CASES	ARI	ESTIMATED	DET.RATE	TARGET%
BAHRALGAZAL	٢١٥٠٠٠٠	٦٥	٠,٠٠٠٠٩	١٩٣٥	٣,٣٥٩١٧٣١٢٧	٧٠
BAHRALGABAL	٥١٣٠٠٠	١٤٤٨	٠,٠٠٠٠٩	٤٦١,٧	٣١٣,٦٢٣٥٦٥١	٧٠
UPPER NILE	١٣٨٦٠٠٠	١٦٠	٠,٠٠٠٠٩	١٢٤٧,٤	١٢,٨٢٦٦٧٩٤٩	٧٠
BLUE NILE	٥٨٢٠٠٠	٢٦٦	٠,٠٠٠٠٩	٥٢٣,٨	٥٠,٧٨٢٧٤١٥	٧٠
WHITE NILE	١٣٦٣٠٠٠	٤٧٢	٠,٠٠٠٠٩	١٢٢٦,٧	٣٨,٤٧٧٢١٥٢٩	٧٠
GAZIRA	٣٠٨٨٠٠٠	٧٥٤	٠,٠٠٠٠٩	٢٧٧٩,٢	٢٧,١٣٠١٠٩٣٨	٧٠
SINNAR	١٠٨٢٠٠٠	٩٢	٠,٠٠٠٠٩	٩٧٣,٨	٩,٤٤٧٥٢٥١٥٩	٧٠
KHARTOUM	٤٢٥٠٠٠٠	٣٤٤٣	٠,٠٠٠٠٩	٣٨٢٥	٩٠,٠١٣٠٧١٩	٧٠
GADARIF	١٣٣٠٠٠٠	١٣١٦	٠,٠٠٠٠٩	١١٩٧	١٠٩,٩٤١٥٢٠٥	٧٠
KASSALA	١٣٦٠٠٠٠	٥٥١	٠,٠٠٠٠٩	١٢٢٤	٤٥,٠١٦٣٣٩٨٧	٧٠
RED SEA	٦٩٣٠٠٠	٤٤١	٠,٠٠٠٠٩	٦٢٣,٧	٧٠,٧٠٧٠٧٠٧١	٧٠
NAHR ALNILE	٨٤٢٠٠٠	٥١٦	٠,٠٠٠٠٩	٧٥٧,٨	٦٨,٠٩١٨٤٤٨١	٧٠
NORTHERN	٥٤٦٠٠٠	٥	٠,٠٠٠٠٩	٤٩١,٤	١,٠١٧٥٠١٠١٨	٧٠
N.KORDOFAN	١٣٩٨٠٠٠	٣٠١	٠,٠٠٠٠٩	١٢٥٨,٢	٢٣,٩٢٣٠٦٤٧	٧٠
S.KORDOFAN	١٠٥٠٠٠٠	١٠٤	٠,٠٠٠٠٩	٩٤٥	١١,٠٠٥٢٩١٠١	٧٠
W.KORDOFAN	١٠٥٦٠٠٠	٧٥	٠,٠٠٠٠٩	٩٥٠,٤	٧,٨٩١٤١٤١٤١	٧٠
TOTAL	٢٢٦٨٩٠٠٠	١٠٠٠٩	٠,٠٠٠٠٩	٢٠٤٢٠,١	٤٩,٠١٥٤٣٠٨٧	٧٠

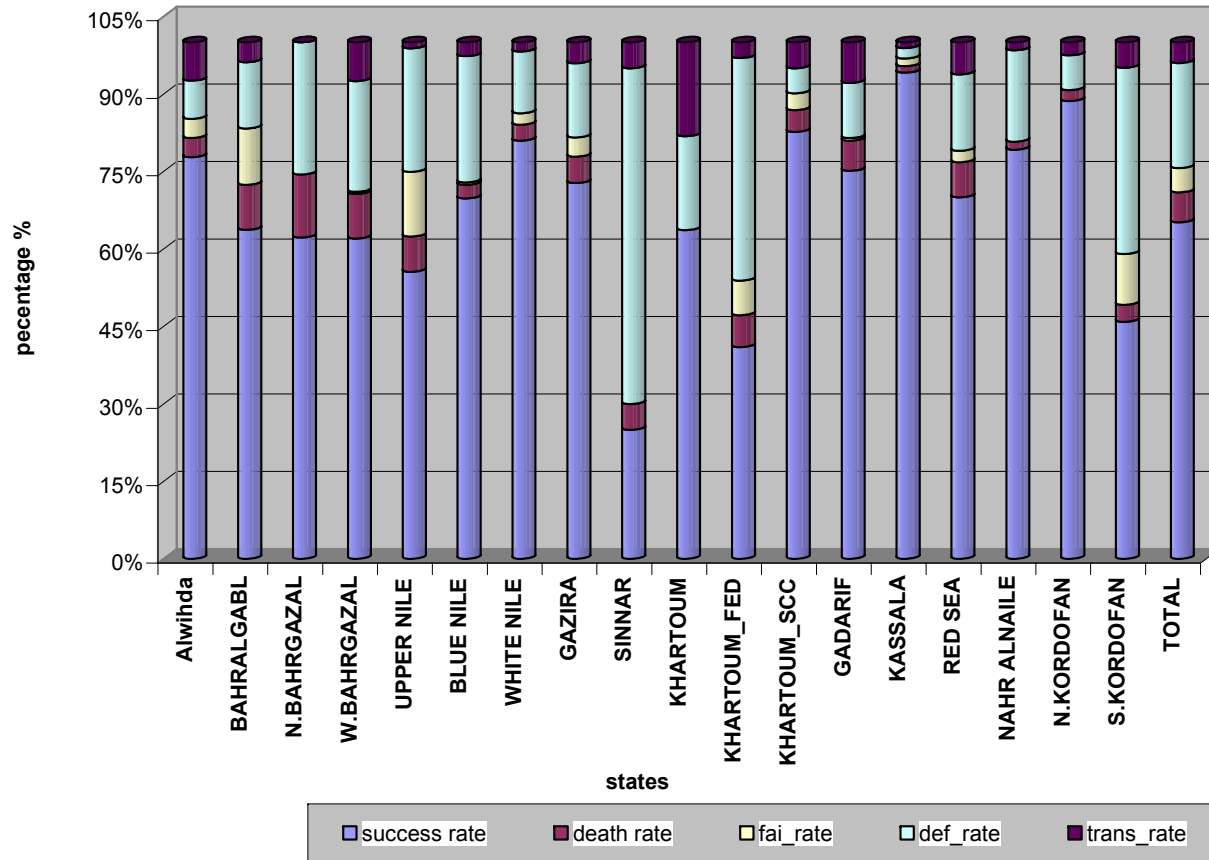
Table (A) shows the case finding – Detection Rate – 2023

state	POPULATION	NEW CASES	ARI	ESTIMATE D	DET.RATE	TARGET %
BAHRALGAZAL	2321000	212	0,009	2088,9	10,14888219	70
BAHRALGABAL	540000	51	0,009	486	103,0874198	70
UPPER NILE	1403000	362	0,009	1307,7	27,7821901	70
BLUE NILE	636000	157	0,009	572,4	27,4283717	70
WHITE NILE	1476000	1448	0,009	1328,4	109,003312	70
GAZIRA	3374000	969	0,009	3036,6	31,9107890	70
SINNAR	1173000	322	0,009	1000,7	30,0010893	70
KHARTOUM	4740000	4200	0,009	4266	99,7421472	70
GADARIF	1460000	760	0,009	1318,0	58,0204778	70
KASSALA	1469000	301	0,009	1322,1	27,0488720	70
RED SEA	721000	680	0,009	648,9	100,0673260	70
NAHR ALNILE	900000	603	0,009	810	80,7172839	70
NORTHERN	582000	222	0,009	523,8	42,3820887	70
N.KORDOFAN	1483000	469	0,009	1334,7	30,1389820	70
S.KORDOFAN	1111000	101	0,009	999,9	10,1010101	70
W.KORDOFAN	1124000	117	0,009	1011,6	11,0608363	70
N.DARFOR	1400000	172	0,009	1309,0	13,1347842	70
TOTAL	26023000	11811	0,009	23420,7	50,4297480	70

Table (9) shows the case finding – Detection Rate from (1996 to 2003)

year	POPULATION	NEW CASES	ARI	ESTIMATED	DET.RATE%	TARGET%
1996	16739...	8876	.,...9	10.60,1	08,91763	7.
1997	22689...	1009	.,...9	2.42,1	49,01043	7.
1998	27271...	1008	.,...9	24043,9	43,0168	7.
1999	28.60...	13788	.,...9	20208,0	04,08706	7.
2000	26.23...	11811	.,...9	2342,7	0,42970	7.
2001	3119...	1.462	.,...9	28.71	37,26978	7.
2002	2890...	1030	.,...9	26.00	38,49049	7.
2003	32913...	1088	.,...9	29621,7	30,74407	7.

figure (1) show the (succes, death,failure , defaulter & transfer out) rates -1998



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figure (2) Illustrates the (succes, death,failure , defaulter & transfer out) rates -1999

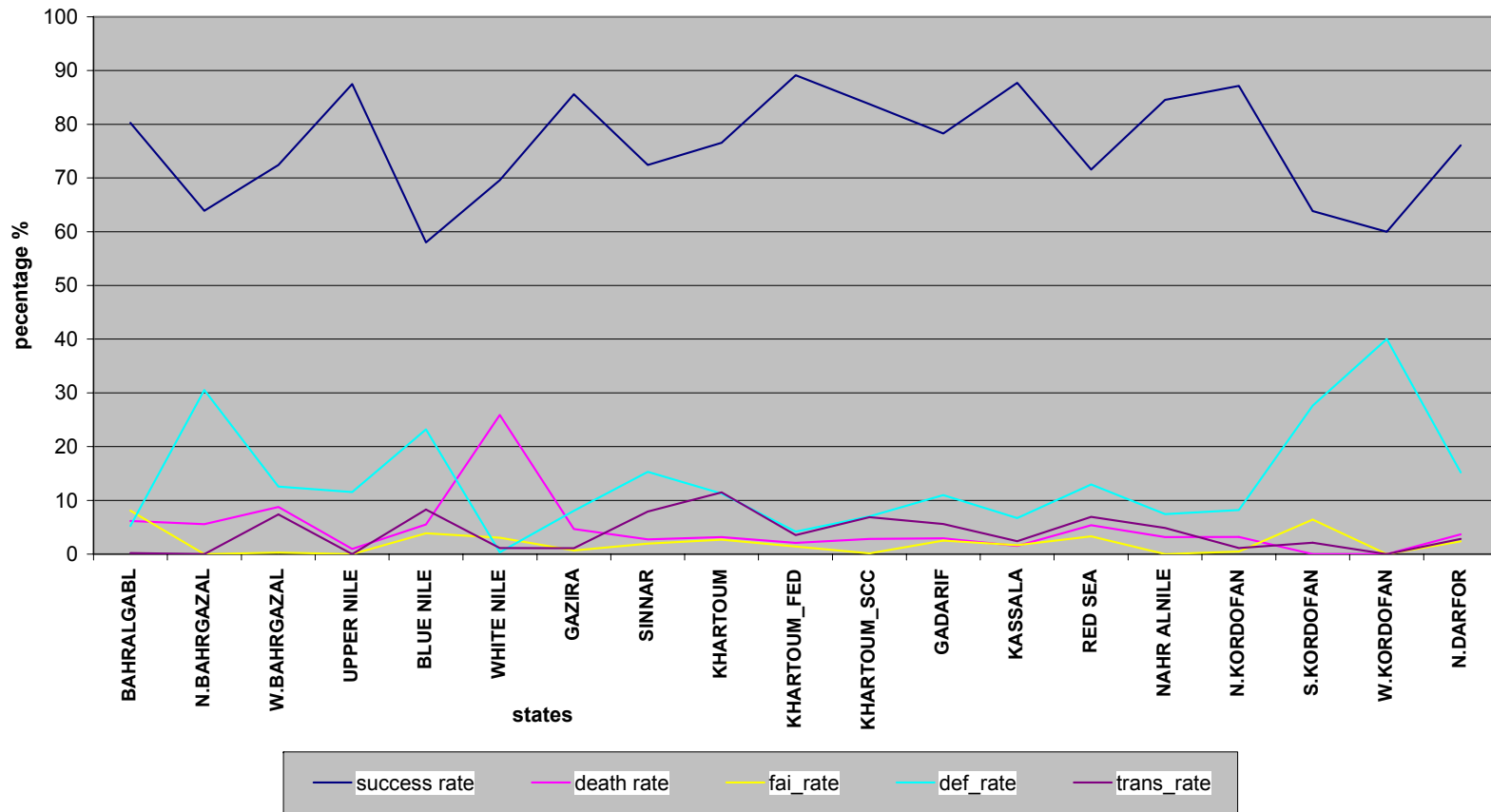


figure (3) demonstrates the (succes rate against defaulter rate) -1999

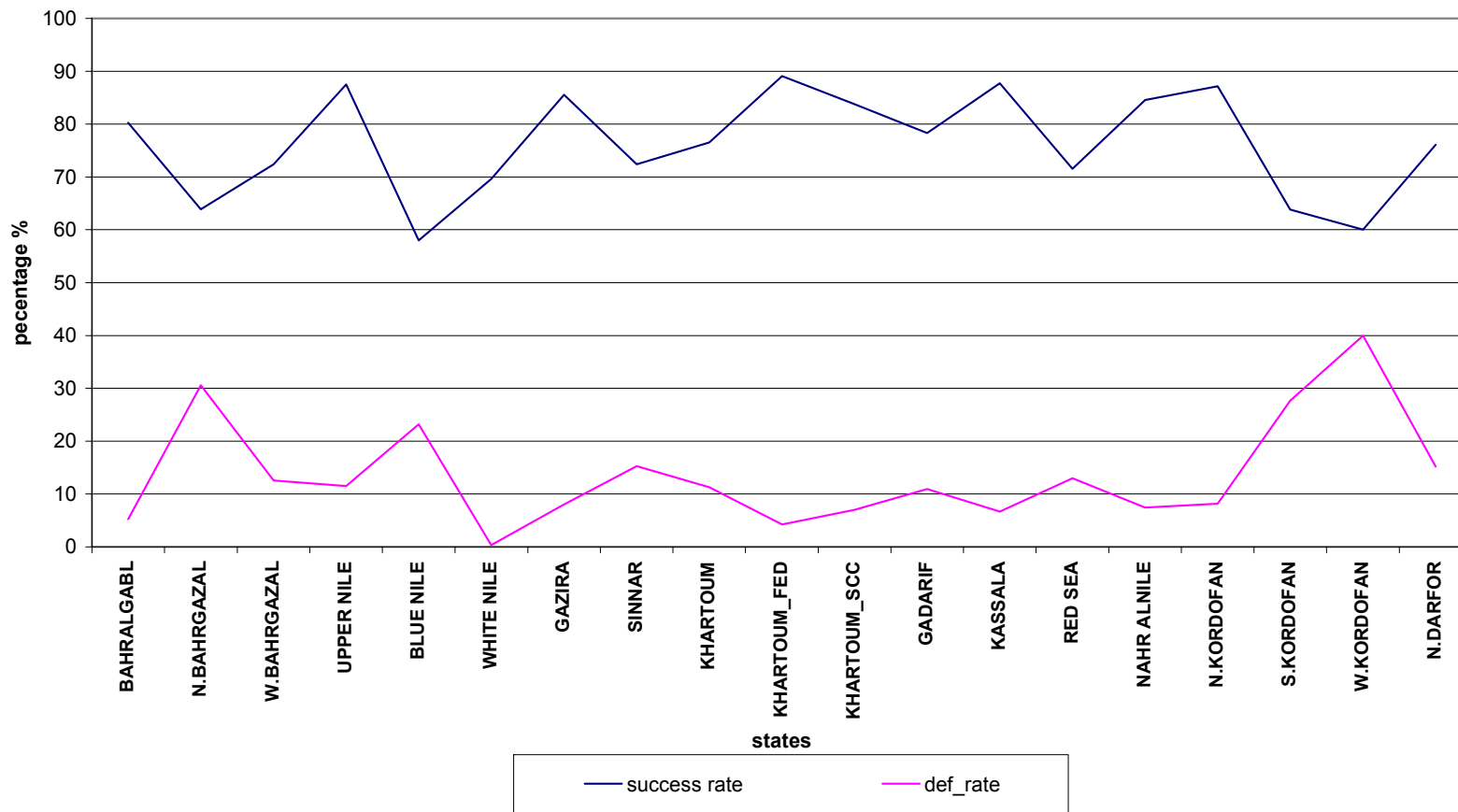
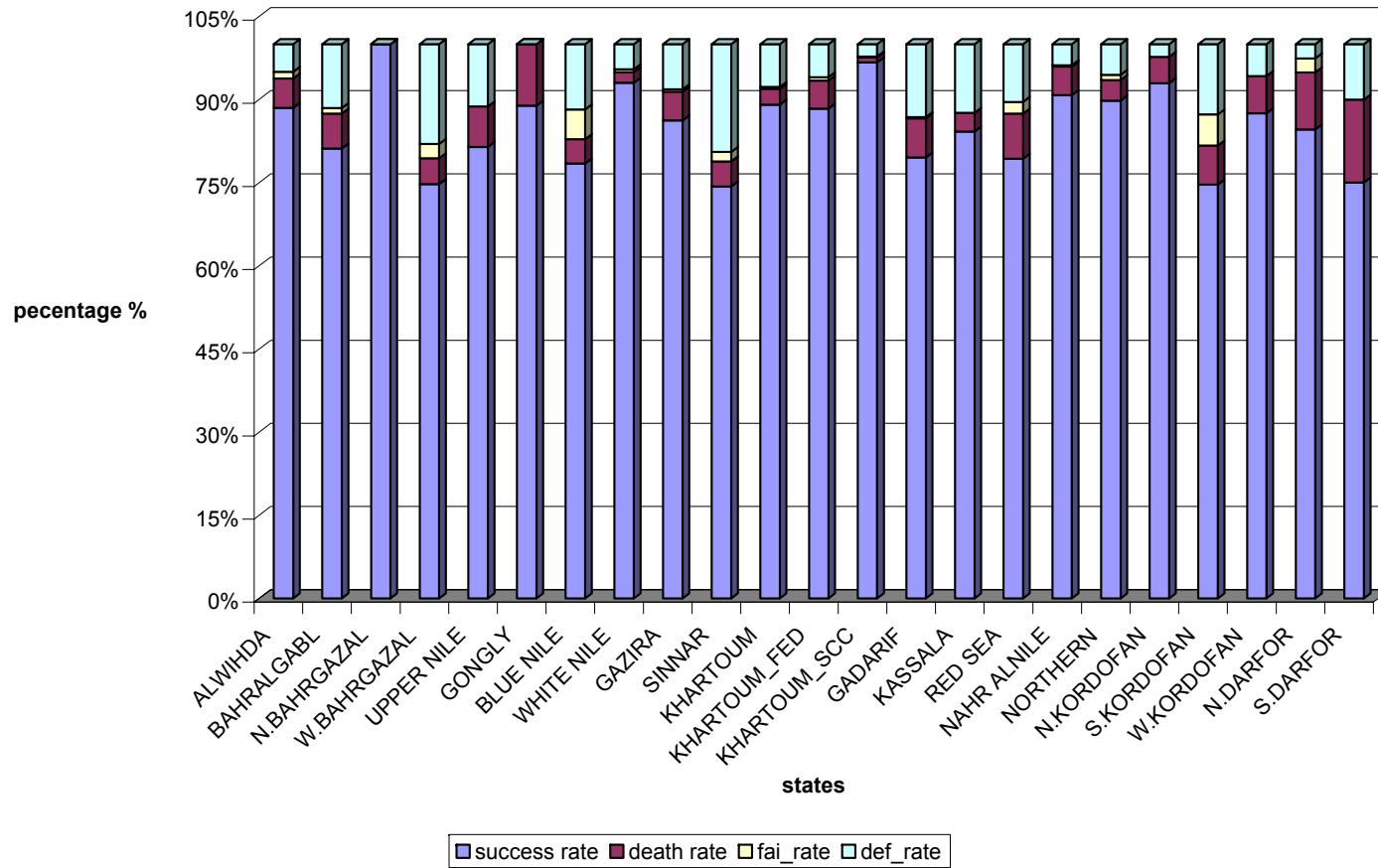
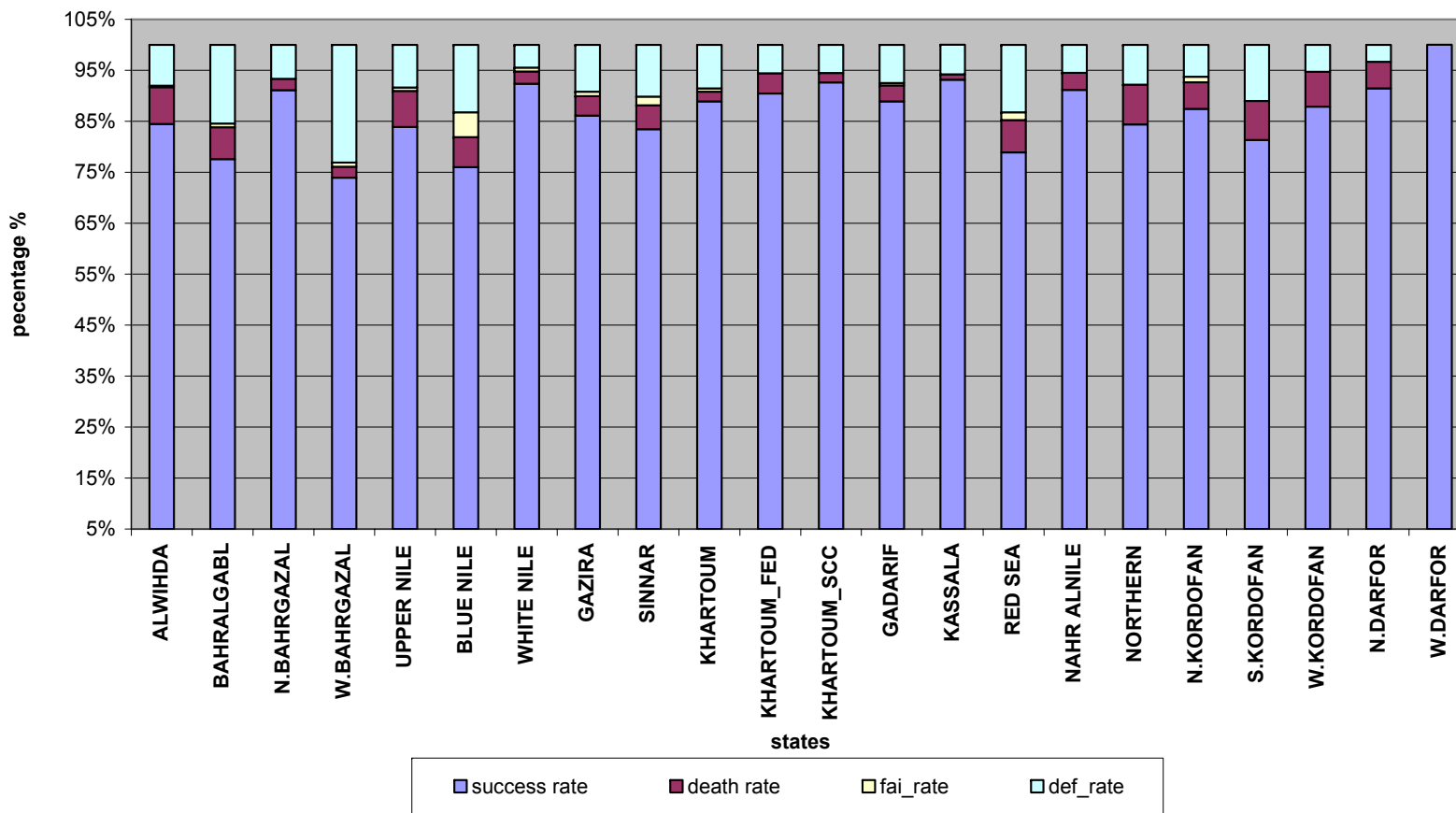


figure (4) shows the (succes, death,failure & defaulter) rates -2001



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figure (5) shows the (succes, death,failure & defaulter) rates -2002



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figure (6) shows the (succes rate against defaulter rates) -2002

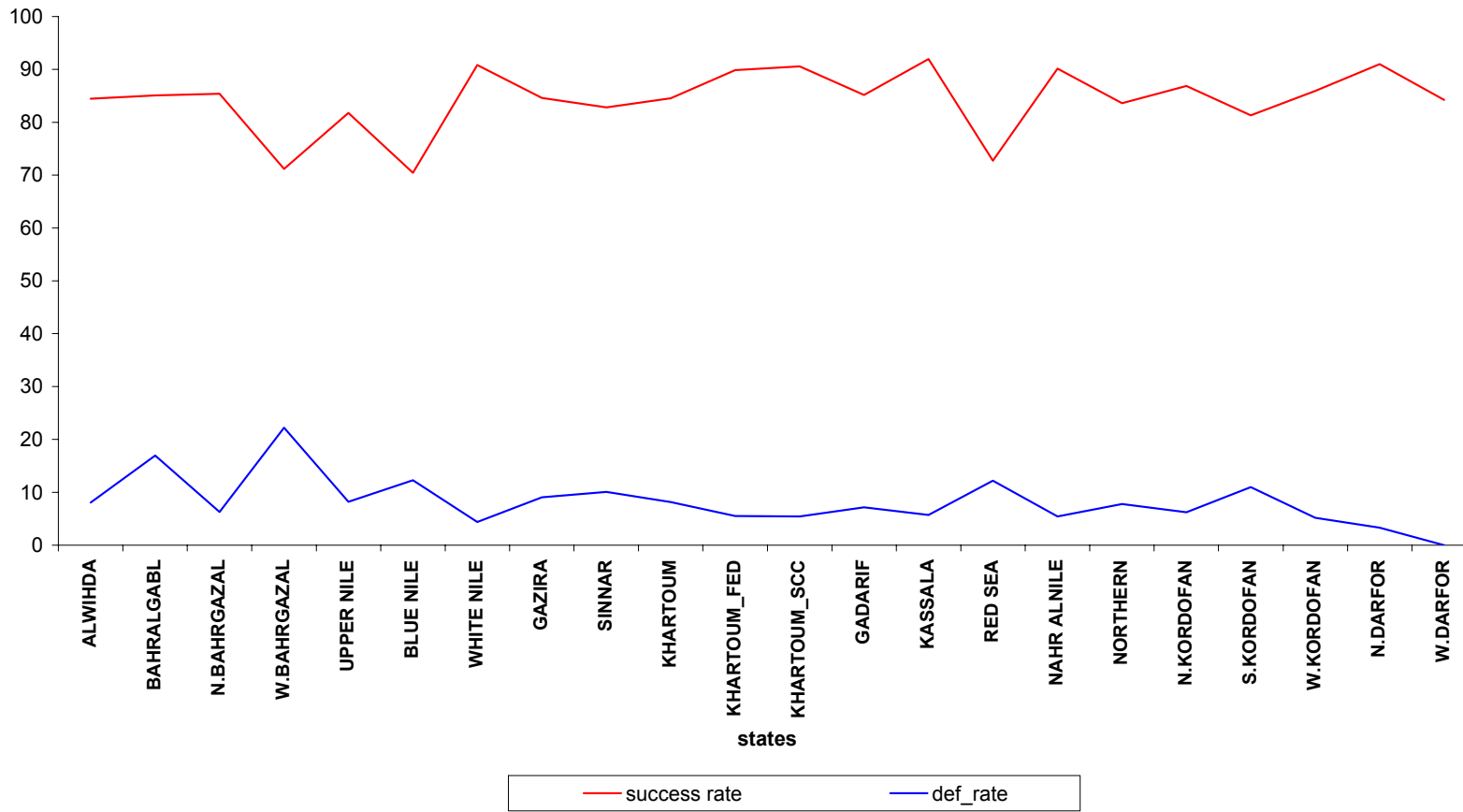


figure (7) shows the (succes, death,failure , defaulter & transfer out) rates -2003

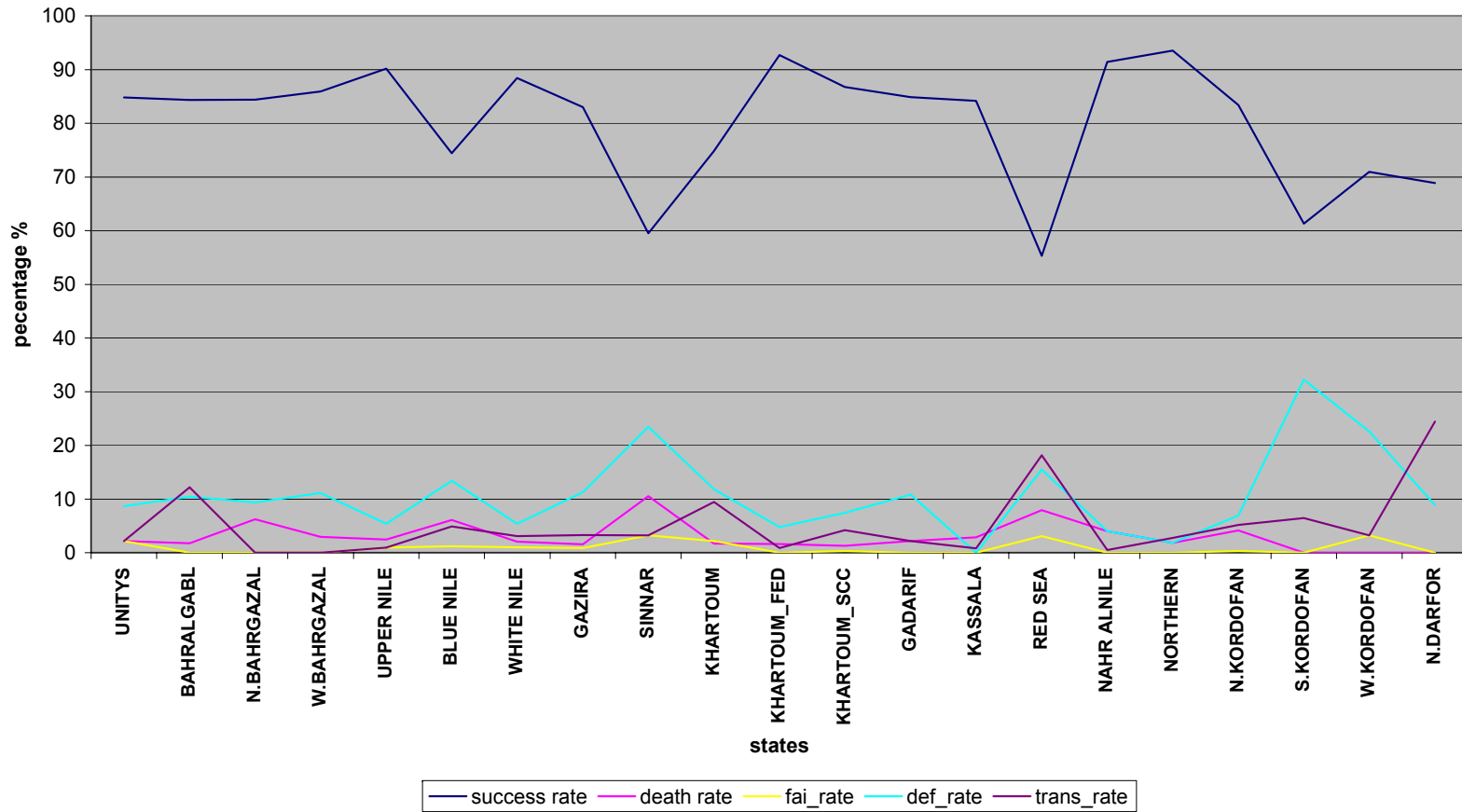
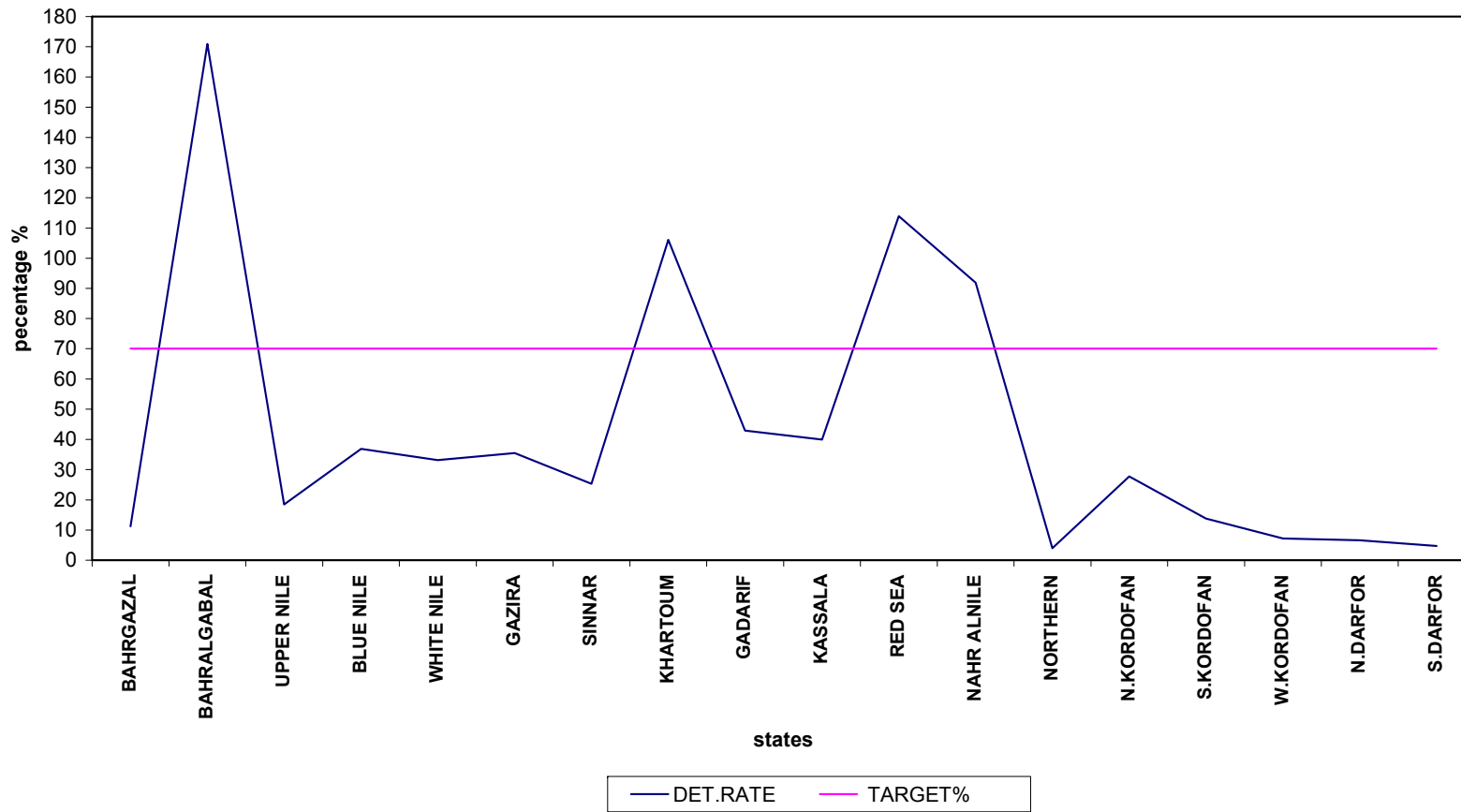
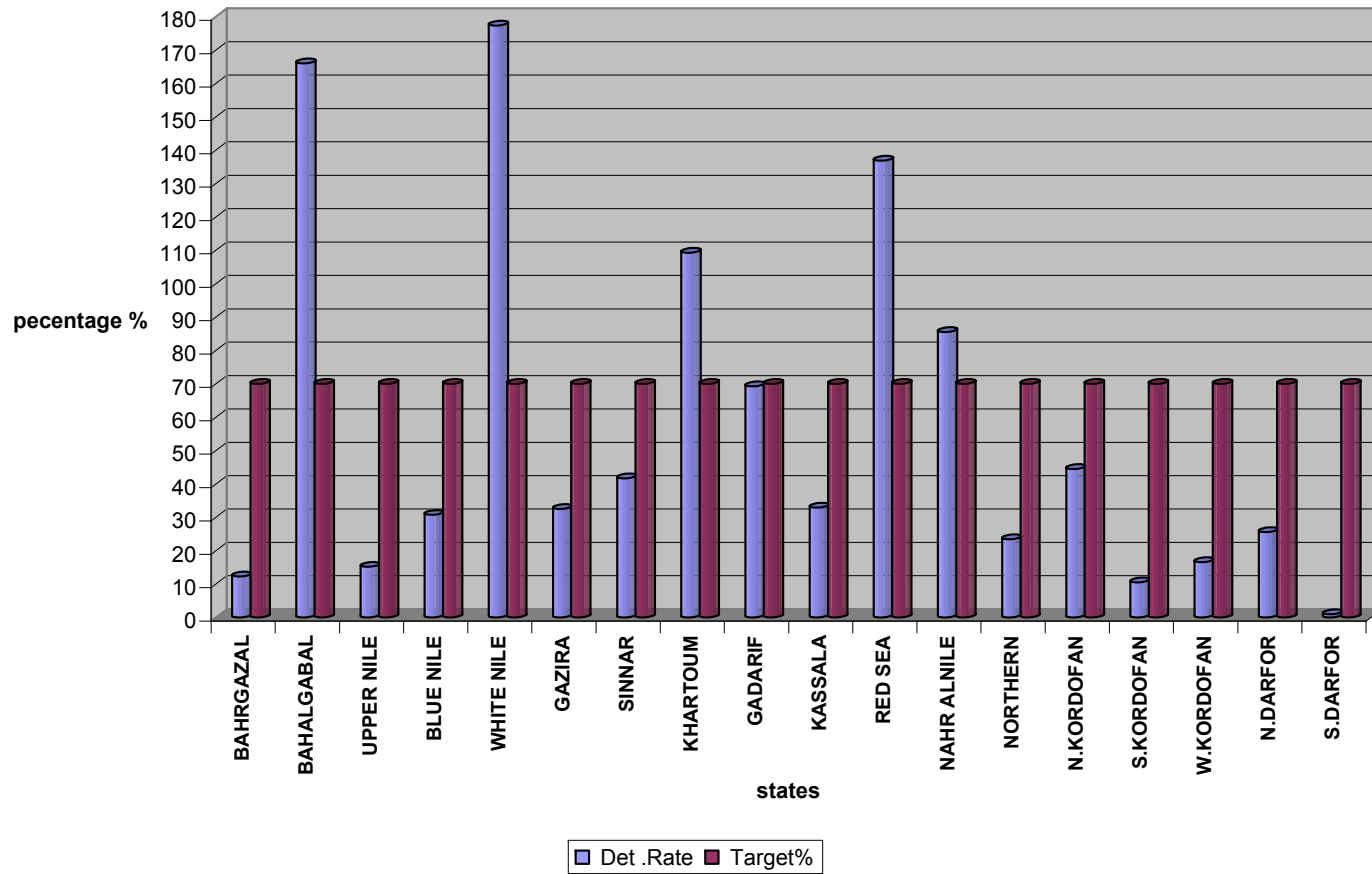


figure (8) compares the detection rate with the target rate -1998



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figure (9) shows compare the detection rate with the target rate - 1999



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figure (10) compares the detection rate with the target rate-2001

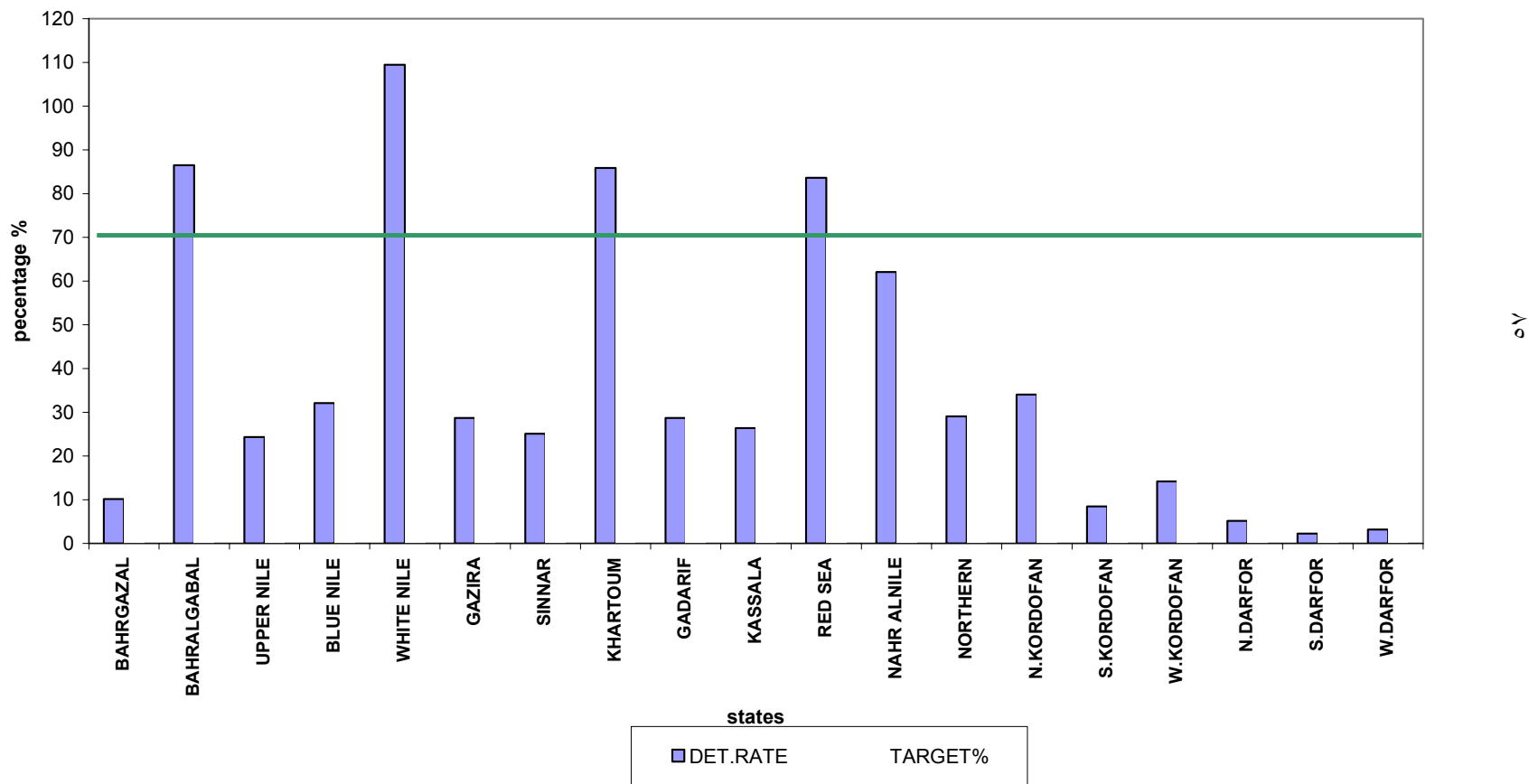
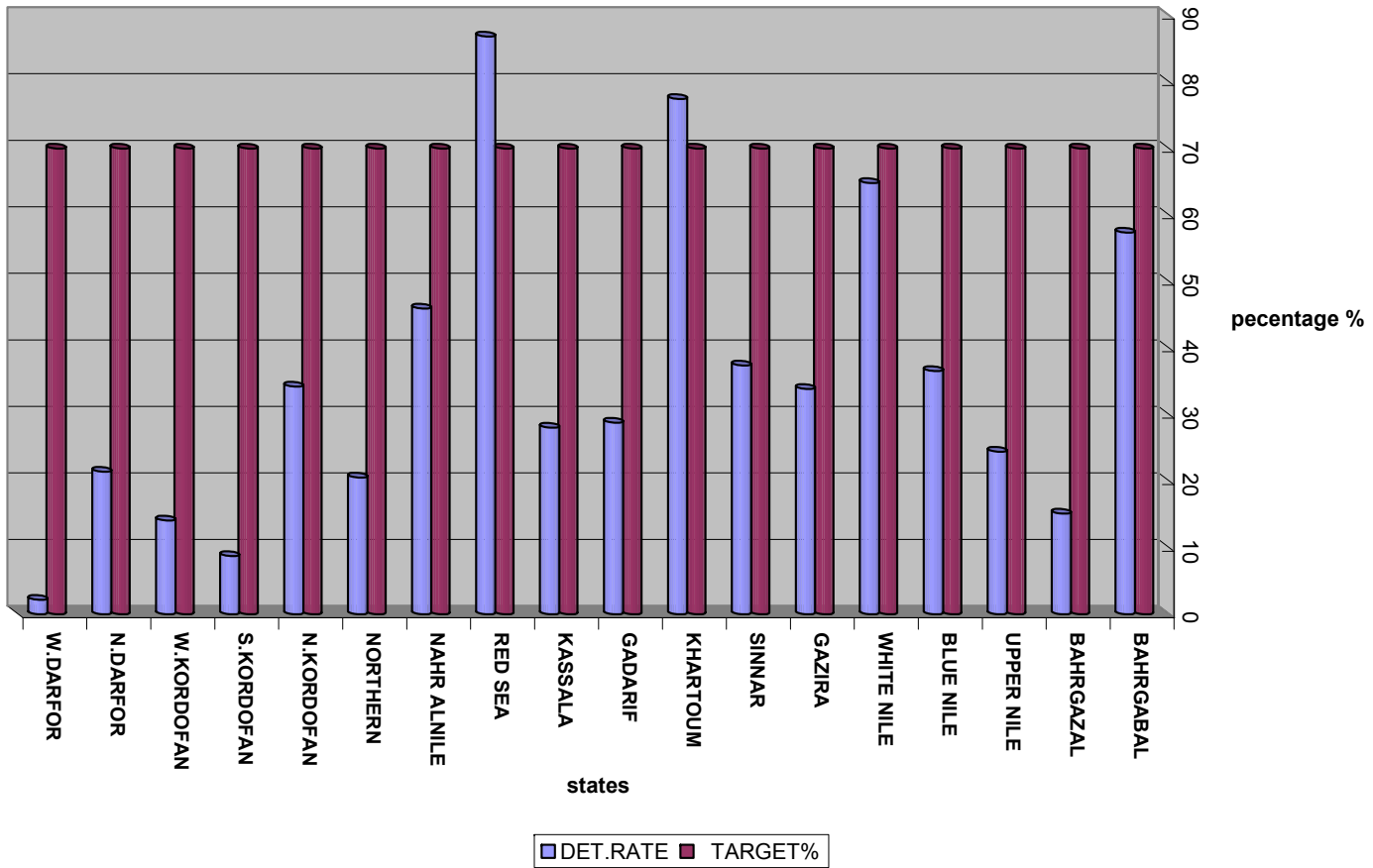
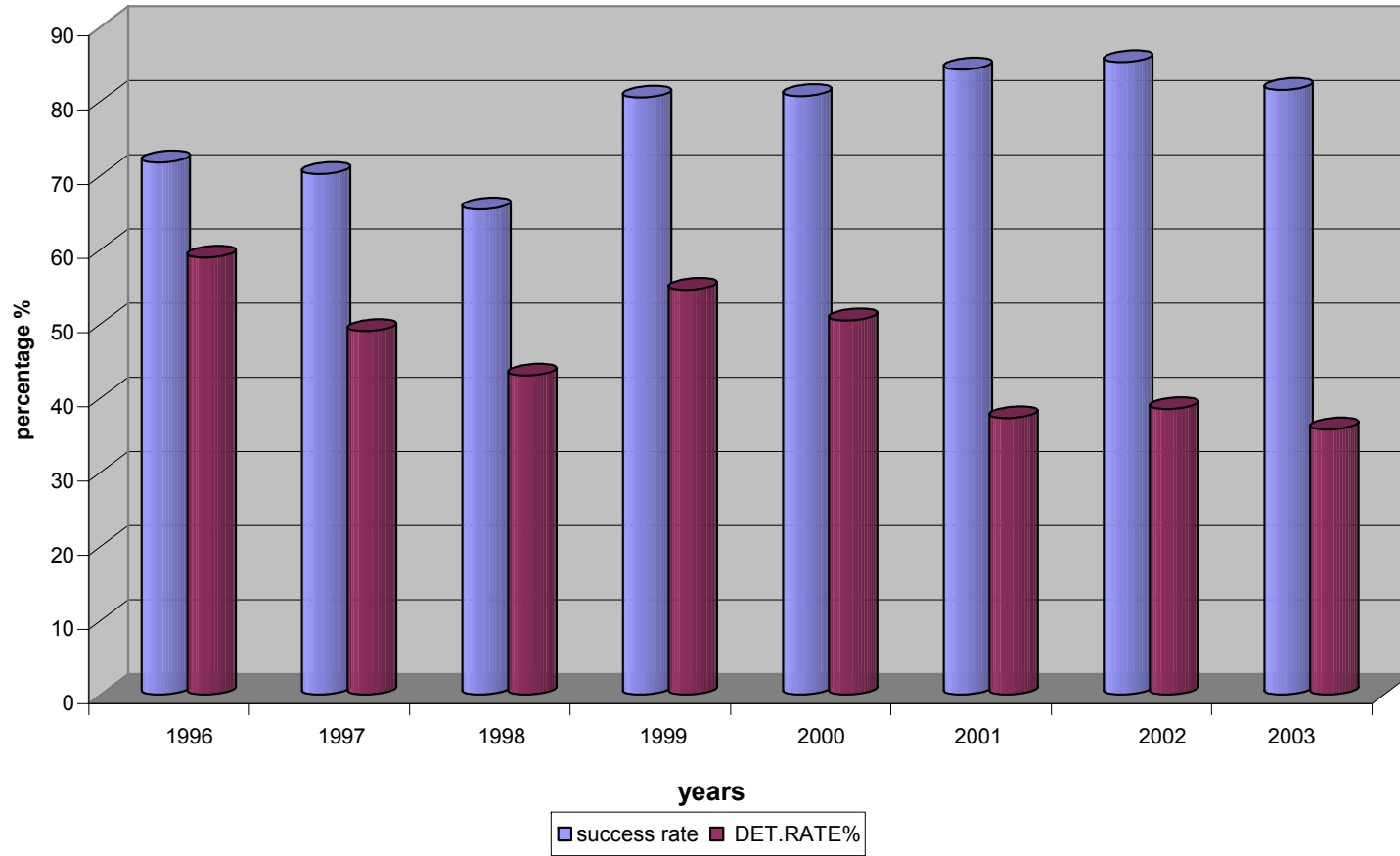


figure (11) compares the detection rate with the target rate-2002



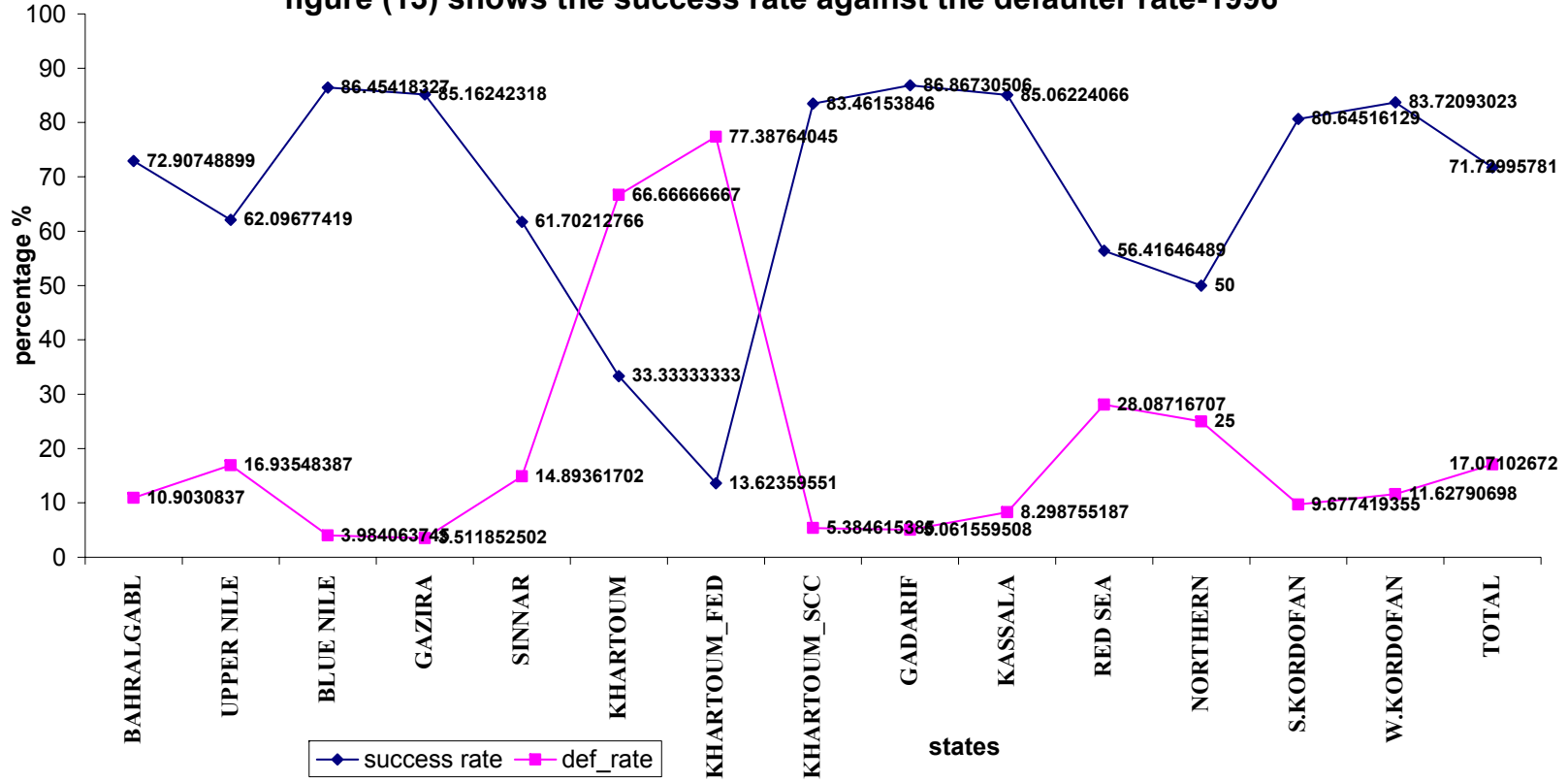
Y

figure (12) compare the success rate with the detection rate (1996 to 2003)



of

figure (13) shows the success rate against the defaulter rate-1996



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Chapter five

Discussion

Discussion

The results collected from reports and records from NTP-Sudan of (1996 to 2003). showed that there has been a continuous increase in treatment success rate. Treatment success for new-positive TB patients rose from 71,7% in 1996 to 81% in 2003.

Eight years after introduction of DOTS strategy in Sudan, it has been possible to achieve treatment success rate of 80% for new smear-positive TB patients except in year 2002. This result is below the WHO recommended 80%. This confirms the study conducted in Ethiopia, the study showed that four years after introduction of DOTS strategy. It has been possible to achieve treatment success rate of 73% in 2000 for new smear-positive TB patients, fairly will towards the WHO/ IUATLD recommended 80%. This confirm with findings in other studies that the DOTS strategy works well. In resources-constrained setting will, low over all health coverage by DOTS improved access to care through decentralization of services and improved patient of DOTS have most likely played a significant role in improving the treatment outcome (**Estifanos B Shargie et al, 2001**). Also, these results comply with a number of studies conducted to assess the effectiveness of DOTS. One of studies was conducted in South Africa, patients were assigned into either DOT or self supervised, DOTS patients were asked to attend the clinic to take medication under supervision of a clinic Nurse in 2 days a week during the first 3 months of treatment. Self supervised patients were required to visit the clinic once a week or to send family members to collect drugs. Treatment success rate among new TB patients were 89% in the DOT and 86% in self supervised. In another study conducted in Pakistan, patients were assigned to DOT either by CHW or to DOT by family member or self-administration. Treatment success rates were 77% in DOT by CHW, 72% in DOT by family member and 600 in self-administrated. It was conducted that direct

observation of treatment did not give any additional improvement in cure rate. The above studies have serious problems, the treatment success rates were low in all, 56-59% in South Africa and 62-67% in Pakistan. The low rates indicate poor in both studies, essential components of TB control were not implemented appropriately (**A Seita, 2003/4**).

The results were also different in the study conducted in China. The study showed that high rate can be achieved and maintained during rapid DOTS expansion. As the program rapidly increased in both geographical coverage and the treatment of patients, there is difficult, to maintain- high quality and management that result in high cure. Low cure rate and increasing drug resistance can develop unless the program maintains the essential training, supervision and quality control activities. The political and financial commitment permitted every one with infectious TB also the use of DOT was improved to ensure a high cure rates other elements of DOTS were equally important (... **Chen, X, et al, 2002**).

The death rates among new-positive TB patients were high especially in Southern and Western states, (more than 5%). The rates were above the WHO recommended of no more than 5 in areas with HIV infection. The reasons behind high rates were co-infection with HIV, poverty, malnutrition and mobile population. This result is confirmed by the study conducted in Ethiopia which showed more deaths among patients of HIV, At DOTS centers, an indication of policy those severely sick patients and those with Infection with HIV must have priority for treatment by DOTS (**Estifanos B Shargie, et al, 2005**). Also the results comply with the study conducted in Malawi where it was shown that there was high deaths rate during treatment. The Finding was though to be possibly related to infection with HIV or TB patients were highly mobile (**Paul M. Kelly, 2001**).

The failure rate among new-positive TB patients was high in the first three years than WHO recommended rate (not more than 3%). The failure rate then

decreased from ۲,۳% in ۱۹۹۹ to ۱% in ۲۰۰۳. This complies with WHO recommended rate. The causes for high rate in the first year may be due to multi drugs resistance or program interventions which are not warranted (WHO, ۲۰۰۵). The results were confirmed by findings of a study conducted in Ethiopia. That study showed high proportion of failure among TB patients which might be due to the emergence of multi drugs resistant TB (MDR-TB). Earlier studies have shown that MDR has been below ۱% (**Stifanos B Shargie, et al, ۲۰۰۵**).

The defaulter rates among new-positive TB patients were high than WHO recommended rate of ۱۵%. In the first three years of introduction of DOTS strategy in Sudan. Especially in Southern, North and West Kordofan states then the rate declined from ۱۵%, to the range (۷-۹,۴) % in ۲۰۰۳. The reasons behind high defaulter rate may be the culture and occupations of the patients, long-term treatment, mobile population in conflict areas and socio-economic factors. The results coincide with the study conducted in Ethiopia. The study showed this group of defaulters seems. To be refractory to conventional approach of treatment supervision, social and culture factors that might be play a role in such outcome (**Estifanos B Shargie, et al, ۲۰۰۵**).

The case detection rate was very low since the introduction of DOTS strategy in Sudan. The detection rate was in the range of ۵۸% in ۱۹۹۶ and ۳۵,۷% in ۲۰۰۳. This rate is below the WHO recommended rate of ۷۰%. The reasons for low detection rates may be incomplete implementation of DOTS strategy turn over of the staff, lack of the strategy of incentives and training of personnel was not sufficient. These reasons comply with WHO notion that the reasons for low TB detection rate countrywide are limited access or utilization of health facilities, insufficient clinic supervision, incomplete disease reporting (give information system) and incomplete implementation of DOTS strategy (**WHO/THM/TB, ۲۰۰۴**). The results also comply with the study conducted in Bangladesh. The study showed that proper implementation of DOTS and

regular monitoring of reports on case detection need to be further increased by informing and involving the community in TB control efforts through social mobilization (**Kumaresan J A, et al, 1998**).

In comparing the effectiveness of DOTS strategy outcome in different states, States will be grouped for evaluation purposes into four categories depending on the level of DOTS expansion services and establishment of the National Tuberculosis Control Program. The fourth category will include Northern, south and west Kordofan, North, and South and West Darfour states. The third category will include Bahr ALgabal, North and West Bahr gazal and Gongly states as it has peculiar situations in term of lack of security and HIV burden. The first category will include Khartoum, Red Sea, Kassala and Gadarif states. While the second category will include Gazira, Sinnar, White Nile, Blue Nile, Nahr Anile and North Kordofan states. All states shared limited expansion of Tuberculosis control services and weak Government contribution as factors that affected tuberculosis control by DOTS strategy.

Concerning TB detection rate, high detection rates are seen in the 1st and 2nd category which goes with the establishment of health services and easy accessibility compared with low detection rate in the 3rd and 4th categories. This may reflect centralization of DOTS services. Also, in the treatment success rate, high rates are in first and second categories than the third and fourth categories (as mentioned above). The death rate is high in third^{and} fourth categories where there is co-infection with HIV, malnutrition, socio-economic factors and wars.

Concerning success rate, the success rate was calculated from the evaluated cases. The graphs of success rate against defaulter rate revealed mirror image configuration. This reflects the effectiveness of short course chemotherapy but also reflected the weakness in control strategy.

With the low expansion in TB services, absence of political commitment, turn over of the staff, lack of incentives and motivation, instability of population in

some areas, poverty, prevalence of HIV, malnutrition, illiteracy, socio-economic factors and wars, improvement of treatment results and detection rates may be difficult.

Chapter six

Conclusion

Recommendations

Conclusion

The study revealed that eight years after introduction of the DOTS strategy in Sudan, it has been possible to achieve the targets in treatment success rate and case detection rate.

The study showed that there are some adverse factors that faced the DOTS strategy to achieve its objectives such as poverty, HIV prevalence, low expansion of Tuberculosis services, absence or inadequate political commitment, movement of population in some areas and wars. The study showed the DOTS services to be concentrated in some states than others.

In spite of all problems mentioned above, a considerable high rate of treatment success rate was achievable using the good tuberculosis treatment protocols. More research is needed in this field, political commitment, internal government supervision and training for staff, reason able incentive, and campaigns of health education to give clear picture about tuberculosis control and hence improve the monitoring system.

Recommendations

١. There should more political commitment that is most important tools for the success of DOTS strategy. Provision of standard regimens to make it accessible and available is also recommended.
٢. Reduction of defaulter rates is needed in order to raise the treatment and success rates, and to expand DOTS centers to cover all population.
٣. There should be internal Government supervision and training for the health workers staff which is very important to achieve the goals of DOTS strategy
٤. There should be intensive campaigns of health education to give clear picture about tuberculosis and.
٥. Promotion of monitoring system is recommended.
٦. There should be regular international evaluation and supervision of the programme to achieve the targets of the WHO and the DOTS strategy and improve the health services and health status of tuberculosis patients for both new smear-positive and defaulters.

Chapter seven

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Appendixes

University of Khartoum

Faculty of Public Health and Environmental Health

Department of Epidemiology

Interview-sheet for NTP-Sudan-staff -- ٢٠٠٥

Number of states covered by DOTS strategy

.....

١. Is the DOTS coverage in different states (which is covered by Dots) according to WHO recommendation?

Yes No

٢. If the answer is No in Qs١, what are the reasons?

.....
.....

٣. What are the focus training areas (for staff)?

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

٤. Is the laboratories facility sufficient in all TBMU?

.....

٥. Is there any constraints facing recording & reporting system?

Yes No

٦. If the answer is yes in Qs٥, what are the constraints?

.....
.....^{٨٧}.

Do you conduct survey among patients to know the reasons behind interruption of treatment (records indicate there are defaulters among cases?)

Yes No

٨. If the answer is yes in Qs٨, what are the reasons?

.....
.....
.....
9. Records indicate there are deaths among cases in different state covered by DOTS strategy especially southern state and western states more than other states. What are the reasons?

.....
.....
.....
10. In many states the detection rate is less than target (70%) since (1996-2003) what are the reasons?

.....
.....
11. Is there any intervention from NTP central in NTP in states to increase the detection rate?

Yes No

12. If the answer is yes Qs 11, what is the intervention?

.....
.....
.....
13. What are the constraints facing DOTS strategy to achieve its objectives?