HEALTH SERVICE DELIVERY AND MATERNAL SURVIVAL AT BANADIR HOSPITALS FOR 2001 – 2010 IN MOGADISHU, SOMALIA

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DECLARATION B

"This thesis my original work and has not been presented for a degree or any other academic award in any university or institution of learning".

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Name and Signature of Candidate

21/09/2012

Date

DEDECTION

I dedicate this thesis to my mother MUMINA AFRAH JIMA'LE and my sisters and brothers, HAWA, FOSIYA, DEQA, MOHAMED, ASAD, ABDI SHAKUUR, ALI, IBRAHIM AND ABDIRAHMAN, to my sons and daughter MOHAMED, ABDIRAHIM AND HIBA and to my beloved wife SAFIYA MOHAMED ADEN, and to my dear friend MR. MOHAMED HASSAN DHORE MAOW.

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In the name ALLAH the compassionate and merciful praise be to ALLAH who has enabled me to write this thesis, and gave me a health during my study.

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I give special thanks to honorable to my parent: **MUMINA AFRAH JIMA'LE**, without her I could not to do anything, my brothers and sisters, for their financial support throughout my life.

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Abstract

This study was set out to establish the relationship between health service delivery and maternal survival at Banadir hospitals for 2001 up to 2010 in Mogadishu, Somalia the study wanted to establish the following: to determine the trend and level of health service delivery for 2001 to 2010 at Banadir Hospitals, to establish the trend and the level of maternal survival for 2001 to 2010 at Banadir Hospitals, and to investigate the relationship between the health service delivery and maternal survival for 2001 to 2010 at Banadir Hospitals in Mogadishu, Somalia.

Using a quantitative approach and exposit facto design, data on Health service delivery and maternal survival were collected from trusted sources using data record sheets. Data were analyzed at bivariate level using correlation and regression analysis.

The computed [t-value =45.9195] is exceeds [t-value =1.83] at 0.05 level of significance and 9 degrees of freedom. Then the null hypothesis that a health service delivery is equal to zero is rejected and accepts the alternative hypothesis that the mean is not zero at 0.05 level of significance. The computed (P-value = 0.0000) < (p= 0.05). Thus, the mean (1001.5) is significantly greater than zero at 5% level of significance. This implies that rate of health service delivery of Banadir hospitals in Mogadishu Somalia is very high.

The computed t-value=13.7312 and tabulated t-value at 0.05 level of significance and 9 degrees of freedom is t =1.83. Since (t_c =13.7312) > (t_{tab}=1.83) then null hypothesis that Maternal survival is equal or less than zero is

rejected at 0.05 level of significance. Since P=0.0000 then mean of Maternal survival is greater than zero at 5% level of significance.

Maternal survival is the dependent variable; of particular interest is which independent variable has correlation with maternal survival. In this case it is professional 95.6%. A change in maternal survival is explained 74% by changing Beds delivery, a change in maternal survival is explained 83.4% by changing Ambulances, and a change in maternal survival is explained 85.7% by changing X-ray.

The strongest correlation among the independent variables is between Ambulances and x-rays (0.922) was called multicollinearity.

The four independent variables explain 92.28% of the variation in maternal survival. We were considered for each independent like a unit change in maternal survival was caused changing by professionals of 116.4912, reduction in maternal survival was caused changing by ambulances of 12.644427, reduction in maternal survival was caused changing by Beds delivery of 4.126387, and a unit change in maternal survival was caused changing by x-rays.

The recommendations and suggestions for further studies arise from study findings above. Enhancement and training with Somalis health sector have to skill with health personality, the government of Somalia should encourage to the hospital according all requirement through minster of health and the central Bank of Somali reduce at least to 10% to encourage the investment like supply of Banadir hospitals.

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AIDS	Acquired immune deficiency Syndrome
AMO	Assistant medicai officers
CORR	Correlation
COV	Covariance
DRC	Democratic Republic of the Congo
DHS	Demographic and health survey
DV	dependent variable. GNPP Gross national product
GP	General Practitioner
HIV	Human immune deficiency virus
IMCI	Integrated management of childhood illness
IV	independent variable. MMR Maternal Mortality Ratio
Log	logarithmic and SA Statistical analysis
STATA	Scientific Statistical Application
UNAIDS	United Nation agency for HIV/AIDS
UNICEF	United Nations Children's Fund
WHO	World Health Organization

CHAPTER ONE

THE PROBLEM AND ITS SCOPE

Background of the Study

Health-service delivery and maternal survival depend on the care given to the newborn which is a very essential element in reducing child mortality, although it often receives less than optimum attention. There have been agreements to affirm the world's commitment to improving newborn health. Current global evaluations confirm that commitment to improving newborn health makes meaningful socio-economic contributions (Yinger & Ransom, 2003). Various reasons can be attributed to why the health of the newborn has been neglected despite the huge mortality rates and why most neonatal deaths are unseen and undocumented. Although child survival programmes have helped reduce death rates among children under-five years over the past 25 years, the biggest impact has been on reducing mortality from diseases that affect infants and children over one month old. As a result, greater proportions of infant mortality occur during the first month of life (the neonatal period), a period when a child's risk of death is nearly 15 times greater than at any other time before the first birthday (Yinger & Ransom, 2003).

Globally, Health service delivery is the most visible part of any health system, both to users and the general public. Health services, be they promotion, prevention, treatment or rehabilitation, may be delivered in the home, the community, the workplace, or in health facilities. Effective health service delivery depends on having some key resources: motivated staff, equipment, information

and finance, and adequate drugs. Improving access, coverage and quality of health services also depends on the ways services are organized and managed, and on the incentives influencing providers and users, in any health system, good health services are those which deliver effective, safe, good quality, personal and non-personal care to those that need it, when needed, and with minimal waste. While many questions remain about how to improve the organization and management of health service delivery so as to achieve better and more equitable coverage and quality, the history of health Service Commissioned Corps is the history of health, in the United States. For more than 200 years, the U.S. Public Health Service Commissioned Corps has been our Nation's frontline against the spread of disease from sailors returning from foreign ports, to immigrants entering the country, to communities affected by natural and manmade disasters. The Corps response to the health threats posed by Hurricane Katrina and other recent disasters underscores the value to our Nation of having a highly trained, multidisciplinary, and quickly mobilized cadre of medical professionals.

The historical evidence is patchy; we do know that in countries like England maternal mortality levels were halved – compared to "natural maternal mortality" – towards the beginning of the 16th century. Progress was in fact much more impressive for maternal than for overall mortality. Loudon explains this "largely in terms of factors specific to childbirth rather than in terms of factors likely to have impinged on mortality of all causes": "the decline in maternal mortality [between 1750 and 1850] was related both to an increasing proportion of midwife deliveries and to a higher standard of midwifery" (Loudon 1992a). By 1850 maternal mortality was at a level of around 800/100,000 or even lower: levels not unlike the median poor country today.

Between the mid-16th century and the late 1930s, the patterns of reduction diverge markedly (Figure). On the one hand there are Northern European countries – Sweden is the prototype, but Denmark, Norway or the Netherlands follow roughly the same pattern: a clear downward trend from as early as 1870, stabilizing at 250-300 per 100,000 between 1900 and 1940.

At the other extreme, maternal mortality ratios in the United States remained in a 600 800 bracket up to the mid-1930s. In-between the Swedish success story and the American failure one finds south-west Europe.

Regionally, Improvement in the survival of the newborn is dependent on healthcare that spans antenatal, intranatal and postnatal periods, i.e. interventions directed to mothers during pregnancy; labour and delivery have a profound impact on newborn survival especially during the first week of life when three-fourths of neonatal mortality occurs. Moreso, improvements in the survival of the newborn includes the care given to women in the pregnancy period as for example; nutrition of young girls can have an impact on their adult height which in turn can influence outcomes for labour and delivery. Another example would be that the pregnancy folic acid status of the mother can determine the incidence of some congenital abnormalities. Maternal care is therefore not only important for reducing maternal mortality but also neonatal mortality. It is estimated that about 12 million pregnant women in Sub-Saharan Africa do not get tetanus immunization, however, the presence of a midwife, nurse or doctor at child birth in developed countries is taken for granted (Vinod, 2005).

Locally,

Somalia's health care system has suffered from inadequate funding, mismanagement, and poor planning and policy development ever since independence. As a result, the people's health suffered. Currently, the health care system is obviously in crisis from the protracted civil war of more than a decade. The population has been growing annually at a rate of 2.8%, although it experienced high mortality rates during the civil war in the early 1990s. The health care needs were increasing while resources and enabling infrastructures were diminishing or ceased to function.

The health status indicators rarely experienced any significant improvements. Many factors were attributed to this desperate situation: Haphazard planning and policy development, overwhelming health problems, Inadequate and misdistribution of resources, corrupted management and absence of strong regulatory policies and fair practices, poor governance, Underdevelopment ,Poverty, Social inequities and continuous natural and man-made disasters. (Gedi Qayad)

Maternal mortality has been likened to the tip of the iceberg, maternal morbidity to its base (Bergström 1994). This implies that many more mothers Studies experience disease and suffering in consequence of pregnancy than those who die. Maternal disease is often reflected in the offspring: low birth weight, malnutrition, other ailments, which underlines the importance of this issue.

Health Service Delivery is the process of equipping heath center with qualified doctors well trained and mid wife with aim of providing health service (consultancy and treatment) to patients and adequate medical facilities which are accessible in health center.

Maternal survival is the process of mobilizing and aware of pregnant woman about neo-Nate -natal and post-natal care which includes family planning service like medical tests.

Problem Statement

There is maternal mortality across Somalia country particularly Mogadishu Somalia capital. Indicators include antibiotics for infections, sterile blades to cut umbilical cords, misoprostol and oxytocin for preventing and treating postpartum hemorrhage, and teaching mothers the importance of immediate, exclusive breastfeeding and skin-to-skin contact to keep their babies warm. Applying such low-cost interventions can ensure the survival of up to 70 percent of newborns. New tools and technologies for early identification of dangerous conditions, plus strategies to more rapidly diagnose and treat mothers and babies, also provide a significant ability to achieve maximum health impact.

However, even with tested, low-cost solutions for maternal and neonatal health available, mothers and infants die needlessly. Every year, Somali women are among the most high risk groups in the world with a maternal mortality rate of 1044 per 100 000. Poor antenatal, delivery and postpartum care and the lack of emergency obstetric referral care has contributed to the high rate of mortality and disability. There are a number of reasons why the tools and treatments available for maternal and neonatal health are not reaching mothers and infants at the critical times needed to save lives. Ensuring access to interventions for the poorest women, who often deliver at hospital and rarely see a trained health provider, has been a significant challenge. Even when they can see a skilled provider, effective

curative and preventive interventions are often unavailable or not practiced, particularly among the poorest. Another challenge is the lack of strong political will and leadership to tackle this issue at national. This entails sound planning and policies from the government, based on rational judgment and empirical evidence, as well as contributions from the consumers and community through cost sharing and resource mobilization. The health care system should also adopt innovative financing mechanisms, decentralization of resources and decisions, and sound management and strong stewardship from the central government through continuous support, guidance, and monitoring and evaluation of health care system performances.

Therefore there is a strong need to assess the present level of maternal survival on health service in Mogadishu, Somalia.

Purpose of the study

This study intends to explore the influence of the health service and maternal survival in Banadir Hospitals under study and differences in the health service and maternal survival in Banadir Hospitals. Further, this study was identifying the strengths and weaknesses/gaps in health service and maternal survival in Banadir Hospitals.

Objectives of the Study

General objective

To correlate the relationship between health service delivery and maternal survival at Banadir Hospitals for 2001 -2010 in Mogadishu, Somalia.

Specific objectives

1. To determine the trend and level of health service delivery for 2001 to 2010 at Banadir Hospitals
2. To establish the trend and the level of maternal survival for 2001 to 2010 at Banadir Hospitals
3. To investigate the relationship between the health service delivery and maternal survival for 2001 to 2010 at Banadir Hospitals in Mogadishu, Somalia.

Research questions

1. What is the level and trend of health service delivery for 2001 to 2010 at Banadir Hospitals?
2. What is the level and trend of maternal survival for 2001 to 2010 at Banadir Hospitals?
3. Is there a significant relationship between the health service delivery and maternal survival for 2001 to 2010 at Banadir Hospitals?

Hypothesis

Null Hypotheses

There is significant relationship between the levels of health service delivery and maternal survival at Banadir Hospitals in Mogadishu, Somalia.

Scope of the Study

Geographical scope

The study was based on Banadir Hospitals in Mogadishu Somalia. Respondents was include: Doctors, Mid wives, nurses, permanent staff and temporary staff. The study focused on exploring how health service delivery stimulates maternal survival.

Theoretical Scope

This study was based on the Survival Analysis theory proposed by Kaplan Meier Estimator which this theory, the data are effectively regarded as grouped in to large number of short time intervals, with each interval as a short as the accuracy of recording permits. Thus if the survival recorded to the accuracy of one year, then time intervals of one year widths would be used.

Content scope

This study was described the level of health service delivery and maternal survival at Banadir in Mogadishu, Somalia. The components of health service delivery such a diseases and environmental degradation was examined. In appropriate roads, poor education and health systems as maternal mortality components was examined in this study.

Time scope

This study was carried out the period between March, 2012 up to September, 2012.

Significance of the Study

The study findings are expected to benefit the country intending to obtain effective performance from their health service workers at Banadir hospital.
The research also intends to be useful to future researchers, students and academicians digesting the effect and importance of the health service delivery on performance of maternal survival.

Operational Definition of Health service delivery

Health service is process of services to the general well being of only children is conducted in a holistic approach under IMCI which handles the treatment of the major childhood disease symptoms and signs such as fever, cough, difficult breathing, diarrhea and malnutrition. It also handles the assessment of child immunization status and feeding practices of children.

Health service Delivery is to make a contribution to the well-being of the People expanded economic growth, increased social development and poverty, undertaken through a National Health System comprising of all institutions, structures and actors whose actions have a primary purpose of achieving and sustaining good health.

Operational Definition of maternal survival

Maternal survival is process as the death of a woman from direct or indirect obstetric causes more than 42 days but less than one year after termination of pregnancy, direct obstetric deaths as "maternal deaths resulting from obstetric complications of the pregnant state (pregnancy, labor, and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above. Indirect obstetric deaths, by contrast, are those resulting from previous existing disease or disease that developed during pregnancy and which was not due to obstetric causes, but was aggravated by physiologic effects of pregnancy. Because accidental deaths are excluded from the definition of maternal deaths.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Concepts, Opinions, Ideas Author or Experts

Health services include all services dealing with the diagnosis and treatment of disease, or the promotion, maintenance and restoration of health. They include personal and non-personal health services Lopez etel (2006.)

Health services are the most visible functions of any health system, both to users and the general public. Service provision refers to the way inputs such as money, staff, equipment and drugs are combined to allow the delivery of health interventions.

Improving access, coverage and quality of services depends on these key resources being available; on the ways services are organized and managed, and on incentives influencing providers and users. (WHO 2010).

Health service for the neonate often receives little attention in maternal and child health programmes. Though various efforts have been made by governments to reduce infant mortality, neonatal mortality keeps increasing. Of the approximately four million global neonatal deaths that occur annually, 98 percent occur in developing countries, where most newborns die at home while they are cared for by mothers, relatives, and traditional birth attendants (WHO, 1996).

Obstetric care has been in the hands of midwives in Europe until the end of the 19th century. With the development of obstetric surgical procedures the responsibility even for uncomplicated deliveries was shifted to medical doctors (Kutner 1994). From Sweden we have clear evidence that maternal mortality had

already drastically declined with the introduction of trained midwives in the rural areas. Surgical delivery, the introduction of blood replacement, antibiotics and intensive care for mothers and new born continued the downward trend in maternal and prenatal mortality (De Brouwere et al. 1998). In many developing countries modern medicine was first introduced as curative care for colonial settlements and armed forces. Eventually curative medicine was also offered to the native population. Therefore obstetric care relied on medical doctors and well-trained European nurses/midwives who cared mainly for obstetric complications. With the introduction of outreach clinics and preventive care (vaccination, well child clinics, and antenatal care) more and more local nurses were trained. The training of medical doctors was limited to very few locals, who had to study abroad. At present most countries have medical personnel either trained in their own country or abroad (within Africa many of them were trained in the States of the former Soviet Union and Cuba). Many of these become specialists and settle in the main towns within their countries. Until the late 20th century the rural areas of most developing countries were largely underserved with medical doctors. To cover the population with preventive and curative services the countries developed different approaches.

Some countries allow only specialists to perform surgical obstetric procedures (e.g. China, Indonesia, Pakistan, Madagascar and Morocco). The specialist coverage in each country is different. In Morocco the aim is to post at least one surgeon, one obstetrician and one anaesthetist at each provincial hospital. Still remote rural areas are not covered. Patients needing caesarean section are therefore referred to regional hospitals.

In Madagascar specialists are only situated in regional hospitals which are usually the only obstetric referral centres. Given the size of the country and the

poor infrastructure, it can take many hours to several days to reach one of them, although there are many lower level facilities, staffed with nonspecialist medical doctors but not providing obstetric care (centre medical, hospital simple). This situation produces enormous negative health impact (30% perinatal mortality in the provincial hospitals)(Beche & Jahn 1992)(Beche T & Jahn A 1992).

In China only 2.7% of senior medical professionals are working in country hospitals (Xiang et al. 1996). The health policy emphasizes preventive care. The one child policy encourages people to be sensible about antenatal care, this is believed to rule out most emergency situations. In addition pregnant women are expected to take utmost care and to go early to a hospital with specialist care. In reality large rural areas are under served with specialists. In Pakistan flourishing private clinics take advantage of the situation. As they are mainly found in the big cities, the rural areas go virtually unserved. In Indonesia the present specialist care is being gradually replaced by general doctors with vocational training in surgery/ obstetrics. The policy makers have reacted in this way to the current situation (Thouw 1992).

Countries like Bangladesh or the Latin American countries (Chile, Peru,Ecuador) allow all medical doctors to perform caesarean sections. In Bangladesh doctors acting as surgeons must upgrading their training, in Latin America a certificate is not necessary (Shaheen 2000). Nepal has a cadre of medical doctors that follows a two years training for general practitioners who includes surgery and obstetrics. They work in rural hospitals and provide emergency obstetric care (Erpelding pers. comm.). In Pakistan the license to practice medicine implies that you are able to perform surgery including caesarean section and you are allowed to do so. But in governmental hospitals officially

caesarean sections are only performed by specialists in obstetrics and gynecology (Thaver 2000).

Some countries chose entirely a different approach to covering the population with emergency obstetric care by training non-academic personnel. Tanzania for example has created the assistant medical officers (AMO), who were to work at the district hospital level (Mbaruku pers. comm.). An upgrading system allows a qualified rural medical aid (working in dispensaries) to go for medical assistant training (three years theoretical and practical training). Qualified medical assistants can follow a two year up-grading course to become an assistant medical officer. AMOs performs surgery and obstetric interventions. With the AMOs the Tanzanian health system has been able to bring qualified emergency obstetric care nearer to the population.

In Burkina Faso registered nurses and midwives must work at least two years in the rural area in a dispensary or health centre. After at least 5 years practical work, they can take upgrading courses of 2 years in surgery, anesthesia, radiology, laboratory etc. Surgical assistants are posted to district and regional hospital. Their main task is minor surgery but they also assist medical doctors in major interventions. They are also trained to perform emergency surgery (mainly caesarean sections and strangulated hernias) and assure service in the absence of medical doctors.

Important imbalances in human resources are found in the distribution of health personnel. Many developing countries have insufficient primary care providers and too many specialists. Even these are concentrated in urban areas.

The rural/urban disparity in qualified personnel trained in obstetrics is further aggravated by migration of medical and paramedical personnel (nurses, midwives) to other countries. South Africa draws many medical people from other southern African countries, as do the Arab countries from East and Central Africa. In the 90s more Sudanese doctors worked in Arabia than in Sudan. This brain drain is damaging health care in their countries of origin and also the home economy. The high input to training of medical personnel is also lost to the country. Career development paths and in service training are needed to retain staff. For improving the balance, nonphysical primary care providers have many advantages: their training cost less (Myanmar, Pakistan and Sri Lanka indicate that 2.5 to 3 nurses can be trained for the cost of training one physician) they receive lower salaries, they are easier to attract to rural areas, and they communicate more efficiently with the patients (World Bank 1993).

In many governmental health systems 60% (SA) to 90% (Senegal, Nigeria) of medical doctors work in the main cities (Solanke 1997). Specialists in surgery or obstetrics and gynecology are almost never found outside the national hospitals other than in private clinics. In China only 3% of senior medical doctors work in country hospitals (Xiang et al. 1996). In the whole country of Malawi only one specialist in anesthesia is working (Adeloye 1993).

In Pakistan we find 3 times more registered doctors than registered midwives (Government of Pakistan 1997). Even with 7% of unemployed medical doctors and 11% working outside the medical profession in Mexico, the rural areas go seriously under-served with medical doctors. They are strictly not willing to leave the major cities (World Bank 1993). In Indonesia, Ethiopia, South Africa

and even Australia rural hospitals (first referral level) are staffed by general practitioners or midwives, who are either not trained to perform emergency treatment in obstetrics, and are therefore reluctant to intervene, or who are not allowed to do so (Craig & Nichols 1993, Loufti et al. 1995, Reid et al. 1998, Thouw 1992).

In Tanzania, as in many other countries, the rural areas are served by general practitioners and assistant medical officers. Here most of the population manages to access first line health services. E.g. one dispensary covers on average 5,000 population and 80% of them live within a 5 km radius (Tanzania / Bureau of Statistics 1996). Obstetric care is provided by a network of regional and district hospitals, with the non-academic assistant medical officers providing the backbone. Still rural areas are underserved as the effective catchment area drops sharply beyond a distance of 10 km (Jahn et al. 1998).

Emergency obstetric care is a male dominated field. Most surgeons the world over are men; only in the states of the former Soviet Union are female obstetricians the rule. At health centre level and dispensaries delivery care is mostly provided by female staff. In China the demand for female rural doctors has led to increased recruitment, training and deployment of female doctors. Since 1997 there is at least one female doctor in every village (Koblinsky et al. 1999).

In Nepal a cadre of mother child aids was formed to staff dispensaries and health centers. Their tasks include assisting in institutional and home delivery and mobile antenatal clinics. Due to strong caste rules the cadre does not work very efficiently (higher caste cannot deliver lower caste)(Dar Iang 1999). In Pakistan

"lady health workers" provide antenatal care through home visits. For women living in strict Purdah the visit to the dispensary or hospital is not acceptable (Jahn 1995). In Burkina Faso male midwifes (maieuticiens) are trained and work in health centers and hospitals.

Training men as midwifes has been necessary to fill the gap left by female midwifes leaving the rural areas to join their husbands in the major cities (there is a legal right of rejoining families for civil servants) (Hien, pers. comm.). For women living in the big cities female trained assistance at delivery is the rule, for rural settings it is by chance.

Several approaches have been tested and implemented to cover the population with emergency obstetric care. A very interesting example is the Obstetric flying squad in peninsula Malaysia. For 30 years emergencies in obstetrics have been attended to by this service. The service is available at all hours and staffed with specialists in obstetrics. Nevertheless, with the development of telecommunication, road access and rural hospitals an ambulance service proved to be faster and cheaper for most of the communities. A prerequisite for ambulance service was a training of ambulance drivers in first aid. Only very isolated communities could still use the flying squad (Monga &Achanna 1999).

Maternal Survival of the newborn is an issue of great concern especially for the developing world. Almost two-thirds of infant deaths occur in the first month of life, among those, more than two-thirds die in their first week and among those, two thirds die in their first 24 hours after birth (Lawn, 2001).

Improvement in the survival of the newborn is dependent on healthcare that spans antenatal, intranatal and postnatal periods, i.e. interventions directed to mother's during pregnancy, labor and delivery have a profound impact on

newborn survival especially during the first week of life when three-fourths of neonatal mortality occurs. Moreso, improvements in the survival of the newborn includes the care given to women in the pregnancy period as for example; nutrition of young girls can have an impact on their adult height which in turn can influence outcomes for labour and delivery. Another example would be that the pregnancy folic acid status of the mother can determine the incidence of some congenital abnormalities. Maternal care is therefore not only important for reducing maternal mortality but also neonatal mortality. It is estimated that about 12 million pregnant women in Sub-Saharan Africa do not get tetanus immunization, however, the presence of a midwife, nurse or doctor at child birth in developed countries is taken for granted (Vinod, 2005).

Households can be regarded as a nation's health production system, in that they produce health from the local community level to that of the wider society. Newborn care remains a neglected problem and these impacts negatively on MDG4 on child health which pledges to reduce under 5 years mortality by the year 2015, however, the survival of humankind as a whole will be impossible without protecting maternal and newborn lives.

Regional variations in the causes of prenatal and neonatal mortality and morbidity rate is linked to the level of social and economic development, the quality of health services, the environmental circumstances as well as cultural practices (WHO, 2002). Almost all maternal mortality is avoidable; the death of a woman during pregnancy or childbirth is a violation of her rights to life and a social injustice to her, her family and the community. The health of a country is directly dependent on its economic and social development. Social and economic

growth is also based on the healthy living conditions and access to good and quality health care for all the people of the nation, and it is their right. The health indicators of a society or nation are therefore affected by inequalities in economic and social conditions. The most affected indicators of health in a country are maternal and infant mortality rates. Women in India for example, find themselves in subordinate positions to men socially, economically and culturally, these women are largely excluded from making decisions, they have limited access to and control over resources, they are restricted in their mobility, and are often under threat of violence from male relatives (Deogaonkar, 2004).

Socio-economic factors that affect access to health care and causes maternal mortality operates at the individual, family and community level and is a complex issue.

The individual woman makes decisions about her health depending on her educational level, occupation, level of personal income or wealth and their autonomy.

The aggregate family income, occupation and education of family members could also affect access to health care for the woman and her newborn baby. With the community, the collective resources and wealth plays an important role in the socio-economic aspects of the health needs of community members (McCarthy & Maine, 1992).

Classified constraints influencing people's ability and willingness to change intrapartum care practices into: informational, social, cultural, and economic. Informational constraints refers to constraints in knowledge such as the clients'

lack of information regarding current recommended essential newborn care practices and their health outcomes, that is, a major reason for not adopting a new practice could simply be lack of knowledge and a sound understanding of its availability, use and benefits.

Social constraints are related to the social patterns in a community that discourage the adoption of essential newborn care practices, for instance, older relatives such as mothers-in-law in many traditional areas still have considerable say over decisions concerning pregnancy, birth and child care, whereas their influence may be weaker in modern urban communities, the influence of the media may be rather stronger.

An example of a cultural constraint would be that, husbands in more traditional areas may dictate their wives' activities but this may be minimal or absent in some urban areas where women have greater independence and education. An example of economic constraint would be the unavailability of cash to pay for essential newborn care services (Parlato, 2004).

There are marked variations in patterns of newborn care and interventions. Knowledge on what is needed for optimal newborn care is lacking in many cases. Modern hospital practices as well as traditional practices neglect the basic needs of newborns, these basic needs include: warmth, cleanliness, breast milk, safety and vigilance. Other interventions such as: thermal protection, breast-feeding, eye care (to reduce blindness), have essential preventive effects (WHO, 2006).

According to The World Health Organization (WHO, 1996) newborns are more likely to survive if delivery is clean, that is if actions are taken to help

prevent infection. Ensuring a clean delivery implies that all those attending to the mother and newborn wash their hands with soap and water before during and after delivery. He perinea area of the vagina is washed before each examination and before delivery, and no foreign material is introduced into the vagina (the examiner's hand only when necessary). Delivery surface is clean, or at a minimum, birth doesn't occur on the bare floor. (Parlato, 2004).

The case for investment in maternal health is compelling. In addition to the proven effectiveness and cost-effectiveness of many maternal health care interventions, there are numerous benefits in addition to the maternal lives saved. Most maternal interventions also directly benefit newborn babies in terms of reduced mortality and morbidity. A maternal life saved also benefits older children. Children whose mothers die have been suggested to be at three to ten times' greater risk of death than those with living parents. Investment in maternal health also has valuable equity benefits, since differences in maternal mortality mirror the huge discrepancies between rich and poor people both within Mogadishu and Somalia at large. Poor people are especially vulnerable during pregnancy; they have less access to cash and live further away from health facilities, limiting the health care options available to them.

All pregnant women face some level of maternal risk. According to the WHO, about 40% of pregnant women will experience delivery complications, while about 15% need obstetric care to manage complications which are potentially life threatening to the mother or infant. Despite the importance of antenatal care to

predict and prevent some complications, many are sudden in onset and unpredictable.

There are few reliable and accurate data on maternal deaths available countrywide in Somalia. According to DHS estimates, the national average for the Maternal Mortality Ratio (MMR) has been 1044 deaths per 100,000 live births. It is conceivable, however, that institutional mortality rates would be higher than national averages due to the fact that women will tend to seek institutional care when complications arise. The prevailing high rates of fertility (6.7 births per woman), in an environment of poor access to quality maternal and neonatal care, have continued to expose Somalia mothers and infants to a high risk of death from pregnancy related causes, with an estimated 3 woman in 10 dying from maternal causes in Somalia (the lifetime risk).

Even champions of Primary Health Care have long had a blind spot for the plight of mothers at childbirth. Only in the mid-eighties activists and enlightened professionals started mobilizing around this poorly documented, underestimated and neglected tragedy: "Every four hours, day in, day out, jumbo jet crashes and all on board are killed. The 250 passengers are all women, most in the prime of life, some still in their teens..." (WHO 1986).

Fifteen years after the Safe Motherhood Initiative was launched we have a much clearer picture of what is actually happening throughout the world: figures are more reliable and more readily available. Yet there is little scope for triumphalism. More and better data mean that we now realize that the situation is

actually worse than even those who were sounding the alarm bell in the 1980s had been thinking.

These years of efforts, documenting and mobilizing have been humbling and often discouraging (AbouZahr 2001, Campbell 2001). The successes are overshadowed by the awareness of the persistence of this tragedy in large parts of the world. Whatever their usefulness may be for other purposes, some of the common-sense activities that had been promoted for decades – risk screening at antenatal consultations, training of traditional birth attendants – proved to be of limited direct effect on maternal mortality (Bergsjø 2001, Bergström & Goodburn 2001, Kolsteren & De Souza 2001).

By the time the Safe Motherhood Initiative took stock of ten years of mobilization in Colombo it had become clear that there were no simple solutions (Starrs & IAGSM 1998). Furthermore, the very real constraints of poverty and lack of resources seemed to make maternal mortality into one of those wicked and intractable problems that are essentially non-vulnerable. The temptation to sit back and wait with tackling maternal mortality until poverty 'disappears' is real. It is not justified.

Most maternal deaths do occur in poor countries, and it is well known that poor countries are also the ones with highest maternal mortality rates. In analogy to the link between poverty and infant mortality the relation poverty- maternal mortality has become part of common wisdom. This being said, there are considerable differences, even among countries that carry similar burdens of poverty, and much of this seems related to poverty constrained access to care (Kunst & Houweling 2001).

Theoretical Perspectives

Pearson's correlation coefficient between two variables is defined as the covariance of the two variables divided by the product of their standard deviations

For a population

Pearson's correlation coefficient when applied to a population is commonly represented by the Greek letter ρ (rho) and may be referred to as the population correlation coefficient or the population Pearson correlation coefficient. The formula for ρ is:

$$\rho_{X,Y} = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y}$$

For a sample

Pearson's correlation coefficient when applied to a sample is commonly represented by the letter r and may be referred to as the sample correlation coefficient or the sample Pearson correlation coefficient. We can obtain a formula for r by substituting estimates of the covariance's and variances based on a sample into the formula above. That formula for r is:

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}}$$

An equivalent expression gives the correlation coefficient as the mean of the products of the standard scores. Based on a sample of paired data (X_i, Y_i), the sample Pearson correlation coefficient is

$$r = \frac{1}{n-1}\sum_{i=1}^{n}\left(\frac{X_i - \bar{X}}{s_X}\right)\left(\frac{Y_i - \bar{Y}}{s_Y}\right)$$

where

$$\frac{X_i - \bar{X}}{s_X}, \bar{X}, \text{ and } s_X$$

are the standard score, sample mean, and sample standard deviation, respectively.

Mathematical properties

The absolute value of both the sample and population Pearson correlation coefficients are less than or equal to 1. Correlations equal to 1 or -1 correspond to data points lying exactly on a line (in the case of the sample correlation), or to a bivariate distribution entirely supported on a line (in the case of the population correlation). The Pearson correlation coefficient is symmetric: corr(X,Y) = corr(Y,X).

A key mathematical property of the Pearson correlation coefficient is that it is invariant (up to a sign) to separate changes in location and scale in the two variables. That is, we may transform X to a + bX and transform Y to c + dY, where a, b, c, and d are constants, without changing the correlation coefficient (this fact holds for both the population and sample Pearson correlation coefficients). Note that more general linear transformations do change the correlation.

The Pearson correlation can be expressed in terms of uncentered moments.

Since $\mu_X = E(X)$, $\sigma_X^2 = E[(X - E(X))^2] = E(X^2) - E^2(X)$ and likewise for Y, and since

$$E[(X - E(X))(Y - E(Y))] = E(XY) - E(X)E(Y),$$

the correlation can also be written as

$$\rho_{X,Y} = \frac{E(XY) - E(X)E(Y)}{\sqrt{E(X^2) - (E(X))^2}\,\sqrt{E(Y^2) - (E(Y))^2}}.$$

Alternative formulae for the sample Pearson correlation coefficient are also available:

$$r_{xy} = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{(n-1)s_x s_y} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\,\sqrt{n\sum y_i^2 - (\sum y_i)^2}}.$$

The above formula suggests a convenient single-pass algorithm for calculating sample correlations, but, depending on the numbers involved, it can sometimes be numerically unstable.

Interpretation

The correlation coefficient ranges from −1 to 1. A value of 1 implies that a linear equation describes the relationship between X and Y perfectly, with all data points lying on a line for which Y increases as X increases. A value of −1 implies that all data points lie on a line for which Y decreases as X increases. A value of 0 implies that there is no linear correlation between the variables.

More generally, note that $(X_i - X)(Y_i - Y)$ is positive if and only if X_i and Y_i lie on the same side of their respective means. Thus the correlation coefficient is positive if X_i and Y_i tend to be simultaneously greater than, or simultaneously less than, their respective means. The correlation coefficient is negative if X_i and Y_i tend to lie on opposite sides of their respective means.

Related Studies

These maternal deaths are no more than the tip of the iceberg, the underlying rates of morbidity linked to unsafe abortions being very much higher. There is a lack of relevant, regularly collected hospital data in most developing countries, so little has been published on this subject. However, it is clear that in countries in which abortion is illegal, many women (between 20 and 30%) are likely to experience non-lethal complications related to unsafe abortion practices, including major psychological stress, fistulas and chronic pelvic infection resulting in ectopic pregnancy and infertility (Benson et al. 1996, Diadhio et al. 1999).

The cost to health care systems in developing countries of treating women suffering from abortion-related complications may be substantial, in terms of the number of maternity beds taken up and gynecology budgets (Johnson et al. 1993, Sjöstrand et al. 1995, Kay et al. 1997, Figa-Talamenca et al. 1986).

In Egypt, in 1996, about one fifth of all admissions to obstetrics and ecology wards were abortion-related (Huntington et al. 1998).

Pregnancy-induced hypertension/eclampsia is a major contributor to severe maternal morbidity and maternal mortality. The management routines have been

quite variable over the last decades but hopeful signs of a scientific approach have emanated from the multicentre study comparing magnesium sulphate and diazepam (Anonymous 1995).

"Fear of the midwife's real power, her ability to do the work of obstetrics – translated into a public portrayal of such women as primarily responsible for long labours and puerperal deaths. Physicians, by contrast, associated themselves with painless labour and safe childbirth" (Fraser 1998).
The problem of maternal mortality only came on the policy agenda as a result of the public outcry against differences with Europe, in the early 1930's.

The first enquiries into maternal deaths, in New York in 1930-32 (Llewellyn-Jones 1974), led the New York Times to put the blame for avoidable maternal deaths on doctors (Porges 1985). Still, the medical lobby managed to ensure hegemony of hospital delivery. From the late 16th century until today, the de facto policy was to promote institutional delivery by obstetricians.
However, without mechanisms to guarantee access or quality standards, this failed to address the problem and actually contributed to mortality through pathogenesis. The lack of norms and accessibility would only be offset by the Emergency Maternity Care Programme during the 2nd World- War (Schmidt & Valadian 1969).

Likely that [in the 1920s] at least 200,000 lives might have been saved by a maternity system based on trained midwives in the very country [the USA] in which the midwife was branded as a relic of the barbaric past" (Loudon 1997).

As a matter of fact the problem was grossly underestimated. Around 1980 many in academic circles still thought maternal mortality in poor countries was of the order of magnitude of 300/100,000 (Rao 1981, Rosa 1981). Furthermore, donor agencies, planners and a substantial part of the scientific community considered that it was easier to have an impact on the mortality of children than on that of mothers; for child mortality seemed to respond rapidly and visibly responds to a range of vertical programmes (Walsh & Warren 1979).

At that time, the 1980s, the international development world was arguing about the correct interpretation of the concept of 'primary health care' (Van Lerberghe 1993, Van Lerberghe & De Brouwere 2000). In the meantime things medical, and especially hospitals, were decidedly unfashionable (Van Lerberghe et al. 1997).

Alongside family planning, the first WHO expert committee formally put the focus on antenatal clinics and education of the mothers in the early 1950s (OMS 1952). The package of measures introduced to reduce maternal mortality had long remained substantially the same (in actual fact these measures had mainly been directed towards improving the survival prospects of infants).

Nevertheless, there had been evidence in the industrialized West, for as long as since 1932, that screening for maternal death was not very effective: a letter to the Lancet stated that "80 percent of maternal deaths were due to conditions (sepsis, hemorrhage, shock) not detectable antenatal" (Browne & Aberd 1932, Reynolds 1934).

Maternal mortality ratios measurements need to be complemented by information that involves the entire community of maternal care providers, with immediate implications for local action. Various such methods are presently promoted: assessment of Unmet Obstetrical Need (De Brouwere & Van Lerberghe 1998).

A Memorandum from the British Ministry of Health in 1929 (Ministry of Health 1929) outlined the principles and details of antenatal care, including timing and content of the visits. It prescribed a number of visits, starting as early in pregnancy as possible, continuing at 4-week intervals until the 28th week, then every two weeks until the 36th week, and then weekly until the onset of labour. This programme of prophylactic care continued for about fifty years before anyone thought of evaluating its effectiveness (Chalmers 1989).

The role and importance of efficient health systems in reducing maternal mortality is now generally accepted (World Bank 1999, Campbell & Goodburn 2001, Papineau Salim 2000).

Over the last decade an increasing number of countries have begun implementing health sector reform programmes. The goal of health sector reform is to improve the health status of populations by promoting and enhancing access, equity, quality, sustainability and efficiency in the delivery of health services to the largest possible number of people (Langer et al. 2000).

Outreach services and home deliveries by trained professionals are not very frequent in Africa and Asia. One example is Malaysia where between the mid-1970s and mid-1980s most births occurred at home assisted by a professional

midwife, whereas the role of traditional midwifes has shifted to a family supportive role. Home providers are well trained and backed up by a strong referral network (see above). Today even women at low risk predominantly give birth at hospitals. The same trend is visible in Sri Lanka (Koblinsky et al. 1999). In China the approach was to shorten medical training (3 instead of 5 years) and thus increase the output of medical doctors (World Bank 1993). Other countries including Ethiopia, Indonesia, South Africa, Malawi and even developed countries like Australia, New Zealand, and Canada established training in emergency treatment skills for general practitioners of rural hospitals and family doctors (Adeloye 1993, Craig & Nichols 1993, Krikke & Bell 1989, Loufti et al. 1995, Reid et al. 1998, Thouw 1992).

In Tanzania, Mozambique, Burkina Faso and DRC a paramedical cadre was trained in surgical and obstetric emergency treatment (da Luz & Bergström 1992, Duale 1992, Pereira et al. 1996).

Indonesia, Somalia and South Africa and even Australia identified general practitioners at rural hospitals and health centers as target group for training in surgical/obstetrical skills. They are often the only available and accessible source of care to the community. But the training in medical school does not provide the necessary skills for a rural doctor. The possibility that a rural GP can refer emergency cases is also limited. Indonesia is considering a training in live-saving skills (manual removal of placenta, uterine curettage etc) for general practitioners of rural health centers and hospitals. South Africa based their decision to implement obligatory vocational training in primary surgery for general doctors on their evaluation of common practice in rural hospitals. They found doctors

undertaking surgical interventions to save mothers lives depended more on personal courage than on acquired skills.

Somalia has already initial experiences with a similar 6 month training course for rural GPs. Even Australia, a country with vast distances and problems to cover the rural population with health care, pursues vocational training modules for family practitioner in various topics including emergency surgery, emergency obstetrics, paediatrics, cardiac emergencies etc (Loufti et al. 1995, Thouw 1992, Reid et al. 1998, Craig & Nichols 1993).

Maternal mortality, for many years the preferred indicator of success of safe motherhood programmes, is not anymore recommended as an outcome measure against which to assess programme successes (Inter-agency group1997). Many pregnancy-related deaths still go unnoticed or unreported, and substantial errors in the estimates of maternal mortality persist, even in industrialized countries (Bouvier Colle et al. 1991, Campbell & Graham 1991). Correctly measuring maternal mortality not only requires a complete registration of deaths in women of reproductive age, which in many countries may be lacking, but also the recognition that the woman was pregnant or recently delivered at the time of her death.

Closing the cycle of quality assurance, or in other words auditing care, is now seen as a promising way to improve quality of services, even in developing countries. Preliminary findings from a number of ongoing projects in developing countries suggest that audits of obstetric care in health facilities may indeed induce change in the quality of the services (Graham et al. 2000, Ronsmans & Filippi 2000).

The good news is that even in poor countries health services can make a difference to reduce maternal mortality (Mc Donagh & Goodburn 2001). The bad news is that resource mobilization alone, however necessary, not enough is. If one wants to tackle maternal mortality, investments in health care will only be really worthwhile if they go along with an investment in the civil society's capacity to build up pressure for accountability.

It is obvious to many practitioners that professionalization of delivery care is a key to reducing maternal mortality (Graham et al. 2001, Kowaleswski & Jahn 2001). Industrialized countries have halved their maternal mortality in the early 20th century through access to professional midwifery care at delivery, and further reduced it to current historical lows through access to effective and safe hospital technology (Loudon 1992). One could imagine trying to reproduce a similar sequence: first develop ambulatory midwifery, and develop hospital care at a later stage. This, would, however, lack political credibility and produce results too slowly: speedy reduction to low levels requires both. Moreover, an exclusive midwifery-based strategy would fuel the latent conflicts between midwives and hospital doctors that have characterized maternal health care in most countries for the whole 20th century. It would be an illusion to hope to promote midwifery without the support and commitment or at least the agreement of hospital doctors Winning the hospital battle for access to quality referral delivery care is crucial from a strategic point of view (Van Lerberghe & De Brouwere 2001).

Where one can combine access to quality primary and referral delivery care (Jahn & De Brouwere 2001) maternal mortality ratios can drop over what is, all things considered, a relatively short time-span. Many industrialized countries halved ratios in 10 years or less halfway the 20th century. Situations abound, however, where there are hospitals with trained professional staff exist, and mortality yet

remains staggeringly high. In 1996, for example, Brazzaville had a maternal mortality ratio of 645 per 100,000, university hospital and health care facilities notwithstanding (Le Coeur et al. 1998). Too little, too late and too sloppy: delivery care is not a mere matter having a hospital with trained clinicians, it is also a question of how professional staff perform and behave (Bergström 2001, Buekens 2001).

Problems with accountability have often become so prevalent that they are hardly noticed any more. Epidemiological documentation of their impact is hard to come by, although sensitized professionals are more than convinced by the anecdotal evidence of day-to-day field experience. Their intuition is corroborated if one uses the (admittedly crude) aggregate responsiveness scores developed by WHO as proxy indicators of accountability. Responsiveness – in its WHO operationalisation of respect towards the patient (dignity, confidentiality, autonomy) and attention devoted to the client (promptness, quality of environment, access to social assistance and free choice of provider) – has only an indirect a priori relationship to maternal mortality, and in the present state of affairs its measurement is rather crude. Still, in low-income countries, it has an explanatory power that is significantly superior to that of female literacy rate and wealth expressed as GNP. This puts common wisdom on the role of poverty and female literacy into a somewhat different perspective.

What are the implications? It would seem that at a given income level – which is correlated with the availability of services - how well their staff responds to the expectations and needs of their clients does make a difference. In other words, if countries of comparable wealth or poverty have different maternal

mortality ratios, this may well have to do not only with the availability of health services, but also with how services relate to their clients.

The whole issue of accountability for performance and for responsiveness is a delicate one for which evidence-based solutions are not readily available. Quality assurance programmes may play a role (Ronsmans 2001), but if history is anything to go by, peer pressure and, more decisively still, client pressure is what makes professionals behave in a responsible and accountable way.

Several approaches have been tested and implemented to cover the population with emergency obstetric care. A very interesting example is the Obstetric flying squad in peninsula Malaysia. For 30 years emergencies in obstetrics have been attended to by this service. The service is available at all hours and staffed with specialists in obstetrics. Nevertheless, with the development of telecommunication, road access and rural hospitals an ambulance service proved to be faster and cheaper for most of the communities. A prerequisite for ambulance service was a training of ambulance drivers in first aid. Only very isolated communities could still use the flying squad (Monga & Achanna 1999).

Primary care providers include physicians, nurses, nurse practitioners, and midwives (World Bank 1993). In 1992 the FIGO (International Association of Obstetricians and Gynecologists) recommended a delegation of functions to various levels of personnel. Currently, in developing countries this delegation of functions occurs in an atmosphere of rigid traditions in both teaching and practice inherited from outdated Western medicine. This delegation is frequently inappropriate for the diverse local situations. The situation is further complicated by different professional groups attempting to protect their turf of clinical functions, despite the clearest evidence that they themselves are unable or

reluctant to deliver these services where they are most needed. On the other hand, there are honestly held perceptions that the delegation of some functions will increase morbidity and mortality (Rooth & Kessel 1992).

The argument about delegation and transfer of skills is several centuries old. Defining professional boundaries and the fear of losing professional control has focused discussions on how to preserve professional status and independence instead of how interdependency of various cadres of health professionals can work. But several studies show that delegation of tasks can work without losing quality of care. In Great Britain nurse practitioners provide outpatient-care, hospital nurses replace interns in surgery, in the US nurses have been trained in special diagnostic procedures, provide intensive care at neonatal units and non-medically qualified assistants work in cardiac surgery. These examples have been evaluated with no significant difference found to care provided by medical professionals (Hopkins *et al.* 1995). In defining the staff, equipment and responsibilities of the district hospital as first referral level facility, it should be borne in mind that in reality it is often the last referral level too (General Assembly at the 16th World Congress of Gynecology and Obstetrics 1992). Hardee and Yount (Hardee 2000) see the possible advantages of delegation of activities from higher level to lower level staff in overcoming shortage of trained workers, freeing physicians from routine tasks, conserving specialist's time for emergencies, avoiding long delays in care caused by a centralized system, and promoting worker satisfaction.

Training differs in time and content according to the envisaged tasks of the newly qualified staff. The most complex training is offered in health systems

where non-academic staff has been integrated at first and second referral levels already for a longer time, and where the political aim is to offer more and better maternity and surgical services nearer to the communities. In these countries, the non-academic "doctors" are well established with an officially endorsed career path.
Good examples of this are Tanzania and Burkina Faso. In both countries the curricula of assistant medical officers or surgical assistants include theoretical knowledge and practical skills in general surgery and obstetrics/ gynecology focusing on the most frequent causes for emergency interventions.

The courses last for 2 years. A precondition for admission to the course in Burkina is registration as a certified nurse or midwife with at least 5 years of practical experience. In Tanzania the course was designed for upgrading medical assistants. In both countries the certificate/licence is officially acknowledged and remune-ration higher for such posts (Mbaruku pers. comm.,Traoré pers. comm.).

In some health systems paramedical staffs are trained to fill the gap left by a lack of physicians without a clear vision for a permanent solution. These courses are often very short. In Malawi medical assistant training lasts one year, the training of surgical technicians in Mozambique lasts 6 months (Adeloye 1993, da Luz Vaz & Bergström 1992). Common to all these courses is a focus on practical skills in general surgery and obstetric / gynecological surgery. The only way to learn surgery is to do it. Acquiring practice in case management and learning indications for surgical interventions falls short in all these courses. Reconsideration of curricula is therefore envisaged. Common also to these courses is the lack of official acknowledgement by the medical societies of the concerned

countries, and no financial or other incentives for the participants in their future posts.

Since the 1950s selected nurses in Congolese (former Zairie) hospitals received practical, on the job, training to conduct caesarean sections. Initiated by a specialist doctor, these nurses attend more than 80% of all emergency cases in obstetrics. In the 1980s their training was extended to cover also gynecological and general surgical cases. The nurses are carefully chosen according to their personal experience and are specifically trained on the techniques of a limited set of surgical interventions (Rosenfield 1992, Duale 1992).

In Malawi and Burkina Faso assistant anesthetists are trained in the same manner as surgical paramedical personnel. Both countries have in common a crucial lack of medical professionals in anesthesia. Thus the newly qualified cadre does not only serve in rural areas which was the first intention, but covers also regional and even national hospitals (Traoré pers.comm.)(Adeloye 1993). The coverage of rural South Africa with anesthetists' service is as difficult as in the above countries. Until now more than half of the emergency surgical interventions in rural hospitals have been carried out single handed by a general practitioner acting as surgeon and anesthetists at the same time. Not only is this practice dangerous, it is also not legally covered. Therefore the training of medical assistants in anesthesia is envisaged (Reid *et al.* 1998).

Distance education is another approach of training health workers in rural areas. Distance learning started in Tanzania in 1981. Since then more than 3000 learners participated in the programme. Several modules for learning have been developed among these are: management of labour, obstetric emergencies,

medical emergencies etc. Upon completion of the module units a certificate is provided. This method is well suited for maternal health teams: first because the instructions occur in the work place, with the learning materials readily accessible; second, it provides a stimulus for isolated workers and thereby promotes morale and effectiveness. A serious setback is the lack of supervised practical experience (Burke & Kisimbo 1997, Parry 1992).

Very important to all short courses is the regular supervision by specialists after their training is finished. This is the most sensible and most difficult requirement to satisfy. The Ethiopian experience of the first course showed that difficulties were encountered in involving the necessary Somalia surgical specialists, as rural health services were not felt to be a priority for the university department of surgery (Loufti *et al.* 1995).

To create more job satisfaction new approaches to training of health staff are tested. In Nepal a recent programme of the Safe Motherhood Project used a needs assessment with competency checklists to model the training to the specific individual requirements (Koblinsky *et al.* 1999).

World Bank, UNICEF and UNAIDS advocate this kind of training programmes. Because of little experience evaluations are not available. But as long as training is driven by supply-side interests and capacities of institutions the needs of the trainees are rarely taken as basis for planning new programmes (Daly *et al.* 1994, UNICEF 2000, Walker 1999).

A very large cohort study in Canada compared the maternal and fetal outcome for family practitioners and specialist doctors in obstetrics. A significant difference was found in the proportion of prim gravid women with spontaneous vaginal delivery, which was higher for family doctors and oxytocin induced labour

which was higher in the specialist group. However the results showed no significant difference in maternal and fetal health outcomes (Krikke & Bell 1989).

In Somalia a group of general practitioners who underwent surgical training produced high quality results despite their patients being generally in very poor condition. The paramedical personnel in Mozambique was carefully followed and their results evaluated as was the work of the nurse surgeons in DRC (ex-Zaire). All studies show the quality of their work to be satisfactory and in large comparable to specialist care given the same conditions and patient choice (da Luz Vaz & Bergström 1992, Duale 1992, Loufti *et al.* 1995, Pereira *et al.* 1996, Sohier *et al.* 1999).

The costs of training are generally difficult to assess. From Myanmar, Pakistan and Sri Lanka we know that that 2.5 to 3 nurses can be trained for the costs of training one physician (World Bank 1993). In Bangladesh the total costs of the training of one doctor is around 2,500 US$ and the total cost of training one nurse is around 300 US$ (Shaheen pers. comm.). In Tanzania the 2 years training for an assistant medical officer is estimated at 1,000 US$ per person (Mbaruku pers. comm.). In addition the trainees receive their monthly salary. The newly installed 6 months training course for general practitioners in Somalia costs 2,000 US$ per person not counting the salary for two expatriate obstetricians (teaching and supervision). The highest proportion of cost was due to per diems paid to course participants (Loufti *et al.* 1995).

The follow-up costs must not be neglected. Supervision of newly acquired skills is absolutely necessary. For example replacing senior house officers in neonatal care by specially trained nurses in Bristol, UK, showed a complex balance sheet. The savings for one group were offset by the higher degree of supervision required in the other (Hopkins *et al.* 1995)

CHAPTER THREE
METHODOLOGY

Research Design

Quantitative design sampling techniques like; simple random sampling, systematic random sampling and stratified random sampling techniques were adopted. A test was made to check for the problems of autocorrelation, multi co-linearity tests and F-test for every regression. A regression model was developed to establish the direction of the relationship between the variables. Quantitative data was generated from secondary sources that was enable a comparative assessment on the quantifiable elements related to the Health service delivery and maternal survival. However, the study was quantitatively biased though qualitative technique cannot be fully ignored.

Research Population

The study was target women and girls in the reproductive age 17-50 years; records on health service delivery and maternal survival 12 Hospitals and 2 hospitals were investigated. It was focus on three distinct health service channels like skilled health personal, equipment and essential supplies. It's on these areas that the relationship between health service and maternal survival was studied. The researcher was visit organizations which are partners in maternal health to capture information from experienced senior officials on their experiences in working with those agencies; these was included Minister of Health, WHO, UNICF, National Drug Author. Their records on Health service delivery and maternal survival was studied and data used in the study.

Target Population

The study was target women and girls in the reproductive age 17-49 years. The computed annual maternal survival, annual health service delivery in Banadir Hospitals Somalia over the years. The study was generally enlisting three different forms of health service. First are the skilled health's personal that have been trained and enhanced with Somali's health sector. The- second group was equipment which is basically financed by government and finally essential supplies which is important in quality service delivery.

Sample Size

Using the Slovene's formula to compute the sample size (n);

Sample size **n;** would then be got by $n = \frac{N}{1+(N* e^2)}$, but since I was reviewing already existing data (secondary source); the sample size n is not needed, records for all the 12 Hospitals and 2 Hospital was used from 2001 up to 2010 which covers a period of 10 years and these was obtained from the major autonomous and semi autonomous bodies that publish such records in the country.

Sampling Procedure

Subjects were picked from past 10 years that is from 2001 to 2010. The researcher pick end of year subjects from past 10 years purposively because information on awareness to maternal survival and recording of data on maternal survival at Banadir Mogadishu, Somalia is stipulated to have started in early 2001s.

Research Instrument

Researcher devised record sheets were designed and used to record time series data on maternal survival and health service delivery.

Data Gathering Procedures

Before the administration of the questionnaires

1. An introduction letter was obtained from the School of Post Graduate Studies and Research for the researcher to solicit approval to conduct the study from health service delivery and maternal survival.
2. When approved, the researcher was secure a list of the qualified respondents from the interior ministry's in charge and select through systematic random sampling from this list to arrive at the minimum sample size.
3. The respondents were explained about the study and were requested to sign the Informed Consent.
4. Reproduce more than enough questionnaires for distribution.
5. Select research assistants who would assist in the data collection; brief and orient them in order to be consistent in administering the questionnaires.

During the administration of the questionnaires

1. The respondents were requested to answer completely and not to leave any part of the questionnaires unanswered.
2. The researcher and assistants was emphasized retrieval of the questionnaires within five days from the date of distribution.
3. On retrieval, all returned questionnaires were checked if all are answered.

After the administration of the questionnaires

The data gathered was collated, encoded into the computer and statistically treated using the Statistical Package for Sciences Applied Statistics.

Data Analysis

The collected data was edited, categorized and entered in to a computer data base system for analysis , STATA was used to do descriptive statistics in form tables like; percentage distributions was drown to determine the level of health service delivery and maternal survival, line and scatter graphs. If the scatter plot is linear regression was done but if it's not linear then a series of analysis (logs, inverse, etc) was performed to and make it linear. However, if still the scatter plot fails to become linear, then the model is not linear thus; an exponential analysis ($y=ab^x$) or probability and no probability was checked.

And STATA was used to fit the trend on health service delivery and maternal survival, and was displayed the scatter plots of maternal survival on health service delivery like professionals, ambulance delivery, beds and x-rays.

Regression analysis both at bivariate and at multivariate levels was conducted, correlation and multicolinearity between the variables was determined. The data was analyzed to establish the multiple linear relationships level. The formula that wills exhibit this relationship is represented by;

$$Y=\mu+\alpha+\beta_1 x_1+\beta_2 x_2+e_i$$

The H_0; $\beta_1 = \beta_2 = 0$. The null hypothesis is that all βs ar equl to zero (0)

and H_A: is that at least one of the βs is not equal to zero (0); $H_A : \beta \neq 0$.

F-test was computed, $F = \frac{MS\ model}{MS\ residual}$

If F is not significant, it means that none of dominants health service delivery and maternal survival. Then individual's tests was done to check which of the resources stronger in the model.

The Pearson's coefficient of correlation and the student's t tests statistic was computed to determine the strength of the relationship. The Pearson's coefficient of correlation, r formula is given below

$$r = \frac{n(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{[n(\Sigma X^2 - (\Sigma X)^2][n(\Sigma Y^2) - (\Sigma Y)^2]}}$$

And the student's t test statistic is,

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Where, r^2 is the coefficient of determination.

Ethical Considerations

The respondents whom data was collected from were kept confidential, and the data was to be used for the purpose of the fulfillment of requirement for award of degree of master science in statistics. The respondent was informing of the aim of research as well as letter for introduction. On the other hand, authors quoted in this study will acknowledge through citations and referencing.

Limitations of the study

The researcher claimed an acceptable level of significance $p \leq$ of 0.05 or 5% error in the view of the following anticipated threats to validity with relevance to this study:

Instrumentation: the research instrument impact of direct foreign investment on job creation is not standardized. A validity and reliability test was do to produce credible research tool.

Attrition: the calculated number of respondents may not be reached, considering the fact that some questionnaires may not be retuned due to the circumstances within respondents and beyond the control of the researcher. The researcher endeavored to attain the appropriate number of respondents for reasons of representativeness.

Other circumstances where the researcher would not have control over the extraneous variables, such as honesty of respondents, personal bias and so on.

Language barrier, because the dominant languages in Somalia are Somali and Arabic, so some of the people cannot understand English.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Introduction

This chapter is a presentation of data, analysis and interpretation of results which are organized in terms of tables and graphs based on the research objectives and corresponding research questions. The chapter also entails testing of the null hypothesis and discussion of meaning and implication of the findings. The objectives are (1) to determine the trend and level of health service delivery at Banadir Hospitals of Somalia (2) to establish the trend and the level of maternal survival at Banadir Hospitals for years 2001 to 2011, and (3) to investigate the relationship between the health service delivery and maternal survival for 2001 to 2010 at Banadir Hospitals in Mogadishu, Somalia.

OBJECTIVE ONE: DETERMINE TREND AND LEVEL OF HEALTH SERVICE DELIVERY AT BANADIR HOSPITALS FOR 2001 TO 2010

Table-1 below presents data on Health service delivery at Banadir Hospitals for period of years 2001 -2010.

Years	Health service delivery rate (%)
2001	8.94658
2002	9.16625
2003	9.445831
2004	9.615577
2005	10.41438
2006	10.77384
2007	10.54418
2008	10.01498
2009	10.11483
2010	10.96355

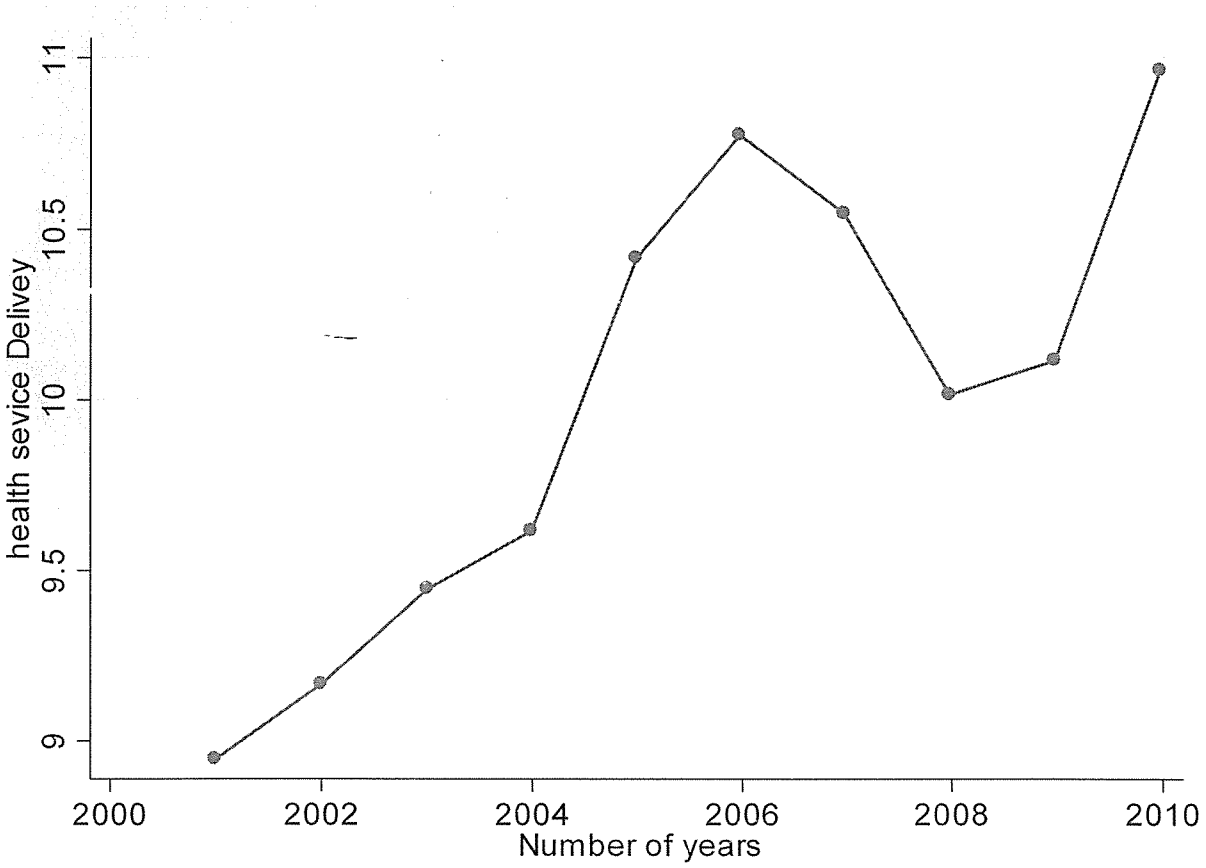
Source; Banadir Hospitals of Statistics (MHOS) abstract (2010)

The first objective of the study was to establish the trend and level of health service delivery rate Banadir hospitals for 2001 to 2010

The following graph illustrates the trend.

1a) Trend of health service delivery rate in hospitals Mogadishu, Somalia

Graph 1: A connected line graph showing trend of health service delivery rate over time/years: 2010-2010.



Sources, compiled by researcher (2012)

Table-1 and graph-1 above suggest that health service delivery is stably growing due to studying finding problems over the last decade in number of year 2001/2002 health service rate was small 8.95%. For years 2003/2004 to 2005/2007, health service rates ranged from 9.445831 to 10.54418; was the relatively higher than rates of the preceding five years. In the number of year 2007/2008, health service rate slowed down to 10.01498. It suddenly rose to

10.11483 in 2008/20099. 2009/2010 health service rate was 10.96355 higher than for the prior two years by around 0.94%.

The researcher implies that health service delivery in Banadir hospitals is easily predictable and controllable.

Table 2: Pearson correlation: health service delivery Vs time/years.

Variables correlated	r-value	P-value	Interpretation
Health service delivery Vs time/years	0.8202	0.0037	Strong - positive significant correlation

Level of significance =0.05

The correlation between health service delivery and time/year's strong and positive with r=0.8202. The correlation is significant since

(p=0.0037) < 0.05.

Table 3: Regression analysis on health service delivery Vs time/years

ariables regressed	Adjusted R^2	F-value	P-value	Interpret	Decision on Ho
lealth service elivery Vs time/years	0.6319	16.45	0.0037	Significant effect	Rejected
oefficients	Beta(β)	t-value	P<|t|	Interpret	Decision on Ho
me	18.68485	4.06	0.004	Significant	Rejected
onstant)	-36470.96	-3.95	0.004	Significant	Rejected

Source; Compiled by researcher (2012), **Level of significance=0.05**

From table 3, [$f_{0.05}(1,8)$]= 16.45 > [f-tab $_{0.05}$ = 5.32] and (p =0.0037)< 0.05, so health service delivery and time/years are significantly related. Adjusted R^2=0.6319 meaning time/years contributes only 63.19% in variation of health service delivery.

Computed student's t –value in model is [t =4.06] < tabulated [t = 1.86] and P-value=0.004; thus health service delivery is significantly related with time at 5% level of significance. Model: health service delivery rate = -36470.96+ 18.68485*time/years; health service delivery increases by only 18.68485 % when time is unit.

1 b) Level of health service delivery

Hypothesis One: health service delivery is significant.

Null hypothesis H_{01}: $\mu_1 = 0$ (mean of health service delivery is equal to zero)

Alternative hypothesis. H_{A1}: $\mu_1 \neq 0$ (mean of health service delivery is not equal to zero)

Table 4: Summary statistics for health service delivery data: 2001-2010.

Statistic	Value
Number of observations	10
Maximum	1098
Minimum	896
Range	202
Mean	1001.5
50^{th} percentile or median	1008
Standard deviation	68.96899
Skewness	-0.1376084
Kurtosis	1.739357

Source, compiled by the researcher (2012)

There were 10 observations each from one year for years 2001 to 2010. The highest (maximum) health service delivery was 1098 for the year 2009/10. The lowest (minimum) health service rate was 896 for the year 2001. The range of health service rate for the period is 202. The mean of health service rate is 1001.5; the 50^{th} percentile (median) is 1008 and standard deviation of 68.96899 implying that the health service rate are much greater than zero. The skewness of -0.1376084 implies data is negatively skewed and the kurtosis of 1.739357 implies that data has leptokurtic distribution that is the distribution is peaked.

Table 5: One sample mean comparison test on health service delivery.

ariable	Mean	t-value	p-value	Interpretation	Decision on H_0
ealth service delivery	1001.5	45.9195	0.0000	Mean is Significant	Rejected

Source, compiled by the researcher (2012) Level of significance =0.000

Table 5 above, the computed t-value is 45.9195. However the tabulated t-value = 1.83 at 0.05 level of significance and 9 degrees of freedom. Then the null hypothesis that a health service delivery is equal to zero is rejected and accepts the alternative hypothesis that the mean is not zero at 0.05 level of significance. The computed (P-value = 0.0000) < (p= 0.05). Thus, the mean (1001.5) is significantly greater than zero at 5% level of significance. This implies that rate of health service delivery of Mogadishu Somalia is very high

OBJECTIVE TWO: TREND AND LEVEL OF MATERNAL SURVIAL AT HOSPITALS BANADIR IN MOGADISHU, SOMALIA.

Table 6: Maternal survival (%) Data: 2001 - 2010.

Time/years	Maternal survival (%) (15-49) years old)
2001	6.72268
2002	7.22877
2003	8.687889
2004	8.234379
2005	9.462361
2006	10.84042
2007	10.76593
2008	11.9972
2009	12.51095
2010	13.54943

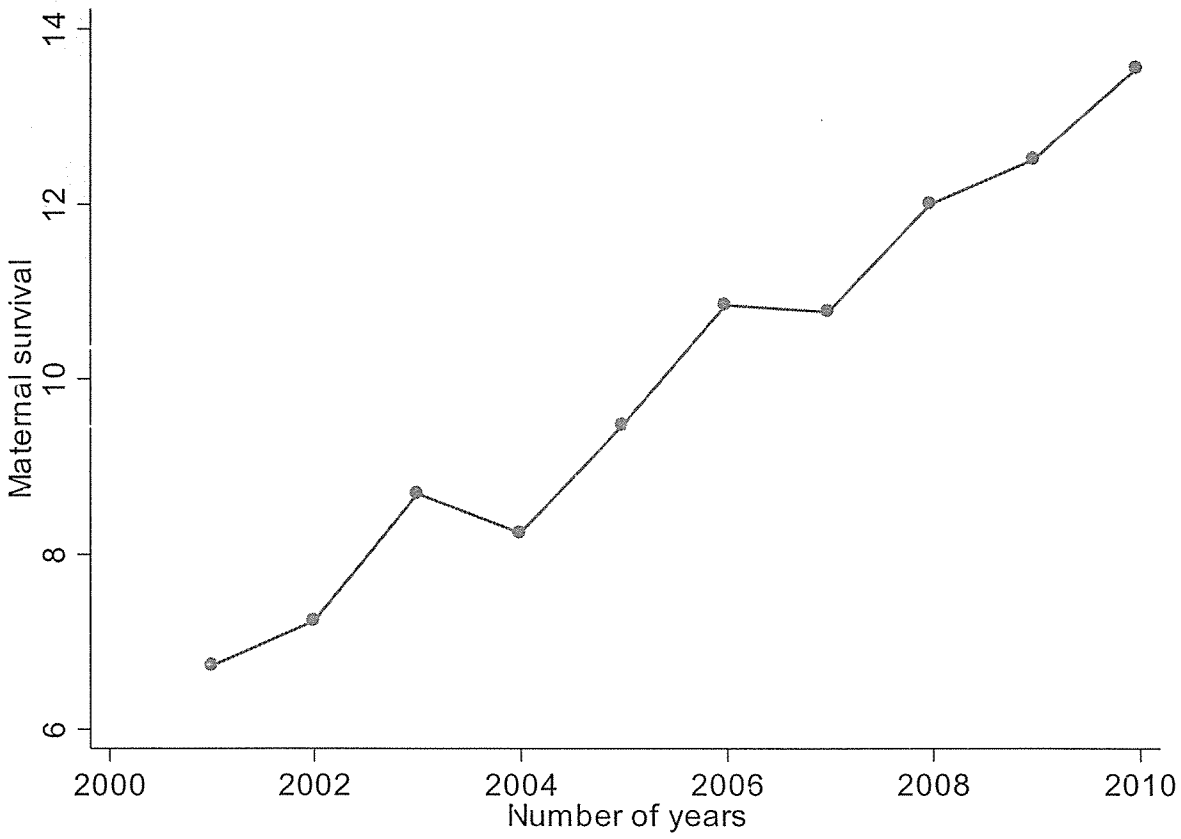
Source: Banadir hospitals Mogadishu, Somalia-publication (2011)

2a) Trend and level of maternal survival at hospital Banadir in Mogadishu, Somalia

The second objective of the study was to establish the trend and level of maternal survival of Mogadishu, Somalia using data rates from 2001 to 2010.

Graph 2

A connected graph showing trend of maternal survival analysis over time/years: 2001-2010



Sources, compiled by researcher (2012)

Graph 2 above suggests a very high positive correlation between maternal survival analysis and time/years.
That is, as x, the number of years so increase, so does the maternal survival.

From table 6 above, maternal survival analysis was largest on average of +13.54% for period of years 2009 to 2010. This could also explain the low maternal survival rates of 2001 and 2002. For the period 2003 to 2004, the researcher found out that there was a general decline in maternal survival of 0.25% between present and preceding year.

The increasing in maternal survival in 2005 and 2006 could be explanation for decreasing maternal mortality rates of 2003 and 2004. For 2007 the maternal survival was 10.77%, 12.51% in 2008, and 13.55% respectively. This shows an increasing for each year from 2007 to 2010. This slight increase in maternal survival could be the reason for increasing in maternal mortality rates from 2001 to 2010.

Table 7: Pearson correlation for maternal survival (%) vs time/years

Variables correlated	r-value	p-value	Interpretation
Maternal survival vs time/years	0.9875	0.0000	Very high positive significant correlation

Source; Compiled by researcher (2012), Level of significance =0.05

The correlation between maternal survival and time/year's strong and very high positive with r=0.9875. The correlation is significant since (p=0.000) <0.05.

Table 8: Regression analysis on maternal survival (%) vs time/years

riables regressed	Adjusted R^2	F-value	P-value	Interpret	Decision
aternal survival rate time/years	0.9720	313.33	0.000	Significant effect	Rejected
efficients on	Beta(β)	t-value	P>|t|	Interpret	Decision
ne	685.6848	17.70	0.000	Positive Significant effect	Rejected
ɔnstant)	-1366012	-17.58	0.000	Negative Significant effect	Rejected

Source; Compiled by researcher (2012), Level of significance is 0.05

The computed Pearson's F-value is [$F_{0.05}$ (1, 8) =313.33] > tabulated

F-value [F-tab $_{0.05}$ =5.32] and the computed p-value is 0.000.

Computed student's t –value in [t =17.70, tabulated t =1.86]. Thus, relationship between maternal survival and time is strong positive significant relationship.

Model: maternal survival =-1366012 +685.6848*time/years. When time/years are zero, maternal survival is -1366012 and as a year elapses, the prevalence increasing by 685.6848. This confirms a systematic positive trend of maternal survival with respect to time/years.

2b) Level of maternal survival

Hypothesis two: maternal survival is not significant.

Null-hypothesis H_{02}:μ_2 mean (Maternal survival) =0

Alternative H_{A2}:μ_2 mean (Maternal survival) ≠0

Table9: Summary Statistics for Distribution of Maternal survival Data.

Statistics	**Value**
Number of observations	10
Maximum	12369
Minimum	6137
Range	6232
Mean	9128.8
50^{th} percentile or median	9233
Standard deviation	2102.35
Skewness	0.0494381
Kurtosis	1.765783

Source; compiled by the researcher (2012).

There were 10 observations each for one year for the years 2001 to 2010. The highest (maximum) maternal survival was 12369 for the year 2009/2010. The lowest (minimum) maternal survival was 6137 in the years of 2001 and 2002. The range of maternal survival for that period is 6232. The mean was 9128.8, the 50^{th} percentile (median) is 9233 and standard deviation 2102.35 implying that the Maternal survival data is greater than zero. The Pearson coefficient of skewness of 0.494381 implies that maternal survival prevalence data is positively skewed. The kurtosis of 1.765783 is greater than zero which implies that the maternal survival

data has leptokurtic distribution, that is, the maternal survival data is relatively peaked.

Table 10

One-Sample Mean Comparison test on Mean of Maternal survival.

Variable	Mean	t-value	p-value	Interpretation	Decision on H_0
Maternal survival rate	9128.8	13.7312	0.0000	Mean is Significant	Rejected

From table 12 above, the computed t-value=13.7312. However the tabulated t-value at 0.05 level of significance and 9 degrees of freedom is t =1.83. Since (t_c =13.7312) > (t_{tab}=1.83) then null hypothesis that Maternal survival is equal or less than zero is rejected at 0.05 level of significance. Since P=0.0000 then mean of Maternal survival is greater than zero at 5% level of significance.

OBJECTIVE 3: TO INVESTIGATE THE RELATIONSHIP BETWEEN MATERNAL SURVIVAL AND HEALTH SERVICEIN MOGADISHU, SOMALIA: 2001-2011.

The major research postulate was: "there is a significant relationship between health service delivery and maternal survival rate of Banadir hospitals, Mogadishu, Somalia.

Null hypothesis $H_0: \beta_1 = 0$ (the coefficient is equal to zero)

Alternative $H_1: \beta_1 \neq 0$ (the coefficient is not equal to zero)

Research model under study:

Maternal survival = $\beta_0 + \beta_1$ (Health service delivery) + e_i where e_i is white noise term);

Table 11

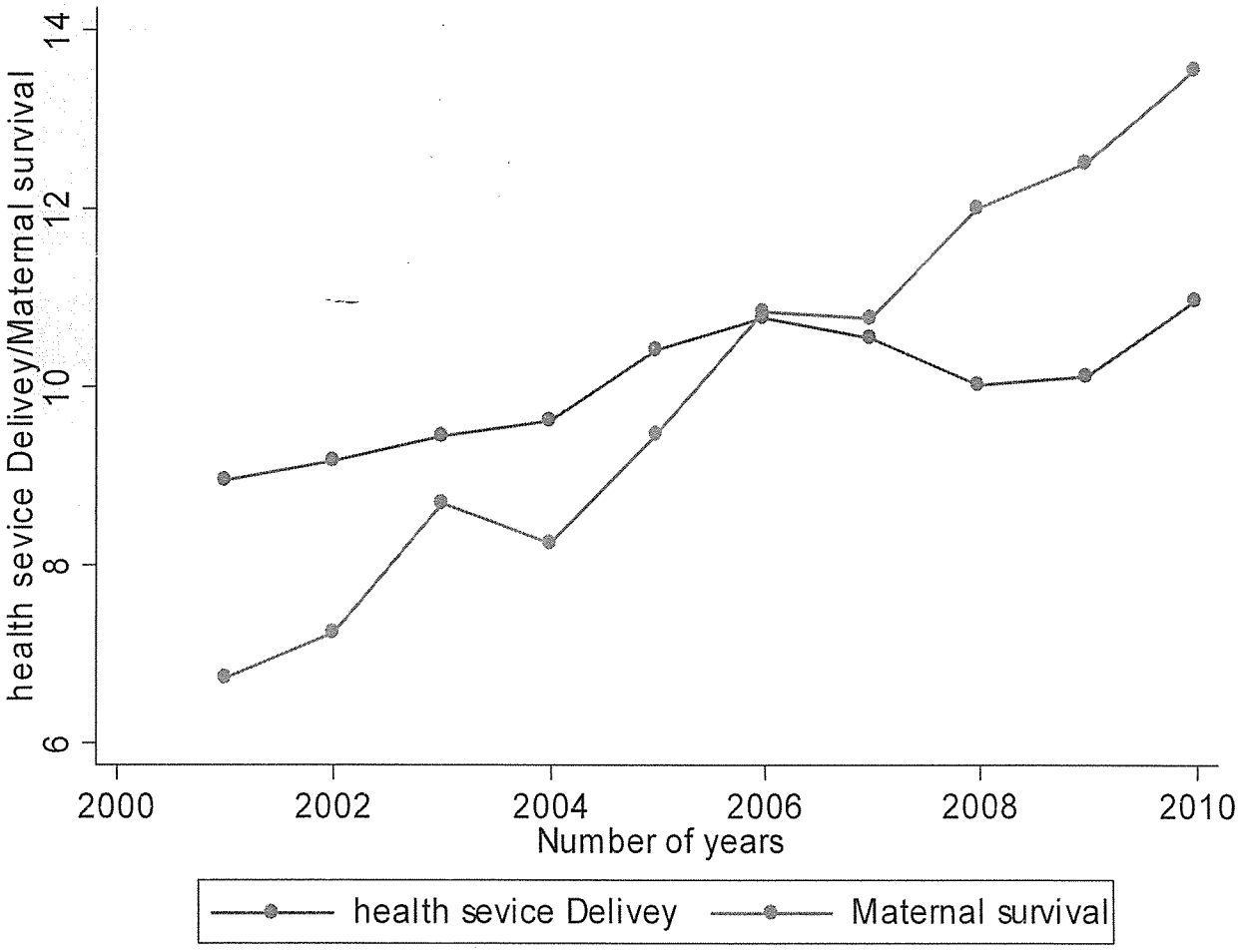
HEALTH SERVICE DELIVERY AND MATERNAL SURVIVAL DATA OVER TIME/YEARS

No. of years	Health Service Delivery	Health Service Delivery (%)	Maternal survival	Maternal survival (%)
2001	896	8.94658	6137	6.72268
2002	918	9.16625	6599	7.22877
2003	946	9.445831	7931	8.687889
2004	963	9.615577	7517	8.234379
2005	1043	10.41438	8638	9.462361
2006	1079	10.77384	9896	10.84042
2007	1056	10.54418	9828	10.76593
2008	1003	10.01498	10952	11.9972
2009	1013	10.11483	11421	12.51095
2010	1098	10.96355	12369	13.54943

Source: Banadir Hospitals Somali Statistics (MHSS) -publication (2011)

Graph 4

A combined connected graph showing trend in health service delivery maternal survival rate over time/years



Graph 5, above suggests that maternal service delivery has a high positive relationship with time where as health service delivery rate has a strong positive relationship with time. Health service delivery is nonrandom and predictable where as maternal service delivery is gradual and can be predicted as years pass on.

Correlation analysis on the relationship between health service delivery and maternal survival

Table 12 below presents the results of correlation analysis;

	Maternal survival	*Professionals*	*Beds Delivery*	*Ambulances*	*x-rays*
Maternal survival	1.000				
Professionals	0.956	1.000			
Beds Delivery	0.740	0.795	1.000		
Ambulances	0.834	0.876	0.905	1.000	
x-rays	0.857	0.861	0.852	0.922	1.000

Maternal survival is the dependent variable; of particular interest is which independent variable has correlation with maternal survival. In this case it is professional 95.6%. A change in maternal survival is explained 74% by changing Beds delivery, a change in maternal survival is explained 83.4% by changing Ambulances, and a change in maternal survival is explained 85.7% by changing X-ray.

A second use of the correlation matrix is to check for multicollinearity. Multicollinearity can distort the standard error of estimate and lead to incorrect conclusions regarding which independent variables are significant. The strongest correlation among the independent variables is between Ambulances and x-rays (0.922). A rule of thumb is that a correlation between -0.70 and 0.70 will not cause problems and can be ignored. At this point it does not appear there is a problem with multicollinearity.

The regression analysis on the relationship between health service delivery and maternal survival rate

Regression analysis was performed on the variables under study and the results of the regression analysis are presented in table 2;

Given the multiple regression models;

$Y = \alpha + \beta x + \theta x + \varepsilon x + bx$ Or

$Y = \alpha + \beta Proffisional + \theta Ambueleces + bBeds\ delivery + bX\_ray$

From table 2 below α =-16309.37, β =116.4912, θ =-12.64427,

$b = -4.126387$ and b =641.9187

So fitted becomes;

$$Y = -16309.37 + 116.4912\ Proffisinals - 12.64427\ Ambluences$$
$$-4.126387\ Beds\ Delivery + 641.9187\ xrays$$

The four independent variables explain 92.28% of the variation in maternal survival. We were considered for each independent like a unit change in maternal survival was caused changing by professionals of 116.4912, reduction in maternal survival was caused changing by ambulances of 12,644427, reduction in maternal survival was caused changing by Beds delivery of 4.126387, and a unit change in maternal survival was caused changing by x-rays.

The t-ratio for professionals (3.82) exceeds the critical value but the computed values for ambulances (-1.26), beds delivery (-0.01), and x-rays (1.73)

are not in the rejection region. This indicates that the independent variable professionals should be rejected and the other three accepted.

Table 13. Multiple regression analyses on maternal survival vs health service

/ariables 'egression		**Adjusted r^2**	**F-value**	**Significant**	**Interpretation**	**Decision on H_0**
\nnual maternal ;urvival and health ;ervice delivery		0.9228	27.89	0.0013	Significant effect	Reject
Coefficients		**Beta(β)**	**t-value**	**Significant**	**Interpretation**	**Decision on H_0**
Constant		-16309.37	-1.70	0.149	No significant	Accept
\nnual naternal survival ;nd health service delivery	Professionals	116.4912	3.82	0.012	Significant effect	Reject
	Beds delivery	-12.64427	-1.26	0.265	No significant	Accept
	Ambulances	-4.126387	-0.01	0.991	No significant	Accept
	x-rays	641.9187	1.73	0.144	No Significant	Accept

Source; Compiled by researcher (2012)

The results shows that health service delivery was a good explanatory variable of maternal survival rate (F=27.89, significant=0.0013) leading the reject of the first null hypothesis. It further increasing that α =-16309.37, β =116.4912 , θ =-12.64427, $b = -4.126387$ and θ =641.9187 at 5% level significant.

The study brought out the fact that maternal survival is greatly affected by health service delivery in Banadir Hospitals in Mogadishu, Somalia. The regression results are in conformity with what Roger Leroy (2004) found out that of health service on maternal survival was becoming high strong over time since 2001s.

Table 14: Pearson correlation on health service rate against maternal survival

Level of significant =5%

Variables correlated	**r-value**	**Prob<0.05**	**Interpretation**	**Decision on H_0**
Maternal survival Vs health service delivery.	0.8233	0.0034	Very strong positive significant correlation	Rejected
	Level of significance=10%			
	r-value	Prob<0.10	Interpretation	Decision on H_0
	0.8233	0.0034	Very strong positive significant correlation	Rejected

Source; Compiled by researcher (2012)

Table 15: Regression analysis on health service rate against maternal survival

a) Level of significance=0.05

Variables regressed	**Adjusted R^2**	**F-value**	**P>0.05**	**Interpretation**	**Decision on Ho**
health service rate against maternal survival	0.6375	16.83	0.0034	Significant effect	Rejected
Coefficients	**Beta(β)**	**t-value**	**P>|0.05|**	**Interpretation**	**Decision on Ho**
health service delivery	25.09609	4.10	0.003	Significant effect	Rejected
(constant)	-16004.93	-2.61	0.031	Significant effect	Rejected

Source; Compiled by researcher (2012)

b) Level of significance=0.15

Variables regressed	**Adjusted R^2**	**F-value**	**P>0.15**	**Interpretation**	**Decision on H_0**
health service rate against maternal survival	0.6375	16.83	0.0034	Significant effect	Rejected
Coefficients	**Beta(β)**	**t-value**	**P>|0.15|**	**Interpretation**	**Decision on H_0**
health service delivery	25.09609	4.10	0.003	Significant effect	Rejected
(constant)	-16004.93	-2.61	0.031	Significant effect	Rejected

Source; Compiled by researcher (2012)

The computed Pearson's F-value at 5% and 15% levels of significance is 16.83. Tabulated F-value at 5% and 15% was 5.32, 2.54 respectively. Computed student's t at 5% and 15% is 4.10. Tabulated t-value at 5% and 15% is 1.86, 1.11 respectively. The above information is sufficient to reject the null hypothesis that $\beta_1=0$, and accepting the alternative hypothesis that $\beta_1 \neq 0$ at 0.05 and 0.15 levels of significance. $\beta_{1=}$ 25.09609.

The computed [P =0.0033]< 0.05 thus confirming that health service rate against maternal survival are significantly positive related at 5% and 15% levels of significance; when variables are differenced by percentage technique. Adjusted R^2 = 0.6375 implying that 63.75% of variation in maternal survival is attributed to variation in Health service delivery. Other factors contribute $1-R^2$ =1-0.6375= 0.3525=35.25% on maternal survival rate.

The model below: maternal survival = β_0 + β_1 (Health service delivery) + e_i where e_i is white noise term);

Increase to: maternal survival =-16004.93 +25.09609*(health service delivery); It means that when health service delivery in Mogadishu hospitals Somalia zero, maternal survival rate was -16004.93. Increase in Health service delivery by a unit, leads increasing in maternal survival rate by 25.09609. These variables yield a better linear estimate than otherwise.

Table 15a) Application of Time Series Analysis on study variables

ARIMA [(p, d, q) = (1, 0, 1)] regression

ARIMA regression Number of obs=10

Sample 2001 to 2010 Wald chi2 (**3**) =1.98

Log likelihood = -81.05711 Prob>chi2 = 0.5763

Level of significance =0.05

Maternal survival	Coeff.(beta)	Z	P>|z|	Interpretation	Decision on H_0
Health service delivery	17.39003	1.12	0.264	Insignificant positive	Accepted
Constant	-8237.278	-0.57	0.56	Negative insignificant effect	Accepted
ARIMA					
ar L1	0.6211838	0.60	0.547		
ma L1	0.3678754	0.35	0.728		
Sigma	760.8276	3.74	0.00		

Tabulated Z= 1.64

Non-parametric tests on the relationship between health service delivery and maternal survival

Table 16a. Kendall's tau_b and spearman's rho coefficients

Variables correlated	**Rho and tau-values**	**p-value**	**Interpretation**	**Decision on H_0**
Annual maternal survival and health service delivery	Spearman's rho = 0.8061	0.0049	Significant relationship	Rejected
	Kendall's tau-b=0.6889	0.0073	Significant relationship	Rejected

Number of observation = 10

From table3 above the p-value is less than the Spearman's rho i.e. 0.0049<0.8061. This implies that there is significant relationship between maternal survival and health service delivery in Banadir hospitals Mogadishu, Somalia leading to the reject hypothesis of the null hypothesis.

The table also shows that the p-value is less than the Kendall's tau i.e. 0.0073<0.6889, the null hypothesis is rejected, implying that there is significant relationship between maternal survival and health service delivery in Banadir hospitals Mogadishu, Somalia.

b). Wilcox on Signed Rank Test

Level of significance =0.05 and prob>0.05

Variables related	**Wilcox on signed Rank Test**	**Asymptotic sig(2-tailed)**	**Interpretation**	**Decision on H_0**
Maternal survival Vs health service	Z= 2.803	0.0051	Positive significant	Rejected

Level of significance=10% and prob>0.10

Variables related	**Wilcox on signed Rank Test**	**Asymptotic sig(2-tailed)**	**Interpretation**	**Decision on H_0**
Maternal survival Vs health service	Z= 2.803	0.0051	Positive significant	Rejected

The null hypothesis that coefficient is zero rejected before and after differencing at 95% and 90% confidence intervals. The relationship between health service delivery is positive but significant.

Graph 11: Non parametric analysis: Lowes smoother

Source, compiled by researcher (2012)

The non parametric Lowes smoother suggests a strong a relationship.

CHAPTER FIVE

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary of major findings on each of the stated research objectives. Conclusions and recommendations are given thereafter.

FINDINGS

Trend and level of health service delivery rate over time/years in hospitals Banadir, Mogadishu, Somalia.

The first objective was to determine the trend and level of health service delivery rate of hospitals Banadir Mogadishu, Somalia from 2001 to 2010. Health service data that is published by Banadir hospitals (Somalia) was obtained from internet. Graph of health service delivery rate against time was plotted; and summary statistics computed. The highest (maximum) health service rate was 1098 for the year 2009/10.The lowest (minimum) health service rate was 896 for the year 2001. The range of health service rate for the period is 202. The mean of health service rate is 1001.5; the 50^{th} percentile (median) is 1008 and standard deviation of 68.96899 implying that the health service rate are much greater than zero. The skewness of -.1376084 implies data is negatively skewed and the kurtosis of 1.739357 implies that data has leptokurtic distribution that is the distribution is peaked.

The first hypothesis was that mean of health service delivery is equal to zero (H_{01}: $\mu_1 = 0$). One sample t-test on mean revealed that the mean is greater than zero since computed t=45.9195, as tabulated t= 1.83. Too, computed P=0.0000 which is less than p=0.05, thus mean is significantly greater than zero at 5% level of significance, thus the level of health service delivery is high.

Pearson correlation revealed a very strong -positive significant relationship (r=0.8202, p=0.0037) between health service delivery on time/years. Regressing health service delivery against time/years, Adjusted R^2=0.6319, computed F= 16.45, tabulated F=5.32. Computed t=4.06, tabulated t=1.86 at 5% level of significance; thus, confirming that trend of health service delivery rate is high with respect to time/years as a variable is non random.

Trend and level of maternal survival rate over time/years in hospitals Banadir, Mogadishu, Somalia.

The second objective was to determine the trend and level of maternal survival health service delivery rate of hospitals Banadir Mogadishu, Somalia from 2001 to 2010. Health service data that is published by Millennium Development Goal (2011) publications was obtained by the researcher from internet.

Graph of health service delivery rate against time was plotted; and summary statistics computed. The highest (maximum) maternal survival was 12369 for the year 2009/2010. The lowest (minimum) maternal survival was 6137 in the years of 2001 and 2002. The range of maternal survival for that period is 6232. The mean was 9128.8, the 50^{th} percentile (median) is 9233 and standard deviation 2102.35 implying that the Maternal survival data is greater than zero. The Pearson coefficient of skewness of 0.494381 implies that maternal survival prevalence data is positively skewed. The kurtosis of 1.765783 is greater than zero which implies that the maternal survival data has leptokurtic distribution, that is, the maternal survival data is relatively peaked.

Basing on above statistics, and related graphs, the trend is predictable – maternal survival systematically decreases as time/years increases.

The second hypothesis was that the mean of maternal survival is less or equal to zero (H_{02}: $\mu_2 \leq 0$). One sample t-test revealed that the mean of maternal survival is greater than zero since computed t=13.7312 is greater than tabulated t=1.83. Too, computed P=0.0000 less than 0.05 thus prevalence mean is significantly greater than zero at 5% level of significance. This implies high level of maternal survival in Banadir hospitals, Somalia.

Pearson correlation was not revealed a very strong-positive significant relationship between maternal survival on time (r=0.9875, p=0.0000). Regressing maternal survival against time/years, Adjusted R^2=0.9720, computed F= 313.33, tabulated F=2.32. Computed t=17.70, tabulated t=1.86 at 5% level of significance. Thus trend of maternal survival is predictable and increase with increase in time/years.

Relationship between health service and maternal survival

The third hypothesis was that "there is significant relationship between health service delivery and maternal survival of Mogadishu, Somalia: 2001-2010. Correlation and regression analysis was performed using STATA, Mega stat and SPSS.

Maternal survival is the dependent variable; of particular interest is which independent variable has correlation with maternal survival. In this case it is professional 95.6%. A change in maternal survival is explained 74% by changing Beds delivery, a change in maternal survival is explained 83.4% by changing

Ambulances, and a change in maternal survival is explained 85.7% by changing X-ray.

A second use of the correlation matrix is to check for multicollinearity. Multicollinearity can distort the standard error of estimate and lead to incorrect conclusions regarding which independent variables are significant. The strongest correlation among the independent variables is between Ambulances and x-rays (0.922).

The four independent variables explain 92.28% of the variation in maternal survival. We was considered for each independent like a unit change in maternal survival will cause changing by professionals of 116.4912, reduction in maternal survival will cause changing by ambulances of 12,644427, reduction in maternal survival will cause changing by Beds delivery of 4.126387, and a unit change in maternal survival will cause changing by x-rays.

The t-ratio for professionals (3.82) exceeds the critical value but the computed values for ambulances (-1.26), beds delivery (-0.01), and x-rays (1.73) are not in the rejection region. This indicates that the independent variable professionals should be rejected and the other three accepted.

The researcher carried out time series regression that is Autoregressive Integrated Moving Average -ARIMA (1, 0, 1) on study variables before, for sample 2001 to 2011. Before logging variable, ARIMA (1, 0, 1) found $\beta=17.39003$, $Z=1.12$, $P=0.264$. The relationship was found to be positive and significant at 5% level of significance.

Non parametric tests were also carried out. From correlations, Kendall's tau_b=0.6889 and corresponding P(sig.)= 0.0073. Spearman's rho=0.8061 and corresponding p(sig.)= 0.0049. The coefficients and P-values suggest that null is rejected and that the relationship is a strong positive and significant. Wilcoxon signed Rank test. Prior to logging, Z= 2.803, asymptotic sig(2-tailed)=0.0051. The null hypothesis rejected and relationship positive and significant at 5% and 10% levels of significance.

The computed Pearson's F-value at 5% and 15% levels of significance is 16.83. Tabulated F-value at 5% and 15% was 5.32, 2.54 respectively. Computed student's t at 5% and 15% is 4.10. Tabulated t-value at 5% and 15% is 1.86, 1.11 respectively. The above information is sufficient to reject the null hypothesis that $\beta_1=0$, and accepting the alternative hypothesis that $\beta_1 \neq 0$ at 0.05 and 0.15 levels of significance. $\beta_{1=}$ 25.09609. The computed P is 0.0033 < 0.05 thus confirming that health service rate against maternal survival are significantly positive related at 5% and 15% levels of significance; when variables are differenced by logging technique. Adjusted R^2 = 0.6375 implying that 63.75% of variation in maternal survival is attributed to variation in Health service delivery. Other factors contribute $1-R^2$ =1-0.6375= 0.3525=35.25% on maternal survival rate.

The model below: maternal survival = $\beta_0 + \beta_1$ (Health service delivery) + e_i where e_i is white noise term);

Increasing: maternal survival =-16004.93 +25.09609*(health service delivery);It means that when health service delivery in Mogadishu hospitals Somalia zero, maternal survival rate was -16004.93.Increase in Health service delivery by a unit,

leads increasing in maternal survival rate by 25.09609. This variable yields a better linear estimate than otherwise.

Basing on above findings, the researcher holds that health service delivery of Somalia for a given year for years 2001-2010 increasing by (3% to 15%) due to maternal survival.

Conclusions

The health care system experienced several milestones that brought opportunities to strengthen the system and improve the health status of the population. However, these opportunities were wasted and many insurmountable challenges paralyzed the health care system. The current HIV/AIDS epidemic could exacerbate these challenges. Therefore, provision of health care services should address and redress the critical challenges and ensure access to basic health care services to the majority of the population, while giving high priority to vulnerable groups. This entails sound planning and policies from the government, based on rational judgment and empirical evidence, as well as contributions from the consumers and community through cost sharing and resource mobilization. The health care system should also adopt innovative financing mechanisms, decentralization of resources and decisions, and sound management and strong stewardship from the central government through continuous support, guidance, and monitoring and evaluation of health care system performances.

In Somalia, now under foreign military occupation and a new phase of bloody civil strife, the health concerns of the population may have to wait until the invading Ethiopian forces leave and a new legitimate order is born. In short, to get

back to the great challenges of public health, it seems that Somalia will have to get the politics right first.

In Banadir Hospitals Somalia, the number of maternal survival is high. This study has attempted to come up with the result of conclusion; many factors contribute to this phenomenon. Among these factors, reduction of under-five mortality, delay age at first birth, correct awareness (knowledge) on the desired number of children before marriage and need additional children were the most contributing factors in reducing high fertility. Among the factors considered in this childhood mortality by far stands as a powerful predictor of fertility. Measures taken to decrease childhood mortality will indirectly help in reducing fertility. Such measures would give impulse to fertility controlling programmes and hence should be further strengthened.

Recommendations

Based on the findings of the study, the following recommendations are made:

Enhancement and training with Somalis health sector have to skill with health personality.

Government of Somalia should encourage to the hospital according all requirement through minster of health.

Central Banks of Somali reduce at least to 10% to encourage the investment like supply of Banadir hospitals.

Banadir Hospital

Ministry of Health
Mogadishu-Somalia

مستشفى بنادر

وزارة الصحة
مقديشو- صوماليه

TO WHOM IT MAY CONCERN

Banadir Hospital administration is delighted to share with you that we allowed Ismail Nur Haji Hassan with registration number MST|35707|113|DF, the Information which he has requested the hospital in the form of questionnaire and interview guide under title of **Health Service Delivery and Maternal Survival at Banadir Hospitals for 2001 – 2010 in Mogadishu, Somalia.** We have given him this information after he has brought us a request letter from Kampala International University. We hope success to him and the University entirely.

Yours sincerely

Deputy Director of Banadir Hospital
Dr. Lul Mohamed Mohamed

Website: www.banadirhospital.com Email: Info@banadirhospital.com
Contacts: +252-62270345 Or +252-62290118

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OFFICE OF THE HEAD OF DEPARTMENT, ECONOMICS AND MANAGEMENT SCIENCES
COLLEGE OF HIGHER DEGREES AND RESEARCH (CHDR)

Date: 09th July, 2012

RE: REQUEST OF ISMAIL NUR HAJI HASSAN MSTAT/35707/113/DF TO CONDUCT RESEARCH IN YOUR ORGANIZATION

The above mentioned is a bonafide student of Kampala International University pursuing Masters of Science in Statistics.

He is currently conducting a research entitled " **Health Service Delivery and Maternal Survival at Banadir Hospitals for 2001-2010 in Mogadishu, Somalia."**

Your organization has been identified as a valuable source of information pertaining to his research project. The purpose of this letter is to request you to avail him with the pertinent information he may need.

Any information shared with him from your organization shall be treated with utmost confidentiality.

Any assistance rendered to him will be highly appreciated.

Yours truly,

Mr. Malinga Ramadhan
Head of Department,
Economics and Management Sciences, (CHDR)
PP.
NOTED BY:
Dr. Sofia Sol T. Gaite
Principal-CHDR

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APPENDIX I

CLEARANCE FROM ETHICS COMMITTEE

Date_____

Candidate's Data

Name: Ismail Nur Haji

Reg.# MST|35707|113|DF

Course: Master Science in Statistics

Title of Study: **Health Service Delivery and Maternal Survival at Banadir Hospitals for**

2001-2010 in Mogadishu, Somalia

Ethical Review Checklist

The study reviewed considered the following:

___ Physical Safety of Human Subjects

___ Psychological Safety

___ Emotional Security

___ Privacy

___ Written Request for Author of Standardized Instrument

___ Coding of Questionnaires/Anonymity/Confidentiality

___ Permission to Conduct the Study

___ Informed Consent

___ Citations/Authors Recognized

Results of Ethical Review

___ Approved

___ Conditional (to provide the Ethics Committee with corrections)

___ Disapproved/ Resubmit Proposal

Ethics Committee (Name and Signature)

Chairperson _____

Member's _____

APPENDIXII

TRANSMITTAL LETTER FOR THE RESPONDENTS

Dear Sir/ Madam,

Greetings!

I am candidate for Master of Economics and Applied Statistics at Kampala International University. Part of the requirements for the award is a dissertation. My study is entitled, **Health Service Delivery and Maternal Survival at Banadir Hospitals for 2000 - 2011 in Mogadishu, Somalia.** Within this context, may I request you to participate in this study by answering the questionnaires? Kindly do not leave any option unanswered. Any data you will provide shall be for academic purposes only and no information of such kind shall be disclosed to others.

May I retrieve the questionnaire within five days (5)?

Thank you very much in advance.

Yours faithfully,

Mr. Ismail Nur Haji Hassan

APPENDIX III

RESEARCH INSTRUMENT

STATISTICAL DATA RECORD SHEET

HEALTH SERVICE DELIVERY DATA:2001-2010

No.	Professionals				Assets			Total
years	Doctors	Midwives	Nurses	Others	Beds delivery	Ambulances	x-rays	
2001								
2002								
2003								
2004								
2005								
2006								
2007								
2008								
2009								
2010								

APPENDIX V

MATERNAL SURVIVAL DATA: 2001-2010

Calculations of product limit estimate of life table of stage maternal survival

Time years t_j	living at start of year n_j	Died d_j	Estimated probability of death q_{tj}	Estimated probability of survival P_{tj}	No. of survival at end of year L_{tj}
2001					
2002					
2003					
2004					
2005					
2006					
2007					
2008					
2009					
2010					

APPENDIX VI

CORRELATION AND REGRESSION ANALYSIS TABLES

Pearson Correlation

Variables correlated	r-value	Sig	Interpretation	Decision on H_0

Kendall's tau_b and spearman's rho coefficients

Variables regressed	Correlation coefficients	p-values	Decision on H_0
	Rho=		
	tau_b =		

Regression table

Variables regressed	Adjusted R^2	F-value	Prob>F	Interpretation	Decision on Ho
Coefficients	Beta(β)	t-value	P>|t|	Interpretation	Decision on Ho
(constant)					

ARIMA [(p, d, q) regression analysis.

Sample 1990 to 2011 Wald chi2 (3)=

iables regressed	(beta)	Z	p-value	Interpretation	Decision on Ho
efficients					
nstant					
IMA					
L1					
L1					
ma					

Log likelihood = Prob>chi2=

APPENDIX VII

PROPOSED BUDGET

No	Item	Unit cost	Units	Total
1	Travel costs			$100.0
2	Stationary	$5	3.00	$15.0
3	Secretarial service			$50.0
4	Communication	$4	800 minutes	$150.0
5	Contingency			$200.0
Total				$515.0

RESEARCHER'S CURRICULUM VITAE

CURRICULUM VITA

Ismail Nur Haji Hassan

Contact: Kampala, Uganda

Mobile: +25679320958

E-mail: ismaciil-stata@hotmail.com

Personal information

Name : Ismail Nur Haji Hassan

Nationality : Somali

Gender : male

Marital Status : Married

Residence : Mogadishu-Somalia

Cell number : +252615806421

Professional Qualification

Year	Institution	Award/Qualification
2012-2013	Kampala International University	Master of Science in Statistics
2008-2009	Mogadishu University	Bachelor of Education

Academic Qualification

Year	***Instituation***	***Award/Qualification***
2001-2004	Khadija Secondary School	Secondary Leaving Certificate

Experience

Year	**Institution /Organization**	**Title/Objective**
2004-2011	Khadija Secondary School, Mogadishu	Math
2009-2011	Ablal Secondary School, Mogadishu	Math

Seminars Attended

- 10 October 2004: Training course for primary teachers, held at Simad Mogadishu, Somalia.
- 10 July 2009: Training courses for secondary teachers, held at Mogadishu University Mogadishu, Somalia.
- 18 Jun 2012: Monitoring and Evaluation Course, held at Makerere University.
- 12 Sep 2012: sample survey analyze course, held at Kampala International University.

Skills

- Good knowledge of research methodology
- Good computer skills (word, excel, access, power point, internet, SPSS, STATA, Mega stat, PHStat and Epi Info.
- Database manager
- Programmer

Language proficiency

• Somali	Native
• Arabic	Excellent
• English	Good

Hobbies

- Teamwork
- Reading and writing
- leadership