Somaliland Women of Reproductive Age Mortality Survey 2014

Analytical report on Cause-specific maternal mortality

Table of Contents

Acknowledgment

Abbreviation List

CIN: Community Informant Network

DARS: Data and Research Solutions

JIN: Joint Informants Network

HIV/AIDS: Human immunodeficiency virus/acquired immunodeficiency syndrome

IRI: International Republican Institute

LAU: Lowest Administrative Unit

MADE-IN: Maternal Deaths from Informants

MADE-FOR: Maternal Deaths Follow on Review

MICS: Multiple indicator cluster survey

MIMIF: MADE-IN/MADE-FOR

MOH: Ministry of Health

MDG: Millennium Development Goal

MMR: Maternal mortality ratio

MMRate: Maternal mortality rate

PIN: Providers Informant network (Health)

PMDF: Proportion maternal among deaths of females of reproductive age

PPP: Purchasing power parity

UNAIDS: Joint United Nations Program on HIV/AIDS

UNFPA: United Nations Population Fund

UNICEF: United Nations Children's Fund

UNPD: United Nations Population Division

VA: Verbal Autopsy

WHO: World Health Organization

WRA: Women of reproductive age

Executive Summary

The UN inter agency group estimated the maternal mortality ratio for Somalia in 2013 at 850 per 100,000 live births, which is among the highest in the World and the last estimate for Somaliland for the period 1994-1996 was reported to be at 955 per 100 000. In Somaliland, as in many low income countries, the majority of deaths occur outside the health facilities, and there is no functioning civil registration system, and therefore, nearly all deaths are not medically certified and the causes of death are not ascertained.

The main objective of this survey is to collect reliable information on causes of death among women of reproductive age (15-54), with an emphasis on maternal-related causes, and to provide evidence for health policy, planning, monitoring and evaluation.

The study employed two data collection approaches or phases: Phase 1: all deaths to women of reproductive age that occurred during the last two years from the survey date in the selected clusters (communities) were identified through two independent networks (community informant and health providers informant). All deaths identified by any of the group, were followed by a WHO verbal autopsy standard questionnaire that was administered to a close relative of the deceased woman (phase 2).

An urban-rural stratified cluster sample technique was used to select 25% of the 1804 clusters or the lowest administrative units from the 6 regions, with 60% rural clusters. Out of the 498 selected clusters, deaths of women of reproductive age were identified in 409 (82%) clusters. Both networks identified half of the deaths, and the community informants identified 43%. Among the 1269 deaths 59.7% were ono-pregnancy related, of all identified deaths, 1,076 were successfully followed-up with the Verbal Autopsy questionnaire

One-third of the deaths among women age 15-49 are due to maternal with Obstetric haemorrhage the leading cause of maternal-related deaths (12.1%) followed by Pregnancy-induced hypertension (9.1%). Obstetric haemorrhage is disproportionately higher among women age 25-34 years.

Maternal death is as twice as high in rural areas than urban (40.6% vs 20.7%), and this ratio remain unchanged for the cause-specific. The majority of deaths took place outside the health facilities and those who live 2 or more hours away from the nearest health facility.

Introduction

Geographical Information:

Somaliland lies between the latitudes of 8' North and 11' 27'' North; and the longitudes of 42 35' and 49 East. In the relative location, Somaliland borders with the Red Sea in the North, Ethiopia in the South, Djibouti in the West; and (Southern) Somalia in the East (as in Figure 1). Somaliland, the home of 3.9 million persons[1], is a former British colony, which united with the Italian colony of (Southern) Somalia to form the independent Republic of Somalia in 1960.

Figure 1 Somaliland

Governance:

When the Republic of Somalia disintegrated in 1991 Somaliland declared its separation[2] from (Southern) Somalia unilaterally. Although, Somaliland experienced some internal armed conflicts during 1990s, it was relatively peaceful, and has moved toward political and economic recovery and development.

The first governance system was established by a consensus of clan-based electoral colleges in grass root based reconciliation conferences (Shirweyne in Somali) during 1991, 1993, and 1997, which has been developed into a democratic system of governance to be compatible with the demands of modernity. However, both the international community and (Southern) Somalia recognized Somaliland as part of Somalia, at least in diplomatic de jure, but also as a de facto separate entity with a number of countries having established chancellor offices in Hargeisa[3], the capital of Somaliland.

The contemporary Somaliland National Development Plan, 2012-2016, which was prepared through a participatory planning process, is the current development guiding document.

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[1] Somaliland In Figures, 2012:
http://siteresources.worldbank.org/SOMALIAEXTN/Resources/Somaliland_in_Figures.pdf
[2] Difference terms were used for this decision, including independence and cessation
[3] Neighboring Ethiopia, Djibouti, and Yemen have chancellor offices in Hargeisa, the capital of Somaliland.

According to the Somaliland 2011 Polling Survey, which was conducted by IRI[4] and DARS[5], 57% of the households live under US$1 per person per day and 25% of the active age populations who are willing to work are unemployed.

Health Sector Development:

The Essential Package of Health Services (EPHS) constitutes a fundamental outline and framework for the organization of the Somali health care delivery system. It is founded on a standardized package of health services, comprising of six core and four additional programmes that need to be delivered in the four health care provision levels. The health workers, the essential drugs and technologies necessary for implementing the EPHS programmatic interventions were also standardized. The provision of effective service delivery is facing many challenges such as inadequate access and underutilization of available services; poor regional and district leadership skills and managerial capacities; insufficient capacities and resources for supervision, monitoring and evaluation; fragmented multi-stakeholder service delivery with weak mechanisms for coordination and the lack of linkages between the private health sector performance and the public sector EPHS. Moreover, the local communities are not sufficiently empowered to make healthy decisions and actively participate in improving their health status, while cultural and economic factors also contribute to decrease utilization of available health services.

According to MICS 2011[6] , overall, only 44 percent of young women aged 15-24 years are literate. Among women living in the poorest households, the literacy rate is as low as 14 percent. In contrast, the literacy rate is 65 percent among women in the richest households. The effect of poverty/ social economic status on access to education is clearly enormous.

The percentage of women age 20-49 years who were first married before age 18 is 31 percent. Differences by wealth quintiles exist; 41 percent of women from the poorest households were married before age 18, while 18 percent from the richest households were married at this age.

Figure 2: Literacy rate, young women age 15-24 years, by wealth quintiles, Somaliland, 2011
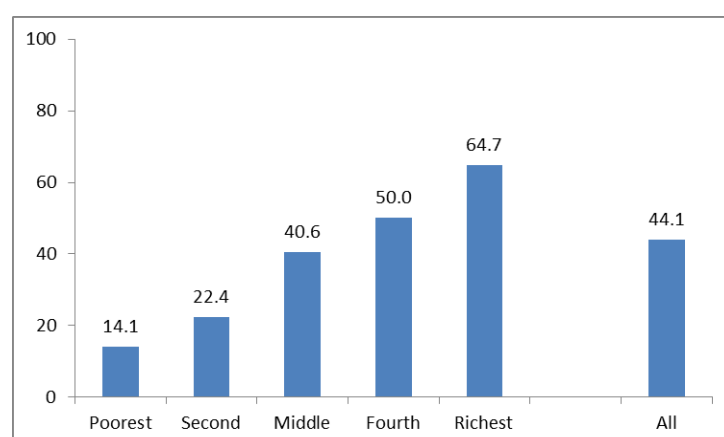
Source: Somaliland MICS, 2011

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[4] International republican Institute, a Washington based international non-governmental organization
[5] Data and Research Solutions, a development and research consultancy firm
[6] http://www.unicef.org/somalia/SOM_resources_somalilandmics4_finalreport.pdf

About thirty two percent of women age 15-49 years with a live birth in the two years preceding the survey received antenatal care (ANC) at least once by skilled personnel. Forty-four percent were attended by a doctor, nurse, midwife or auxiliary midwife at delivery and 31 percent delivered in a health facility.

Figure 3: Delivery care, Somaliland, 2011
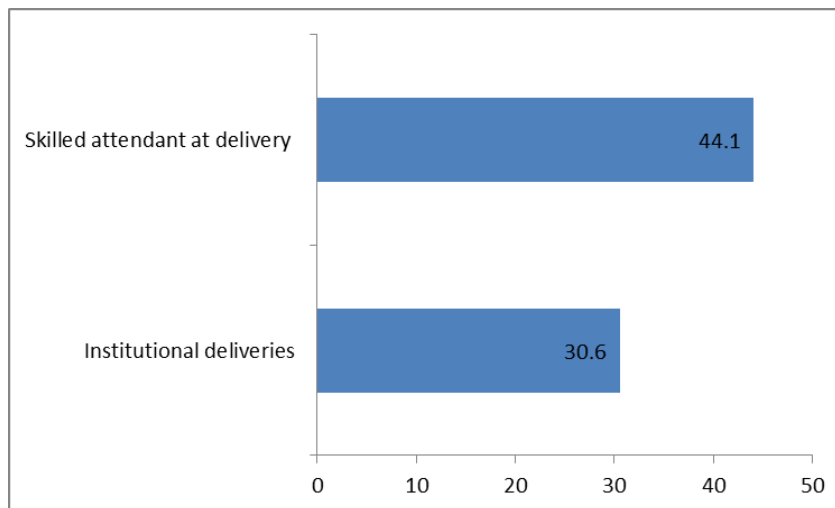
Source: Somaliland MICS 2011

Only 10 percent of married women age 15-49 years uses a contraceptive method. The unmet need for contraception (for either spacing or liming births), is 20 percent. In addition, about 27 percent of children have received BCG[6] vaccination, 11 percent have received three doses of DPT[6] and 17 percent have received three doses of polio vaccine by their first birthday. Only about a quarter are immunized against measles by the time they are one year old. There is a strong need to improve the access and utilization of essential health service.

The rural populations of Somalia have low health seeking behaviours. Rural populations tend to resort to prayer or use of traditional approaches and remedies and consume fewer modern health services. Their patterns of consumption are determined by their locations (proximity to town, roads, public or private services). Urban populations also show high use of private services, both pharmacies and clinical, despite access to public services. The fact that urban populations choose to access the private sector when both are available, suggests preference for and higher trust and convenience of private services. Pastoral communities have the lowest overall use of modern health services and the lowest use of public health services. They also have the highest proportional use of private services, such as the purchase of medicines from private pharmacies. There is very little information on use of health posts, however, most evidence indicates that HPs are not valued by consumers and they do not generally use them.

Overall, most health seeking responses are based on the traditional knowledge, beliefs and the perceived causes of the specific illnesses. Across all livelihood zones, these responses tend to follow a generalized pattern of: Prayer->Traditional home health practice->Traditional healer->Buy Medicine->Get Sheikh to pray-> Health facility. Apart from cultural

factors impinging on demand (lack of previous exposure, lack of knowledge about health services, gender roles and decisional power), the low number of facilities and charging of fees at point of service also has a major impact on accessing health services and when services are accessed. Data reviewed for safe motherhood programmes etc. indicates that cost and distance (transport cost) to health facilities is a major barrier to use. The low numbers of people actually using child and maternal health services shows many crisis cases and indicates people come late and only when the risks of death or serious negative outcomes is very high and when all other options have be tried.

The human resource for health (HRH) crisis is of a highly significant magnitude, ranking among the worst in the world. Considering the global thresholds set by WHO for the collective density of doctors, qualified nurses and qualified midwives of 23 per 10,000 population, representing the minimum coverage level, necessary to support the realization of Universal Health Coverage (UHC) alongside the attainment of the health related MDGs, the score ranges between 3 and 4 per 10,000 population - six to seven times lower than the minimum threshold indicated by WHO, posing a real challenge for expanding the coverage of health services, particularly to the rural areas. The salient human resource challenges of the health sector include shortage in the training and production of qualified health workers; the difficulty to realize the desirable workforce skill mix; the lack of uniform standards for workforce training curricula, educational programmes, certification and accreditation systems; inadequate teaching facilities; low and ineffectively harmonized salaries and incentives and poor working environments that have a major bearing on the quality of services delivery, performance, motivation and retention of the health workforce.

The post conflict legacy has posed important challenges to health system governance, from inadequacies in health system infrastructure; weak institutional capacities and lack of explicit strategies for public health sector accountability; inequity in the delivery of health services; lack of inter-sectoral approach for health; weak operational decentralization of health system management and poor regulation of health professions education and absence of standard mechanisms for accreditation, registration, licensing and performance management based on clear job descriptions.

The EPHS has contributed to standardization of medicines supplied to the different levels of care provision, with treatment guidelines available for some of the core programmatic interventions. Although efforts to revitalize the pharmaceutical system were recently initiated by the health authorities, yet the challenges being faced are characterized by a lack of effectively functioning drug quality control laboratories and medicines regulation and control.

The HMIS data is generated through the analysis of the routinely collected information from the outpatient departments of public health facilities, including hospitals. The data is complemented by the information generated from key vertical programmes and through the disease surveillance system. Frequently cited challenges include limited data base and the inadequate capacity for the timely collection of health data, reporting, analysis, dissemination for evidence based decision making and use of information for planning and implementation.

The health sector's under-funded budgetary outlays are severely inadequate for covering the basic health services. The earmarked resources for the health sector are less than 6% of the government budget, which are significantly short of covering the essential health needs of the population. This evident resource gap in the health sector is partly bridged through the generous contributions provided by the international health partners and through the private health sector services in urban settings and the diverse non-for-profit organizations offering a reasonable range of services to the population. The challenges of health financing exacerbate the inequitable access to available essential health services.

Maternal Mortality in Somaliland:

In the 2012 Somaliland Polling Survey conducted by IRI and DARS, respondent identified maternal health improvement as a priority within the health sector, with 40% of the respondents identifying maternal health improvement as the first priority[7] .

The public perception is consistent with the reality, since the Somaliland Maternal Mortality Ratio was estimated to be 955 deaths per[8] 100,000 live births in 2011[9]. Earlier, indirect estimate for 1994–1996 the figure was 1044; Somaliland 2010 Millennium Development Goals (MDG) Report puts it at 950. And WHO estimate for Somalia 2013 the figure was 850.

The estimated maternal mortality ranks Somaliland as having the world's 5th highest level of maternal mortality[10]. Based on the estimated 131,000 annual births in Somaliland and this level of maternal mortality ratio, approximately 1,300 maternal deaths occur in Somaliland annually, which is equivalent to 25 maternal deaths per week, 4 maternal deaths per day, and one maternal death in every 6 hours.

In Somaliland, as in many low income countries, the majority of deaths occur outside health facilities. There is no functioning civil registration system. Most deaths are therefore neither notified nor medically certified and the causes of death are not ascertained.

Options for measuring maternal mortality

In 2011, DFID-Somalia commissioned Immpact at the University of Aberdeen to assess the feasibility of measuring maternal mortality in Somaliland. An Immpact consultant conducted a feasibility study in Somaliland concluding that the Immpact methodology of MADE-IN MADE-FOR (MIMF)to measure maternal mortality could be used.

In Somaliland, as for many other developing countries, vital registration systems are inadequate for obtaining accurate and reliable health-related data. The vital registration system in Somaliland is non-existent or poorly maintained. Where they do exist, the causes of deaths related to pregnancy, childbirth and the puerperium are often poorly recorded. In these circumstances, different approaches have been used to measure levels and causes of

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[7] Somaliland Polling Survey, IRI and DARS, June 2012

[8] This figure is based on the data of whole Somali as per 2006 MICS

[9] Diriye, Ahmed; Somaliland Ministry of National Planning, Somaliland 2010 MDG Report.

[10] http://www.nationmaster.com/graph/hea_mat_mor-health-maternal-mortality

mortality. The problems with most of the commonly used methods are outlined in the World Health Organization (WHO) publication Maternal Mortality in 2000 (WHO, 2004a) and include cost, requirement for large sample sizes and undercounting. Large-scale surveys, in particular, are often used as a way of gaining reliable data, and modules to measure maternal mortality have often been added to other major health surveys such as the Demographic and Health Surveys (DHSs) (Stanton et al, 1997) or censuses (Stanton et al, 2001). These surveys, however, are not always an 'easy' solution: they usually only take place every five to ten years, are costly to implement, and do not permit useful estimates to be made at sub-national levels.

The MIMF was selected as the method of choice to obtain a maternal mortality estimate in Somaliland after a series of detailed consultation with stakeholders in 2011-12. A number of technical and policy meetings were held in Nairobi to discuss various options for estimating the level of maternal mortality. Registration of births and deaths in Somaliland was not thought to be reliable and up to date census data were not available. There was a desire to supplement global estimates with primary data collection that would give a relatively current estimate. The possibility of conducting population based household surveys and reproductive age mortality surveys were discussed but were felt to be too costly. Opportunities were looked for to work alongside other surveys which could include a maternal mortality assessment but none were found. Two relatively low cost options to measure maternal mortality were discussed. 'Sampling at service sites (SSS)' involved interviewing women about the deaths of their sisters at locations where representative groups of women usually congregate (such as market places or health facilities). Local knowledge of Somaliland indicated that this was not a suitable approach to take and that samples were likely not to be a random community sample. MIMF was thought to be a more feasible option. This was established after a field visits to Hargesia and Garowe in October 2011 and subsequent consultation meetings in Nairobi in September 2012. MIMF was assessed as having cultural and systems suitability in Somaliland and had potential to collect reliable data.

Then MIMF is a low-cost approach to recording and analyzing maternal deaths at the community level. It reduces the financial and logistical overheads of carrying out a major survey by involving the community in identifying maternal deaths. In its implementation in Indonesia, for example, as compared to DHS survey, the costs are reduced by a factor of 10-100. For the DHS, the cost exceeding US$150 per household interview, implying US$12 or more per women year of exposure, while MIMF only cost US$0.1 per woman-year of exposure. This is not only very important for ensuring accurate data but also, and perhaps even more importantly, it raises community awareness of maternal health issues and acts as an advocacy tool. MIMF potentially allows the recording of *all* maternal deaths in a defined area, enabling more precise estimates of maternal mortality in relatively small populations. The method also includes important steps to verify reported information on mortality. Through a collective process, village informants discuss death listings together with other informants from the same area, and results are verified through follow-up visits. By involving several people in recording deaths, the accuracy of the information collected is improved and thus provides a more comprehensive picture of the determinants of maternal mortality.

The key limitations in MIMF include:

- Reliance on informants' memories and knowledge to record deaths in the community and the memory of the family in describing the circumstances of a death. We limited the bias by restricting the recall period to two years (Dr Ali please confirm)
- The method has not been extensively validated and has been implemented only in a few settings.
- Estimates of uncertainty cannot be generated.
- As with other methods of collecting data on maternal mortality, undercounting of deaths is likely. Under-reporting is a particular concern for early pregnancy deaths and for deaths from indirect causes, while direct causes of maternal deaths may be over-reported.
- The verbal autopsy component also has its limitations. Causes of death obtained from lay informers are not always in accord with those obtained from death certificates. (see references below)

Objectives of the study:

It is recognized that there is a significant information gap on Maternal and Child Health (MCH) indicators in Somaliland. According to the Multiple Indicator Cluster Survey, Round 3 (MICS-3), Somalia is estimated to have one of the highest maternal mortality ratios (1,044 - 1,400 deaths per 100,000 live births). However, these estimates need to be used with caution as MICS methodology is not specifically designed to capture maternal mortality (MM) estimates for relatively smaller countries like Somaliland. MM measures have been excluded from the current round of MICS-4 in Somaliland, conducted in 2011.

The main objective of this survey is to:

1. Collect reliable information on causes of death among women of reproductive age (15-54 years of age), with an emphasis on maternal-related causes,
2. Provide evidence for health policy, planning, monitoring and evaluation.

Preparations for the study

Upon approval of funds from DFID, preparatory activities and consultative meetings were conducted to inform stakeholders in Somaliland about the study and the new methodology and to get support and inputs.

During those consultative meetings it was agreed that the World Health Organization (WHO), to lead the study due to its expertise on the subject matter and its extensive experience and network in Somaliland/Somalia. During a consultation meeting with all partners in Nairobi in July 2013, the methodology was reviewed and amendments introduced to expand the data collection on all cause-of-death in addition to pregnancy-related deaths for all women of reproductive age, and follow up visit using the WHO verbal autopsy standard.

A plan was designed to allow Immpact and WHO consultants to provide guidance and inputs at key points in the study in Nairobi. This was necessary due to the lack of clearance from the University of Aberdeen (the institution through which Immpact works) to travel to Somaliland. The activity plan had six main activities, which were:

1. Finalize management set up
2. Formative research
3. Field team selection and training
4. Roll-out of the survey
5. Data entry and analysis
6. Dissemination and report writing

Finalization of management set up: This is to form the two research committees (steering and technical) and to develop the terms of reference for each committee. This activity was led by the MOH.

Formative research: This included the adaptation and translation of instruments and protocol, followed by pre-testing of the instruments; determining the study denominator data and its source; the finalization of the training protocol tools and designing of the dataset by database expert from WHO-EMRO in Cairo.

Cascade training has been conducted starting with training of trainers in Nairobi. Five persons from the MOH and DARS (the research institute selected to do the field-work) were trained by researchers from Immpact during this stage.

Field team selection and training: The trained personnel then trained the district coordinators (DCs) on collection of data from village informant meetings. The district coordinators will then train the community team members to collect the data through meetings with village informants. In consultation with Ministry of Health, DARS recruited data collectors from the regional level instead of the district level, and to increase data accuracy, educated and experienced data collectors were provided with adequate training and practice to administer the Verbal Autopsy.

Translation of the Study Tools: DARS translated the study tools, including questionnaires, study protocols; manuals and guides into Somali language. DARS' policies on translations are that all translations are reverse-translated into the original language by independent translators that have not been involved in the first translation to increase the accuracy of the translation. Due to the nature of this study—with medical and healthcare nomenclature—it was deemed that a consultation and validation workshop was necessary during which a number of healthcare professionals were invited to review the tools and to ensure the proper translation of the tools. Changes were made where required. The review also took into account local context and regional dialects.

Study Ethical Clearance: the study tools—the original and the translated versions—were submitted to the Health Research Ethical Clearance Committee of the ministry of health. The committee studied the tools and study protocol and got back to DARS for clarification of

several points; following the clarification the committee issued an Ethical clearance letter (ref:04/2013—see the appendix).

Study design

At the beginning of the study, adaptation and translation of instruments and pre-testing of the instruments was conducted. The study employed two data collection phases: Phase 1: all deaths of women of reproductive age that occurred during the last two years from the survey date in the selected clusters (communities) were identified through two independent networks (community informants and health provider informants). Phase 2: all deaths identified by any of the two groups, were followed-up using a verbal autopsy questionnaire that was administered to a close relative of the deceased woman.

Phase 1:
Data Collection:

Data collection was based on the MADE-IN approach which uses a questionnaire completed by community informants with a data collector during a meeting, listing deaths of women of reproductive age within their communities in the specified period, whether pregnancy-related, and giving contact details of a relative.[11] The method is a low-cost approach to identify deaths at the community level and it reduces the financial and logistical overheads of carrying out a major survey by bringing the community together at a meeting to identify maternal and other non-maternal deaths. Through a collective process, village informants discuss death listings together with other informants from the same area. By involving several people in recording deaths, the accuracy of the information collected is improved.

Since MADE-IN relies on the memory of community informants to record deaths, and that of family members to give details on the circumstances of the death, recall periods are kept as short as possible. For the same reason, each informant was responsible for collecting data in a small area that they can be expected to know really well. Where there are suitable networks of informants available, this approach can be used for estimating total coverage of all deaths in a community. Only deaths in the previous two years before the study were recorded.

Pilot testing:
To commence the study in Somaliland, pilot studies were first conducted to establish the most suitable network(s) of informants which comprised two informant networks in all sample villages in Somaliland. The two informant networks were:
  1) Community informant network (CIN)
  2) (Health services) Provider informant network (PIN)

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[11] Qomariyah SN et al An option for measuring maternal mortality in developing countries: a survey using community informants *BMC Pregnancy and Childbirth* 2010, **10**:74

Methodology:

Data on deaths of women of reproductive age was gathered through focus group discussions (FGD). In each selected lowest administrative unit (LAU) three FGDs were conducted, one FGD for the community informants network (CIN), one in the health provider informant network (PIN), and a final FGD with the joint network informants (JIN). These FGDs were facilitated by the trained community mobilization team members.

Each death identified by any of the networks in the MADE-IN phase was followed up with a visit to the family of the deceased women to conduct an in-depth interview.

Phase 2:

Data Collection:

In settings where the majority of deaths occur at home and where civil registration systems do not function, there is little chance that deaths occurring away from health facilities will be recorded and certified as to the cause or causes of death. In most instances institutional deaths were not notified or the cause of death is not properly recorded. To collect data on causes of death, therefore, Verbal Autopsy (VA) tools have become a reliable alternative method for collecting information on causes of death in populations lacking vital registration and medical certification.

The VA has become an essential public health tool for obtaining a reasonable direct estimation of the cause structure of mortality at a community or population level, although it may not be an accurate method for attributing causes of death at the individual level. Verbal autopsy is a method used to ascertain the cause of a death based on an interview with next of kin or other caregivers of the deceased. This is done using a standardized questionnaire that elicits information on signs, symptoms, medical history and circumstances preceding death. The cause of death, or the sequence of causes that led to death, are assigned based on the data collected by using the WHO standardized verbal autopsy questionnaire.

Rules and guidelines, algorithms or computer programs may be used to assist in interpreting the VA information to determine the cause of death. The main objective of VA is to describe the causes of death at the community level or population level where civil registration and death certification systems are weak and where most people die at home, without having had contact with the health system.

Sampling Frame

The primary sampling units were the lowest administrative units (LAUs). 25% of LUAs (451) out 1804 from the 23 districts of the 6 regions were randomly selected with probability proportion to population size. The sample size of 25% was based on resources constrains and it seems reasonable in such settings.

The sampling frame of the LAUs was based on the UNDP 2006 settlement survey, and the Ministry of Planning's 2011 enumeration area list compiled by the Data and Research Solutions (DARS). This was the only available sampling frame and several challenges were encountered in the development of the frame. First, the UN organizations working in Somalia including Somaliland used the administrative units of the Somalia Government before 1991, in which Somaliland comprised of 5 regions and 18 districts. However, 6 administrative regions and 23 districts is used by the Somaliland Ministry of Planning and approved by the Somaliland House of Representatives. To add to the complexity, 13 regions and 81 districts are defined by the Ministry of Interior, which governs the regions and districts. A new plan to have 7 regions and 57 districts is yet to be approved by the Parliament as per Somaliland law, where there is no border demarcation. A further complication is that these lists were compiled in different time periods. Therefore, changes to the number of LAUs were expected. Notwithstanding these limitations, this study used the 6 districts and the 23 regions approved by the Parliament, where there are demarcated borders recognized by the Government including the Ministry of Planning.

In this study the following definitions were used:

URBAN: All households living in the headquarters of the 23 districts approved by the Somaliland House of Representatives as per the regional and districts law.

RURAL: All households living in a place called home, at least for six months in a year, unless there is a circumstance that forces them to move temporarily to another place.

NOMAD: All households roaming with their livestock seeking for grazing and water, who don't have a place called home to live at least for six months in a year.

Sample selection

A stratified cluster sample technique was used, which allocated 40% of the sample clusters to urban areas. LAUs are wards in urban areas and villages in rural areas. All six regions were covered and two administrative districts (out of four) from each region were randomly selected. However, since the districts have different numbers of LAUs; 50% of the LAUs of the selected 12 districts became 537 LAUs, which is more than the originally planned sample of 451 LAUs. The additional 86 LAUs could mitigate loss of sample size due to inaccessibility and non-response'

Finally, DARS dispatched its researchers to the selected 12 districts to update the sample frame by meeting with the district's mayors prior to the survey. The mayors removed some LAUs from the lists, including abandoned villages and villages which belonged to other district, or added some more LAUs, specifically in urban areas where some sub-districts were further divided into two or more sub-districts by the local governments after the sample frame was generated.

As a result, 39 LAUs were excluded and the final sample was 498 LAUs; which were selected using the following selection procedure. Each of the urban centers of the selected 12 districts were divided into four quadrants (NE, SE, NW, and SW) by using the administrative borders of the urban sub-districts (Xaafadaha in Somali); and two quadrants were selected randomly. Then, all the wards (Laan in Somali) of the selected xaafadaha were covered.

Similarly, the rural settlements (villages and permanent agro-pastoralist settlements) of each of the selected 12 districts were divided into four quadrants based on their direction from the district headquarter (NE, SE, NW, and SW); and two quadrants were selected randomly; where the sample covered all the rural settlements in the selected quadrants.

Fieldwork

The survey team (consisting of 16 groups of 48 females and 16 males) visited the selected clusters in the 12 districts and established the two groups of informants. Three focus group discussions were held, comprising the community informants network (CIN), health provider informants network (PIN), and the joint informants network (JIN). The informants listed all women of reproductive age who died in the last two years, using a tabular format, which included the name, age at death, home address and time of death and if the death occurred during pregnancy, birth or 42 days postpartum. The composition and the background of the informants groups is provided in (Annex 1).

Addresses of the relatives of all deceased women identified by the informant groups were recorded. The relatives were visited and a WHO standard verbal autopsy questionnaire was administered to eligible respondents who fulfilled the following criteria: at least 18 years old and was with the woman when she died, lived with the woman for 3 consecutive months before her death, or lived with the woman during her illness before death (if the woman was sick before death). The recommended respondent was the husband (if the woman was married) or the mother (if the woman was unmarried).

Data management and analysis

Data quality assessments were conducted during the fieldwork by the team supervisor and the field coordinator checking and editing every completed questionnaire. An office edit was also conducted prior to data entry and double data entry was done for all questionnaires to eliminate data entry errors. CSPro software was used for data management ofor both MADE-IN and verbal autopsy questionnaires. Final datasets were exorted to STATA for further data quality assessment and manipulations

The VA data from completed questionnaires were transferred into InterVA software to derive population level cause-specific mortality fractions (CSMFs), the sum of likelihoods for each cause category (including indeterminate) was divided by the sum of the likelihoods for all causes, thus splitting individual deaths between multiple causes weighted by the specific cause probabilities. The sum of all fractions in each cause category divided by the total number of deaths represents the population CSMF. The resulting file was transferred into STATA 13 for analysis. MADE-IN data were merged with the VA data and diagnostic tests were applied to measure concordance of the two tools.

Results

Out of the 498 clusters, deaths of women of reproductive age were identified in 409 clusters, which is (82%). Table 1a gives the distribution of deaths identified by the type of informant's network in 409 clusters by region.

Table 1: Result of the focus group discussion (MADE-IN)

| | Informant network | | | | | | Total | |
| | Community only | | Health provider only | | Both networks | | | |
	n	%	n	%	n	%	n	%
Region								
Awdal	18	21.7	10	12.1	55	66.3	83	100
Maroodi Jeex	388	60.6	52	8.1	200	31.3	640	100
Togdheer	59	26.3	15	6.7	150	67.0	224	100
Sanaag	19	16.5	8	7.0	88	76.5	115	100
Sool	26	33.3	14	18.0	38	48.7	78	100
Saaxil	37	28.7	2	1.6	90	69.8	129	100
Total	547	43.1	101	8.0	621	48.9	1,269	100

Half of the deaths were identified by both networks, and the community informants identified 43% that were not identified by the health worker network and the remaining 8% were identified by the health provider network only. The distribution of joint identification varies from 76.0% in Togdheer to 31.4% to Maroodi Jeex. The overall percentage of deaths identified by health providers only is relatively low, although the proportions are higher in Awdal and Sool.

Table 2ab presents the time of death by region, 60% of the deaths are non-pregnancy related, and 25% of the identified deaths were during the post-partum period. Non-pregnancy elated deaths vary substantially between regions ranging from 31% in Sool to 69% Maroodi Jeex. Similarly, Table 2b presents the timing of death by age at death, apart from the few deaths report in the lower and higher age groups; the PRD pattern follows the expected inverted U-shape.

Table 2a: Time of death, by region (MADE-IN)

	Non-pregnancy related		During Pregnancy		During Delivery		During Postpartum		Total	
	n	%	n	%	n	%	n	%	n	%
Region										
Awdal	35	42.2	14	16.9	9	10.8	25	30.1	83	100
Maroodi Jeex	439	68.6	47	7.3	24	3.8	130	20.3	640	100
Togdheer	109	48.7	21	9.4	23	10.3	71	31.7	224	100
Sanaag	72	62.6	14	12.2	9	7.8	20	17.4	115	100
Sool	24	30.8	16	20.5	7	9.0	31	39.7	78	100
Saaxil	78	60.5	17	13.2		0.0	34	26.4	129	100
Total	757	59.7	129	10.2	72	5.7	311	24.5	1,269	100

Table 2b: Time of death, by age group (MADE-IN)

	Non-pregnancy related		During Pregnancy		During Delivery		During Postpartum		Total	
	n	%	n	%	n	%	n	%	n	%
Age group										
11-14	46	95.8	1	2.1			1	2.1	48	100
15-19	82	70.7	4	3.5	8	6.9	22	19.0	116	100
20-24	51	42.9	25	21.0	5	4.2	38	31.9	119	100
25-29	83	38.4	24	11.1	20	9.26	89	41.2	216	100
30-34	70	38.9	29	16.1	19	10.56	62	34.4	180	100
35-39	73	41.0	30	16.9	17	9.55	58	32.6	178	100
40-44	87	71.3	8	6.6	1	0.82	26	21.3	122	100
45-49	71	84.5	5	6.0	2	2.38	6	7.1	84	100
50-54	165	95.4	3	1.7			5	2.9	173	100
55+	12	100.0							12	100
Missing	17	81.0					4	19.1	21	100
Total	757	59.7	129	10.2	72	5.67	311	24.5	1,269	100

Out of 1,269 identified deaths, 1,076 were successfully followed-up with the Verbal Autopsy (VA) questionnaire (Response rates for the VA interviews are presented in Table 3). The overall response rate of the VA questionnaire was 84.8% ranging from 72.8% in Togdheer to 97.4 in Sool. The main reason for non- response was family migration (5.9%) followed by

lack of eligible informant to be interviewed. The relatively low response rate in Togdheer was mainly due to family migration.

Table 3: Final response of the verbal autopsy interview, by region

Result of the questionnaire	Awdal		Maroodi Jeex		Togdheer		Sanaag		Sool		Saaxil		All	
	n	%	n	%	N	%	n	%	n	%	n	%	N	%
Completed	66	79.5	551	86.1	163	72.8	102	88.7	76	97.4	118	91.5	1,076	84.8
Partly completed, then refused	1	1.2	3	0.5	1	0.4	1	0.9	0	0.0	0	0.0	6	0.5
Completed, ineligible age	0	0.0	10	1.6	2	0.9	1	0.9	1	1.3	0	0.0	14	1.1
Completed, ineligible death date	1	1.2	15	2.3	2	0.9	0	0.0	0	0.0	1	0.8	19	1.5
Not done, refused	3	3.6	7	1.1	2	0.9	3	2.6	0	0.0	3	2.3	18	1.4
Not done, family moved	6	7.2	32	5.0	25	11.2	5	4.3	0	0.0	7	5.4	75	5.9
Not done, house not found	1	1.2	6	0.9	2	0.9	0	0.0	0	0.0	0	0.0	9	0.7
Not done, no informant	0	0.0	8	1.3	18	8.0	0	0.0	0	0.0	0	0.0	26	2.0
Not done, other (specify)	4	4.8	3	0.5	9	4.0	0	0.0	0	0.0	0	0.0	16	1.3
Not found	1	1.2	5	0.8	0	0.0	3	2.6	1	1.3	0	0.0	10	0.8
Total	83	100.0	640	100.0	224	100.0	115	100.0	78	100.0	129	100.0	1,269	100.0

Accuracy of the MADE-IN in assigning pregnancy-related deaths in comparison with VA tool was examined and the results are summarized in Table 4, overall, and by informant network and place of death with 95%CI. The results showed that the MADE-IN tool is very sensitive to identifying PRD and has a high negative predictive value; however the low specificity and positive predictive value is very low, 71.7% and 61.1% respectively. There is no significant difference between networks type and place of residence in the four accuracy parameters.

Table 4: Accuracy of the MADE-IN in assigning pregnancy-related deaths

	N	Sensitivity (n/N)	% (95%CI)		Specificity (n/N)	% (95%CI)		PPV (n/N)	% (95%CI)		NPV (n/N)	% (95%CI)	
Total	872	(259/289)	89.6		(418/583)	71.7		(259/424)	61.1		(418/448)	93.3	
			(85.5	92.9)		(67.9	75.3)		(56.3	65.8)		(90.6	95.4)
Informant network1													
Community	802	(234/260)	90.0		(391/542)	72.1		(234/385)	60.8		(291/417)	93.8	
			(85.7	93.4)		(68.2	75.9)		(55.7	65.7)		(91.0	95.9)
Health provider	515	(158/176)	89.8		(235/339)	69.3		(158/262)	60.3		(235/339)	92.9	
			(84.3	93.8)		(64.1	74.2)		(54.1	66.3)		(89.0	95.7)
Place of residence													
Urban	368	(70/81)	86.4		(225/287)	78.4		(70/132)	53		(225/236)	95.3	
			(77.0	93.0)		(73.2	83.0)		(44.2	61.8)		(91.8	97.7)
Rural/ Nomad	504	(189/208)	90.9		(193/296)	65.2		(189/292)	64.7		(193/212)	91.0	
			(86.1	94.4)		(59.5	70.6)		(59.0	70.2)		(86.4	94.5)

(1) Please note the identification by the two networks is not mutually exclusive
PPV =Positive Predictive Value NPV =Negative Predictive Value

Causes of death among women of reproductive age 15-49 years

The cause-specific mortality fraction (CSMF) generated by inter-VA for all women is presented in a series of tables in the annex (annex 3a-3c). As the focus of this report on maternal mortality among women age 15-49, the cause-specific maternal mortality fractions overall and by selected characteristics are presented in Tables 5a-5c.

Nearly one-third of the deaths are due to maternal with Obstetric haemorrhage the lead cause of maternal-related deaths (12.1%) followed by Pregnancy-induced hypertension (9.1%). Nearly, two in five women age 20-24 died from maternal related causes. Obstetric haemorrhage is disproportionately higher among women age 25-34 years.

Table 5a: maternal mortality causes of death by age group (Women of reproductive age 15-49 years)

	Total	Age group (Years)						
		15-19	20-24	25-29	30-34	35-39	40-44	45-49
	(872)	(100)	(108)	(188)	(161)	(145)	(103)	(67)
Communicable	22.7	18.9	24.2	23.1	24.6	18.3	28.8	19.6
NCD	29.8	25.0	23.1	21.6	24.1	31.3	45.2	57.9
Injuries	3.9	15.4	1.9	3.2	2.3	1.5	2.5	3.5
Maternal								
Ectopic pregnancy	0.1		0.5					
Abortion-related death	2.3	4.6	1.9	2.7	1.2	3.6	1.5	
Pregnancy-induced hypertension	9.0	8.0	13.8	7.3	8.7	13.4	4.8	4.9
Obstetric haemorrhage	12.1	3.5	13.2	17.5	19.6	9.9	7.7	1.4
Obstructed labour	0.4	1.0	0.8		0.3	0.6	0.3	
Pregnancy-related sepsis	5.3	7.4	8.0	8.2	4.4	4.8	0.5	
Anaemia of pregnancy	1.5	1.8	0.3	3.2	1.2	1.5	0.6	
Ruptured uterus	0.1					0.4		
Other and unspecified maternal CoD	0.5	0.5	1.2	0.7			1.0	
Indeterminate	12.5	13.9	11.0	12.6	13.7	14.7	7.1	12.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 5b shows the CSMF by region and place of residence. Half of the death in Awdal and Sool are due to maternal causes with obstetric haemorrhage is the leading cause. Only in Togdheer, the pregnancy-induced hypertension is the leading maternal cause of death.

Maternal death is as twice as high in rural areas than urban (40.6% vs 20.7%), and this ratio remain unchanged for the cause-specific.

Table 5b: Causes of death by region and place of residence (Women of reproductive age 15-49 years)

	Region residence						Place of residence		
	Awdal	Maroodi Jeex	Togdheer	Sanaag	Sool	Saaxil	Urban	Rural	Nomad
Number	(57)	(412)	(143)	(84)	(72)	(104)	(368)	(461)	(43)
Communicable	25.4	24.4	21.9	18.9	21.0	19.3	27.3	19.0	22.1
NCD	9.8	32.9	27.8	27.4	16.0	43.1	35.7	25.2	29.2
Injuries	3.2	3.5	4.9	5.5	3.4	3.8	3.4	3.4	14.3
Maternal									
Ectopic pregnancy			0.4				0.2		
Abortion-related death	1.6	1.8	2.8	6.3	2.6	0.8	1.8	2.8	2.2
Pregnancy-induced hypertension	13.5	7.1	13.5	6.4	13.1	7.0	6.5	11.0	8.6
Obstetric haemorrhage	20.7	10.4	9.3	15.0	23.5	7.6	7.2	16.5	6.9
Obstructed labour	3.0	0.1			1.4	0.3	0.3	0.6	
Pregnancy-related sepsis	10.5	5.0	4.0	4.4	6.5	5.5	3.5	7.0	2.1
Anaemia of pregnancy	2.6	1.5	1.0	2.0		2.0	1.0	2.0	
Ruptured uterus		0.1					0.1		
Other and unspecified maternal CoD	1.7		0.2	1.8		1.2	0.1	0.8	
Indeterminate	8.0	13.2	14.4	12.5	12.5	9.4	12.9	11.9	14.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Maternal causes of death by place of death, time to facility and proximity are presented in Table 5c. there is no appreciable difference in overall maternal death by place of death, however, women are more likely to die at home from Obstetric haemorrhage. Maternal mortality is high among women who live 2 hours away from any facility. Although abortion related death is relatively rate but was much higher among women who live more than 2 hours from the nearest health facility and rural settings.

Table 5c: Causes of death by place of death, time to facility and proximity (Women of reproductive age 15-49 years)

	Place of death		Time to facility		Proximity		
	Home/other	Facility	<=2hr	>2hr	Urban	Rural<=2hr	Rural>2hr
Number	(615)	(257)	(577)	(295)	(368)	(254)	(250)
Communicable	21.4	25.5	23.4	21.1	27.3	18.4	20.1
NCD	28.3	33.4	33.5	22.7	35.7	29.1	21.8
Injuries	4.6	2.4	4.5	2.8	3.4	6.0	2.6
Maternal							
Ectopic pregnancy		0.2	0.1		0.2		
Abortion-related death	2.5	2.0	1.7	3.5	1.8	1.7	3.8
Pregnancy-induced hypertension	9.0	8.9	7.9	11.1	6.5	9.9	11.6
Obstetric haemorrhage	13.1	9.7	9.1	18.1	7.2	12.7	18.7
Obstructed labour	0.3	0.7	0.6	0.1	0.3	0.9	0.1
Pregnancy-related sepsis	5.2	5.6	5.4	5.0	3.5	7.9	5.3
Anaemia of pregnancy	1.8	0.6	1.5	1.4	1.0	2.0	1.7
Ruptured uterus		0.2	0.1		0.1		
Other and unspecified maternal CoD	0.6	0.1	0.2	0.9	0.1	0.4	1.1
Indeterminate	13.2	10.7	12.0	13.3	12.9	11.1	13.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Main challenges and lessons learned

Collecting information on mortality generally provokes emotions of the relatives and the family of the deceased; obtaining deep and at times intrusive information about the dead often provokes resistance and suspicions. Although the response rate of this survey was very good (85%), the success was due to fact that survey team took considerable time in explaining the objectives of the survey. The success rate could be attributed to the gender composition of teams. Since women respondents were more than men, two out of the three-team members were females. Moreover, the teams also developed effective persuasion techniques to elicit responses. The team reported the following challenges during the survey:

- Difficulty on data validation: due to the reasons mentioned above the supervisors and quality controllers met more resistance to interview the respondents twice.

- In some communities rumors and misinformation regarding the real intention of the survey were often encountered. Example of the misinformation included the perception that orphans would be assisted or health facilitates for the community would be constructed etc.

- Difficulties in bringing Community and Health Worker together;

- Health providers live in part of the city; while they are work in other part. Therefore, finding them in their residential areas was challenging;

- Three out of four rural settlements have no health facilities, and health providers lead Focus Group Discussion was only done in quarter of the rural LAU;

- In urban areas health facilities are concentrated in business areas (Down town) rather than residential areas, where data collection is focused on.

- Family member were reluctant to responded to certain questions, especially those related to habits of the deceased (smoking, jawing qad, drinking etc);

- Difficulty of LAU demarcations and names of some of LAU that changed or do not exist;

- The community informant groups have much better information on mortality cases within their community than the Provider informant networks;

- Due to nature of the verbal autopsy, which requires extensive and personal information, it is necessary that the gender of the interviewer and that of the respondents be matched. The study confirmed that women respondents are more likely to provide information on verbal autopsy;

Discussion and recommendations

By collecting in-depth information on cause-specific maternal mortality using MADE-IN and followed by full verbal autopsy, the study was the first effort fulfilling the longstanding need to have an understanding of the causes of maternal deaths in the context of Somaliland.

Burden of maternal and reproductive health is amenable to significant reduction with measures on emergency basis. Findings remain valuable tools for advocacy and maintaining high political commitment.

The level of cause-specific maternal death indicates poor status of maternal health, due to lack of access to quality reproductive and maternal health services, low utilization of services, delays in seeking treatment, harmful practices such as FGM and early marriage, frequent and short interval live births, malnutrition of women and emerging epidemic of HIV and AIDS in the country.

The study concluded that pregnancy-induced hypertension and obstetric haemorrhage increase with age while pregnancy-related sepsis decreases with age. The causes of maternal death differ among regions of Somaliland

The findings of the study show that all women with ectopic pregnancy and ruptured uterus die at home which could mean a misdiagnosis. Awareness raising interventions at community level are critical so that high risk pregnancy cases must not be subjected to home delivery.

The risks of dying during pregnancy and childbirth are increased by women's lack of empowerment, education, and access to economic resources, as well as poor nutrition and a heavy physical workload during pregnancy. Most maternal deaths could be prevented by ensuring good quality maternal health services, such as antenatal and postnatal care, and skilled assistance during childbirth, including emergency obstetric care. Prevention of unwanted pregnancies and the provision of safe abortion services could reduce maternal deaths and injuries caused by unsafe abortions. High quality birth spacing services, counseling, and information could significantly reduce maternal deaths and injuries significantly.

Because of the high percentage of unintended pregnancies in Somaliland– birth spacing programs should pay special attention to providing information on effective use of contraceptive methods, increasing access to quality birth spacing services and addressing the challenge of unsafe abortion.

Women understand the benefits of delivering their babies in a health facility and the importance of antenatal care. Yet the majority of women do not go to health facilities for delivery even in places where such facilities are accessible. Research needs to be conducted to learn why women do not use health facilities for ANC, delivery and postnatal care

services. Particular attention should be paid to the nutritional and educational needs of girls and women, broadening the scope for women to make decisions about the number and timing of children and use of healthcare services and fostering at all levels a sense of shared responsibility and solidarity with women, particularly at such vulnerable times as pregnancy and childbirth

Maternal mortality requires services that integrate several levels of care from the community health post to the nearest hospital. Sustained efforts are needed to provide this service.

Births at home can be safe, provided a woman's family members and attendants can recognize the signs of complications and, if complications occur, move her to a facility where skilled professionals can provide care. Regrettably, very few live births are attended by persons who are able to recognize the signs of complications and who can provide the needed care. Hence, in order to improve maternal morbidity and mortality, it is critically important to increase public awareness about the benefits of ANC, delivery and postnatal care; and training of persons in midwifery skills and deploy them to underserved areas.

Decision-makers at all levels of political, economic, social, religious, and household, must foster the perception that pregnancy and childbirth can and should be made safer. A long-term commitment is needed to fuel sustainable change and ensure that the necessary inputs are maintained over the several years needed to reduce maternal mortality significantly.

Involving communities and decision-makers in the regular analysis of maternal deaths and ``near misses'' and promoting mechanisms for local accountability help to ensure that commitment is maintained over the long-term and that resources are allocated as needed.

Improvements in access to, and quality of, health cares, i.e. the aim must be to ensure that all pregnant women have access to a skilled attendant at the time of delivery and to the necessary care for obstetric complications when they arise.

In summary, specific recommendations include:

1. Investigating the determinants of health and risk factors in different areas to come out with needed interventions

2. Refining of the estimated number of live birth through establishing Civil Registration and Reporting System

3. Improving access to skilled birth attendance by training of midwifes and specialists should be addressed on emergency basis.

4. Building capacity of existing midwives and community based female health workers on screening of high risk pregnancy at community level

5. Establishing referral system for high-risk cases to higher level of care with availability of comprehensive and basic emergency obstetric care services in all regions needs to be ensured

6. Introducing Prevention of Mothers to Child Transmission (PMTCT) as an integral part of Essential Package of Health Services (EPHS), Risk Reduction Interventions for high risk groups for HIV and a strong HIV Treatment & Care component to be implemented on a priority basis.

7. Improving secondary and tertiary levels of care for better management of high risk and complicated cases

8. Establishing Maternal Death Surveillance and Response System (MDSR) for better tracking maternal cause of death and appropriate response

Annexes:

Annex 1: List of Informant Network members and their potential replacements

Important members	Replacement members
Community	
Chairperson	Deputy chairperson or member of committee
Mosque Imam	Koranic Teacher
School principle	Any teacher
Traditional elder	Any traditional elder
Health providers	
Important members	Replacement members
Physician	Traditional Birth Attendant (TBA)
Nurse/auxiliary nurse	Community health worker
Midwife/ auxiliary midwife	Herbal doctor
Pharmacist	Thabeeb (spiritual healer)

Annex 2a: Population distribution by region

Region	Urban	Rural	Nomads	IDP	Total
Awdal	287,821	143,743	233,709	7,990	673,263
Wooqoy Galbeed	802,740	138,912	255,761	44,590	1,242,003
Togdheere	483,724	57,356	154,523	25,760	721,363
Sool	120,993	13,983	187,632	4,820	327,428
Sanaag	59,717	30,804	352,692	910	544,123
TOTAL	**1,754,995**	**384,798**	**1,184,317**	**84,070**	**3,408,180**

Source: PES 2014, UNFPA

Annex 3a: Causes of death by age group (all women)

	Total	Age group (Years)			
		12-14	15-49	50-64	65+
Number	(1,076)	(39)	(868)	(159)	(10)
Communicable					
Sepsis (non-obstetric)	0.2		0.3		
Acute respiratory infection including pneumonia	3.4	19.6	2.4	4.4	4.2
HIV/AIDS related death	8.9	10.2	9.1	8.0	
Diarrheal diseases	0.4		0.3	1.0	
Malaria	2.2	9.6	2.1	0.6	
Meningitis and encephalitis	1.7	5.2	1.7	1.2	
Pulmonary tuberculosis	6.6	2.6	6.4	9.2	
Other and unspecified infect diseases	0.4		0.4	1.0	
NCD					
Oral neoplasms	0.3		0.2		10.0
Digestive neoplasms	1.5		0.6	6.2	8.6
Respiratory neoplasms	0.8		0.8	1.3	
Breast neoplasms	0.8		0.7	1.8	
Reproductive neoplasms MF	2.3		2.5	1.5	
Other and unspecified neoplasms	0.3	2.0		1.7	
Severe anaemia	0.9		1.0	0.6	
Severe malnutrition	0.2			0.9	3.3
Diabetes mellitus	1.1		0.8	3.3	
Acute cardiac disease	2.5		2.3	3.4	11.2
Stroke	7.4	2.5	6.1	15.2	22.1
Other and unspecified cardiac diseases	7.3		7.5	8.2	3.4
Chronic obstructive pulmonary diseases	0.9		0.4	4.4	
Asthma	0.5		0.5	0.9	
Acute abdominal	2.6	2.2	2.4	4.1	
Liver cirrhosis	1.6		1.6	1.8	
Renal failure	2.0	2.6	1.4	5.3	4.2
Epilepsy	0.6	3.9	0.4	0.5	
Other and unspecified NCD	0.8		0.8	1.1	
Injuries					
Road traffic accident	1.1	1.3	1.2	0.6	
Other transport accident	1.1	4.5	1.1		
Accident expos to smoke fire & flame	0.1	1.7	0.1		
Accident poisoning & noxious substance	0.1	2.2	0.1		
Intentional self-harm	0.2		0.2		
Assault	1.1	2.5	1.3		
Other and unspecified external injuries	0.0				4.7
Maternal					

Ectopic pregnancy	0.1		0.1		
Abortion-related death	1.9		2.3		
Pregnancy-induced hypertension	7.3		9.0		
Obstetric haemorrhage	9.8		12.2		
Obstructed labour	0.3		0.4		
Pregnancy-related sepsis	4.3		5.3		
Anaemia of pregnancy	1.2		1.5		
Ruptured uterus	0.1		0.1		
Other and unspecified maternal CoD	0.4		0.5		
Indeterminate	13.0	27.5	12.3	11.9	28.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

	Region residence						Place of residence		
	Awdal	Maroodi Jeex	Togdheer	Sanaag	Sool	Saaxil	Urban	Rural	Nomad
Number	(66)	(551)	(163)	(102)	(76)	(118)	(478)	(551)	(19)
Communicable									
Sepsis (non-obstetric)		0.1		1.4		0.4	0.3	0.2	
Acute respiratory infection including pneumonia	2.0	2.8	2.4	5.3	3.9	6.1	4.3	2.8	
HIV/AIDS related death	10.0	9.3	9.9	8.6	5.9	7.0	11.1	6.8	10.6
Diarrheal diseases		0.3	0.5	0.8		0.8	0.5	0.3	
Malaria	3.0	2.1	2.9	1.4	1.1	2.2	1.4	3.0	
Meningitis and encephalitis	4.1	2.0	2.2			0.9	2.0	1.6	
Pulmonary tuberculosis	2.7	8.5	5.3	3.7	9.1	2.5	7.7	5.2	11.7
Other and unspecified infect diseases	1.5	0.5	0.1		1.2		0.6	0.4	
NCD									
Oral neoplasms		0.2			1.3	0.9	0.4	0.2	
Digestive neoplasms		2.3	1.4			0.8	1.8	1.2	2.1
Respiratory neoplasms	3.0	1.0				0.9	0.8	0.7	2.1
Breast neoplasms		0.7	0.6	1.0		2.5	1.4	0.4	
Reproductive neoplasms MF	1.3	3.0	2.3	2.5	0.4	0.4	2.8	1.9	1.6
Other and unspecified neoplasms	1.2	0.3		0.4		0.8	0.2	0.4	
Severe anaemia		0.8	0.6	2.0		1.7	0.5	1.3	
Severe malnutrition		0.2		0.4		0.3	0.1	0.3	
Diabetes mellitus		1.6	0.6	2.7			1.5	0.9	
Acute cardiac disease	0.6	2.8	3.2	2.4	0.7	2.1	2.9	2.3	
Stroke	0.4	8.8	8.3	5.2		10.6	8.3	7.0	2.9
Other and unspecified cardiac diseases	1.5	8.0	6.0	2.9	7.0	12.6	8.9	5.5	11.1
Chronic obstructive pulmonary diseases	1.4	1.1		1.0		1.7	0.8	1.1	
Asthma		0.6		1.0		0.9	0.8	0.3	
Acute abdominal		2.6	1.9	3.4	3.8	3.9	2.4	2.8	3.2
Liver cirrhosis	3.5	1.1	1.2	3.3	1.3	1.7	1.4	1.2	7.1
Renal failure	3.7	2.1	2.2	1.3	1.3	1.7	2.8	1.5	0.8
Epilepsy		0.7		0.5		1.6	1.0	0.1	2.1
Other and unspecified NCD		1.0	1.4		0.6		1.0	0.7	
Injuries									
Road traffic accident		0.9	1.6	1.8		2.3	1.2	1.1	0.6
Other transport accident	1.1	0.8	1.8	1.4	2.1	0.6	0.3	1.3	5.9
Accident expos to smoke fire & flame	1.0	0.1					0.1		1.4

Accident poisoning & noxious substance		0.1		0.8			0.1	0.2	
Intentional self-harm		0.1			1.1	0.5	0.2	0.2	
Assault	0.7	1.2	1.4	1.3	1.3	0.4	1.0	0.8	5.2
Other and unspecified external injuries				0.5				0.1	
Maternal									
Ectopic pregnancy			0.3				0.1		
Abortion-related death	1.4	1.3	2.5	5.2	2.5	0.7	1.4	2.3	2.0
Pregnancy-induced hypertension	11.7	5.3	11.9	5.3	12.4	6.2	5.0	9.2	7.9
Obstetric haemorrhage	17.8	7.8	8.1	12.4	22.3	6.7	5.5	13.8	6.3
Obstructed labour	2.6	0.1			1.3	0.3	0.2	0.5	
Pregnancy-related sepsis	9.1	3.7	3.5	3.6	6.1	4.8	2.7	5.9	1.9
Anaemia of pregnancy	2.2	1.1	0.9	1.6		1.8	0.8	1.7	
Ruptured uterus		0.1					0.1		
Other and unspecified maternal CoD	1.5		0.2	1.4		1.1	0.1	0.7	
Indeterminate	11.0	13.1	14.9	13.6	13.3	10.0	13.5	12.4	13.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Annex 3c: Causes of death by place of death, time to facility and proximity (all women)

	Place of death		Time to facility		Proximity		
	Home/other	Facility	<=2hr	>2hr	Urban	Rural<=2hr	Rural>2hr
Number	(771)	(297)	(742)	(334)	(478)	(321)	(277)
Communicable							
Sepsis (non-obstetric)	0.1	0.5	0.3		0.3	0.3	
Acute respiratory infection including pneumonia	3.2	3.8	3.6	2.8	4.3	2.3	3.0
HIV/AIDS related death	8.6	9.7	9.2	8.1	11.1	6.7	7.6
Diarrheal diseases	0.4	0.4	0.5	0.2	0.5	0.3	0.3
Malaria	2.4	1.4	2.1	2.2	1.4	3.0	2.4
Meningitis and encephalitis	1.4	2.6	1.7	1.7	2.0	1.3	1.7
Pulmonary tuberculosis	5.6	9.3	6.5	6.8	7.7	5.7	5.7
Other and unspecified infect diseases	0.5	0.4	0.3	0.9	0.6		0.7
NCD							
Oral neoplasms	0.4		0.4		0.4	0.3	
Digestive neoplasms	2.0	0.1	1.4	1.7	1.8	1.2	1.5
Respiratory neoplasms	0.8	0.9	1.0	0.3	0.8	1.2	0.4
Breast neoplasms	0.9	0.7	0.9	0.6	1.4	0.3	0.4
Reproductive neoplasms MF	2.2	2.5	2.7	1.3	2.8	2.6	1.0
Other and unspecified neoplasms	0.5		0.5		0.2	0.7	
Severe anaemia	1.1	0.3	1.0	0.6	0.5	1.6	0.7
Severe malnutrition	0.2		0.2		0.1	0.5	
Diabetes mellitus	1.4	0.3	1.2	1.0	1.5	0.5	1.2
Acute cardiac disease	2.6	2.3	2.5	2.4	2.9	1.9	2.4
Stroke	8.3	5.3	8.5	5.1	8.3	8.9	4.2
Other and unspecified cardiac diseases	5.8	11.0	8.0	5.6	8.9	6.4	5.4
Chronic obstructive pulmonary diseases	0.8	1.4	1.3		0.8	1.9	
Asthma	0.4	0.7	0.6	0.3	0.8	0.5	
Acute abdominal	1.9	4.4	2.7	2.4	2.4	2.8	2.9
Liver cirrhosis	1.9	0.7	1.8	1.1	1.4	2.0	1.4
Renal failure	1.6	3.3	2.1	1.9	2.8	1.2	1.7
Epilepsy	0.6	0.5	0.8	0.2	1.0	0.3	0.2
Other and unspecified NCD	0.7	0.9	0.7	1.0	1.0	0.4	0.8
Injuries							
Road traffic accident	1.1	1.1	1.3	0.7	1.2	1.3	0.8
Other transport accident	1.4	0.2	1.2	0.9	0.3	2.2	1.1
Accident expos to smoke fire & flame		0.5	0.2		0.1	0.2	
Accident poisoning & noxious substance	0.2		0.1	0.3	0.1		0.3
Intentional self-harm	0.3		0.3		0.2	0.4	

Assault	1.3	0.5	1.1	1.1	1.0	1.5	0.8
Other and unspecified external injuries	0.1				0.1			0.2

Maternal

Ectopic pregnancy		0.2	0.1		0.1		
Abortion-related death	2.0	1.7	1.4	3.1	1.4	1.3	3.4
Pregnancy-induced hypertension	7.1	7.7	6.1	9.8	5.0	7.9	10.5
Obstetric haemorrhage	10.3	8.4	7.0	15.9	5.5	10.0	16.9
Obstructed labour	0.2	0.6	0.4	0.1	0.2	0.7	0.1
Pregnancy-related sepsis	4.1	4.8	4.2	4.4	2.7	6.2	4.7
Anaemia of pregnancy	1.5	0.5	1.2	1.3	0.8	1.6	1.5
Ruptured uterus		0.2	0.1		0.1		
Other and unspecified maternal CoD	0.5	0.1	0.2	0.8	0.1	0.3	1.0
Indeterminate	13.9	10.4	12.7	13.5	13.5	11.8	13.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Rural includes nomads

Annex 4: Ethical Clearance

REPUBLIC OF

Wasaaradda Caafimaadka

SOMALILAND

Ministry of Health

HEALTH RESEARCH ETHICAL CLEARANCE COMMITTEE

Email:moh22@hotmail.com

Tel: 2522-523213

Ref: 04/2013

Date: 14/01/2013

To: Aberdeen University, DARS, WHO

Re: Ethical Clearance Letter

Research Title: Maternal Mortality Study in Somaliland

Research Objective: Improving maternal and prenatal health outcomes in Somaliland

Ethical Consideration:

The ethical clearance committee received and reviewed the following items in connection with the above study to be conducted in Somaliland in 2013
1. Research protocol (English Version)
2. Questionnaire (English Version)

After reviewing the above documents, the ethical committee confirms that your research proposal "has been ethically considered and approved"

Comments:
1. Questionnaires should be translated into local language (Somali)
2. A consent form should be included in the questionnaire and translated into Somali

Hussein Jama Haad

Health Systems Research Coordinator &

Chair of Health Research Ethical Clearance committee

References:

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