

An Evidence-Based Policy Brief

Application of equitable impact sensitive tool (EQUIST) in evidence informed policymaking to improve Maternal and Child health outcomes in Burkina Faso

This policy brief was prepared for the West African Health Organization (WAHO) MEP Project by the African Institute for Health Policy & Health Systems Ebonyi State University Abakaliki Nigeria.

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Who is this policy brief for?

Policymakers, their support staff, and people with an interest in the problem that this policy brief addresses

Why was this policy brief prepared?

This policy brief was prepared to summarize the best available evidence about the problem which it addresses and solutions to that problem

! This evidence-based policy brief includes:

- A description of a health system problem
- Viable options for addressing this problem
- Strategies for implementing these options

Key Messages

A shorter version of this Full Report is available in the Key Messages section.

What is an evidence-based policy brief?

Evidence-based policy briefs bring together global research evidence and local evidence to inform deliberations about health policies and programmes

Key messages

The Policy Issue

Burkina Faso has a population of 18.6 million and a high total fertility rate (6 children per woman). The country is plagued with very high morbidity and mortality rates which are among the worst in the world, attributable to low rates of access to and utilization of health services. Among the most critical health systems components that requires strengthening to improve MNCH outcomes in Burkina Faso is the concept of equity. UNICEF has designed the EQUitable Impact Sensitive Tool (EQUIST) to enable the global health community improve equity in MNCH and reduce health disparities between the most marginalized mothers and young children and the better-off. Using the latest available DHS data sets, we conducted EQUIST Situation Analysis of maternal and child health outcomes in Benin by sub-national categorization, wealth and by residence. We then identified the poorest population class within the country with the highest maternal and child mortality and performed EQUIST Scenario Analysis of this population in order to identify the intervention package, the bottlenecks and strategies to address them, the cost of the intervention and strategies as well as the number of deaths avertible.

Magnitude of the problem

Under-five mortality was highest in Sahel region. The number of under-five deaths was considerably higher among the poorest and rural population in Burkina Faso. Neonatal causes, malaria, pneumonia and diarrhoea were responsible for most of the under-five deaths. Highest maternal mortality was recorded in the Boude du Mou region. Ante-partum, intra-partum, and post-partum haemorrhages, and hypertensive disorder, were responsible for highest maternal deaths. The percentage national average for WASH (improved water source) was 17%. ITN ownership percentage national average for Burkina Faso was 47%. The percentage of the ITN ownership was lower among the poorest compared to the national average in the country (42% vs. 47%) (Table 7). The percentage of national average of exclusive breast feeding was 25%. In Burkina Faso, the percentage coverage of DTP3 immunization among the poorest (83%) was lower than the national average (90%). In terms of the curative services (case management of premature babies), the percentage national coverage was 25%. The percentage coverage among the poorest was generally lower than the national average. Delivery by skilled professional is a major intervention capable of averting the highest number of under-five and maternal deaths in Burkina Faso. Redeployment/relocation of existing staff was the intervention strategies with the highest costs in the country and cost per capita was recorded was \$3.0.

Policy Options and strategies

Policy Option 1: Scaling up integrated packages of essential interventions across the continuum of care.

Policy Option 2: Increasing budget allocation to the health sector to address the significant material and human resource shortages in the health systems.

Policy Option 3: Making the Health sector market attractive to private sector.

Policy Option 4: Establishing effective Health insurance schemes through strong health systems reforms.

Policy Option 5: Focusing the health systems on diseases and risks that affect the largest number of people and the poorest.

Policy Option 6: Curbing population growth and making the improvement of the status of women an utmost priority.

Policy Option 7: Establishing accountability mechanisms in order to restore confidence in health services and increase efficiency in the delivery of health care services.

COMPLETE REPORT

Introduction and Background Information

Burkina Faso is a landlocked Sahel country that is bounded by six countries, Mali to the north; Niger to the east; Benin to the southeast; Togo and Ghana to the south; and Ivory Coast to the southwest. It has **an area of 273,800 km²** and lies between latitudes 9° and 15°N and longitudes 6°W and 3°E, and between the Sahara Desert and the Gulf of Guinea, south of the loop of the Niger River [1]. With a population of about 18.6 million in 2016, the life expectancy in Burkina Faso at birth in 2015 was 59.9 years, neonatal mortality was 25.6 per 1000 live births (2016), under-five mortality rate of 84.6 per 1000 live births (2016), infant mortality rate of 54.4 per 1000 live births (2015) and maternal mortality ration of 371 per 100 000 live births (2015) [2].

Burkina Faso's population is mostly rural (71%) and continues to experience high poverty rates [3]. The country is experiencing a rapid population growth rate which is impeding its capacity to complete its demographic transition and to harness its economic potential. At the heart of this population growth is reproductive health: the 2010 Demographic and Health Survey indicates a high total fertility rate (i.e. 6 children per woman), high adolescent birth rate (i.e. 11 percent) and low contraceptive prevalence rate (15 percent) [4]. Burkina Faso is plagued with very high morbidity and mortality rates, attributable to low rates of access to and utilization of health services and the persistently high incidence of infectious and parasite-borne diseases, consequently maternal and child mortality rates in Burkina Faso are among the highest in the world [5]. This is further compounded by poor child survival rates with only one in five children reaching the age of five, and by poor maternal outcomes, with only 17 percent of pregnant women completing four antenatal care visits [4].

Burkina Faso health systems performance was ranked 132nd in the world in 2000 [6]. The health system suffers from under equipment, shortage of financial and human resources, and malnutrition and such constraints are compounded by inequalities between rural and urban areas, which concentrate most of the sanitation facilities [7]. Further, there are large variations in access to services and health outcomes between urban and rural areas, and between the wealthiest 20 percent and the poorest 20 percent of the population [4]. Doctors and midwives remain disproportionately concentrated in urban areas, and service quality is undermined by the inadequate motivation of public sector health workers due to low salaries, poorly developed career structures, and limited accountability for performance [4].

In Burkina Faso, the overall burden of disease consists mainly in infectious illnesses, particularly through the appearance of non-transmissible ones in recent years and children under five and women

remain the primary victims [8]. In the remote, arid Sahel region in northern Burkina Faso, women and their newborns are much more likely to die during pregnancy and childbirth than are women in other parts of the country [9]. The causes of neonatal morbidity and mortality are infections (32%), prematurity / low birth weight (22%), asphyxia (21%), and neonatal tetanus (12%) [7]. Child mortality is due to pneumonia (24%), malaria (20%), diarrhoea (19%), neonatal causes (18%), HIV-AIDS (4%), and measles (3%) [7].

Despite a noticeable improvement in recent years, maternal and child health indicators have not yet attained the targets set in the sustainable development goals (SDGs) of the United Nations and the National Economic and Social Development Plan (PNDES) [8]. The government of Burkina Faso has attempted to restructure the health sector by providing primary health care services to local populations despite barriers such as limited access to health care facilities, lack of consumer confidence in the public health care system, and limited resources for staff, materials, and drug supplies [5]. This restructuring included the decentralization of health care services and implementation of several initiatives designed to empower local communities to take responsibility for the health and welfare of their populations [5].

On September 2015, the government in Burkina Faso adopted a policy to ensure Universal Health Coverage (UHC) for all Burkinabe [10]. In early 2016, Burkina Faso transformed this law into a landmark decree allowing free health care fees for children under the age of five, pregnant women and breastfeeding mothers in March 2016 with its rollout beginning in April 2016 [10]. Despite the that human and financial resources are insufficient to ensure efficiency of health projects and programs in Burkina Faso, the country is making constant progress to improve the health sector.

Definition and Magnitude of the Problem using EQUIST Analysis

Introduction to EQUIST

Among the most critical health systems components that requires strengthening to improve MNCH outcomes in Burkina Faso is the concept of equity. The importance of equity consideration in evidence-informed policymaking and interventions to improve MNCH in Burkina Faso cannot be overstated. This is because evidence abound which showed that decrease in maternal and child mortality in low and middle-income countries (LMICs) including the African region has been accompanied by increased inequity in health outcomes between the poor and those better off [11-14]. Consequently, the United Nations Children’s Fund (UNICEF) has strongly advocated against the ‘mainstream approach’ where scaling–up of health interventions is first provided to wealthier groups in the society, but rather is promoting an ‘equity–focused’ approach in which interventions are targeted at the poorest in the society [15]. In a recent publication [14], UNICEF made a strong case

for equitable investment and argued that since most maternal and child deaths in LMIC could have been prevented with practical, high-impact, and, low-cost health interventions, extending services to the most deprived and marginalized communities would not only avert more deaths, but would also do so more cost-effectively.

To this end, a number of tools have been developed to assess the relationship between cost-effectiveness and equitable impact in maternal and child mortality reduction [15]. Some of these tools included the Marginal Budgeting for Bottlenecks (MBB) [16], Choice of Interventions that are Cost-Effective (CHOICE) [17], and the Lives Saved Tool (LiST) [18]. According to Waters and colleagues [15], the major limitation of these tools is that they make no allowance for income-related inequalities in countries and therefore cannot fully address equitable impact considerations. To address this limitation, the UNICEF designed the **EQUitable Impact Sensitive Tool (EQUIST)** to enable the global health community improve equity in MNCH and reduce health disparities between the most marginalized mothers and young children and the better-off [19,20].

EQUIST is an online tool (<http://equist.info/en/pages/home>), which has been described as a medium-term strategic planning, modelling and monitoring platform that serves to improve child and maternal health as well as nutrition equity in LMICs [19,20]. A key difference between EQUIST and previous tools is that EQUIST is considerably simpler and more user-friendly, with most of the calculations happening automatically [20]. EQUIST helps policy makers select strategies that balance the principles of equity, effectiveness and efficiency by leading them through a logical process to identify the most rational and cost-effective solutions for their context [21]. EQUIST's structure consists of three modules: situation analysis, scenario analysis, and scenario comparison [22].

The purpose of the policy brief is to use EQUIST to provide reliable evidence, based on available Burkina Faso demographic health surveys (DHS) on cost-effectiveness and equitable impact of interventions that will improve MNCH outcomes in Burkina Faso. The goal is to provide decision makers and Burkina Faso health community with scientific information that will enable them think about issues of equity in MNCH in a more systematic and evidence-informed way, in order to design health intervention strategies that will lead to stronger, more resilient health systems in the country.

EQUIST situational analysis

EQUIST is pre-loaded with Burkina Faso DHS data sets and we used the latest available DHS data sets for the country which is 2014 to perform both profile and frontier situational analysis. The analysis was conducted as instructed in the EQUIST user guide [23]. We conducted a general EQUIST situation analysis of maternal and child health outcomes in Burkina Faso by sub-national

categorization, by wealth and by residence. We then identified the poorest population class within the country with the highest maternal and child mortality and performed EQUIST scenario analysis of this population in order to identify the intervention package, the bottlenecks and strategies to address them, the cost of the intervention and strategies as well as the number of deaths avertible and lives saved per US\$ invested.

(a). Profile analysis: Using the EQUIST Profile analysis, we assessed the general extent, nature and implications of inequities as they affect MNCH in Burkina Faso. The profile analysis is categorized into Sector and Theme. The Sector Category is further divided into Demographic and Epidemiological Parameters, while the Theme Category is divided into family care practices, preventive services and curative services.

Under the Demographic Parameters of the Sector Category, we examined under-five mortality and neonatal mortality with reference to the key drivers of inequity, the underlying factors that explain inequities (wealth quintile, geography, and location) and analysed the scale of inequity (deprivation mostly concentrated in poorest quintile and in rural areas). The analysis was used to provide information on the following: (a). The part of Burkina Faso that recorded the highest child (under-five and neonatal) mortality and considered the most deprived in terms of MNCH interventions; (b) The most disadvantaged or vulnerable children; i.e. how deprivation is affected by various drivers such as wealth, geography, and location; (c) The health conditions that cause excess mortality among the most disadvantaged populations; and (d) The health interventions that are linked to this excess mortality in the most deprived areas.

Under the Epidemiological Parameters of the Sector Category, we performed EQUIST Profile analysis to determine the key epidemiological causes and the specific number of under-five, neonatal and maternal mortality in Burkina Faso. The diseases analysed responsible for under-five and neonatal mortality included diarrhoea, malaria, measles, pneumonia, injuries, meningitis, pertussis, asphyxia, prematurity, sepsis, tetanus and congenital disorders. The diseases analysed responsible for maternal mortality included ante-partum haemorrhage, intra-partum haemorrhage, post-partum haemorrhage, hypertensive disorders, maternal sepsis and complicated abortion. We related these to the various zones in Burkina Faso to identify the population that is mostly affected by sub-national categorization, wealth and residence. Under the Theme Category, we also performed EQUIST Profile analysis of the percentage of Effective Coverage of maternal and child health interventions including: (i). Family care practices (WASH, ITNs/Environmental safety, neonatal/infant care); (ii). Preventive services (immunization plus); (iii). Curative services (IMNCI, delivery by skilled professionals,

EMONC). We related these interventions and effective coverage to the country by wealth (poorest and richest) and by residence (rural and urban).

(b). Frontier analysis: Using the EQUIST Frontier analysis, we identified the factors most likely to drive inequity, and compared the number of Under-five and maternal deaths that could be averted in the poorest wealth quintile in Burkina Faso under the Frontier, we performed two analyses.

First, we performed the Equity Frontier analysis to identify how many under-five and maternal lives that could have been saved if Burkina Faso equalizes coverage values for the least disadvantaged within the most disadvantaged population (poorest quintile). This was to enable us know the number of deaths that will be averted if the coverage gaps for the most disadvantaged population was equivalent to that of the richest in the country's context.

Second, we performed the Operational Frontier analysis to determine the number of under-five and maternal deaths that could be averted if effective coverage of evidence based high impact interventions are implemented and if their bottlenecks are reduced with the same proportion as observed in the most disadvantaged quintiles in best- performing countries.

EQUIST scenario analysis

We conducted EQUIST scenario analysis for Burkina Faso by wealth focusing on the poorest quintile.

(a). Analysis of epidemiological priorities: Because our key interests were on the under-five mortality and maternal mortality, using the EQUIST epidemiological priorities we identified three categories of mortality and their main causes in the poorest quintile as follows: (i). Neonatal mortality (asphyxia, prematurity, sepsis, pneumonia, diarrhoea, tetanus); (ii). Post-neonatal and child mortality (diarrhoea, malaria, meningitis, pneumonia, asphyxia, sepsis, measles, tetanus, pertussis, prematurity); (iii). Maternal mortality (antepartum haemorrhage, complicated abortion, obstructed labour, postpartum haemorrhage, sepsis infection). We analysed simultaneously the absolute burden of diseases (the disease specific mortality rate for the targeted population), as well as the relative “excess” mortality in the group (the gap in relative disease burden between the targeted population and the least disadvantaged group).

(b). Analysis of interventions: We identified the priority interventions with which to address the epidemiological issues we selected. The interventions are grouped in nine “packages” further grouped into three service delivery modes: family care practices, preventive services, and curative services (Table 2).

(c). Analysis of bottlenecks, causes & recommendations: We identified the priority bottlenecks to implementing the interventions we selected. We related the priority bottle necks with the eight EQUIST scenario coverage determinants including: (i) Availability of commodities, (ii) availability of human resources, (iii) geographical accessibility, (iv) financial affordability, (v) sociocultural acceptability, (vi) initial utilization, (vii) adequate coverage, and, (viii) effective coverage. The bottleneck analysis framework in EQUIST assumes that eight conditions (coverage determinants) must be met to provide effective coverage of any health intervention [23]. Using the EQUIST bottleneck analysis, we determined the severity of bottlenecks based on the indicators used to measure the level of compliance with each condition for utilization, as well as the relationship between initial utilization, adequate coverage. For each intervention, we identified the coverage determinant, bottleneck, cause of the bottleneck and recommendations to address them (Table 3).

(d). Analysis of enabling environment and strategies to address bottlenecks and their causes:

We performed the analysis of the enabling environment which is classified into four (social norms; legislation/policy; budget/expenditure; management/coordination) and identified the direct causes (Table 4). We also performed the analysis of the strategies classified into five health systems building blocks (financing; service delivery; medical products, vaccines and technologies; health workforce; governance/leadership; information) to address the bottlenecks (Table 4).

(e). Analysis of impact and cost: The EQUIST impact and cost analysis was performed to determine the following: (i). The operational frontier for maternal, under-five and neonatal mortality: that is amenable deaths if the deprived population coverage value was equal to the best performing countries, (ii). The equity frontier for maternal, under-five and neonatal mortality: that is amenable deaths if the deprived population coverage value was equal to the non-deprived population coverage value; (iii). Amenable under-five and maternal deaths among the poorest by intervention package in Burkina Faso; (iv). The cost of strategies to avert both maternal and under-five mortality; (v). The cost per capita averting the number of deaths.

Outcome of EQUIST situational analysis

The EQUIST profile analysis of under-five mortality by sub-national regions under the demographic parameters of the sector category in Burkina Faso showed that the Sahel region recorded the highest mortality. The number of deaths/1000 live births in the region was more than twice the number recorded in the Centre Est, which is the region with the lowest number of deaths/1000 live births and the value were considerably higher than the national average (Table 5). The number of under-five deaths/1000 live births was considerably higher among the poorest compared to the richest and among the rural compared to the urban population (Table 5). The outcome of profile analysis of

neonatal mortality by sub-national regions, wealth and residence under the demographic parameters of the sector category is summarized in Table 5. The Est region recorded the highest neonatal mortality (2,920). The number of neonatal deaths/1000 live births was consistently higher among the poorest compared to the richest and among the rural compared to the urban population. (Table 5).

The Sahel Burkina Faso recorded the highest neonatal mortality by epidemiological cause under the Sector Category. The poorest and the rural dwellers across the country had the highest number of neonatal deaths (Table 6). The four diseases responsible for the highest neonatal mortality included sepsis, asphyxia, prematurity and congenital disorders (Table 6). Asphyxia was the major killer of the neonates in the country with the mortality considerably higher among the rural compared to the urban population in Burkina Faso (4,501 vs. 1,186) (Figs 2-4).

The under-five mortality by epidemiological cause under the Sector Category is also presented in Table 6. The four diseases responsible for most of the deaths are neonatal causes, malaria, pneumonia and diarrhoea. The Est. region recorded the highest number of under-five mortality by epidemiological cause, while the least number of mortality was recorded in the Centre (excluding Ouagadougou) region. Most of the under-five deaths in Burkina Faso occurred in the rural compared to the urban areas and resulted from malaria (12,623 vs. 2,574) and neonatal causes (15,205 vs. 3,796). The poorest had higher under-five mortality numbers in the country (Table 6). (Figs 5-7).

The Boude du Mou. of Burkina Faso recorded the highest maternal mortality by epidemiological cause (Table 6). The six diseases responsible for the highest maternal mortality included ante-partum haemorrhage, intra-partum haemorrhage, post-partum haemorrhage, hypertensive disorder, maternal sepsis and complicated abortion. Higher maternal mortality was recorded in the rural compared to the urban population in the country. The poorest compared to the richest population also recorded considerably higher maternal mortality (Table 6). (Figs 8-10).

The percentage national average for WASH (improved water source) was 17%. ITN ownership percentage national average for Burkina Faso was 47%. The percentage of the ITN ownership was lower among the poorest compared to the national average in the country (42% vs. 47%) (Table 7). The percentage of national average of exclusive breast feeding was 25%. In Burkina Faso, the percentage coverage of DTP3 immunization among the poorest (83%) was lower than the national average (90%) (Table 7). In terms of the curative services (case management of premature babies), the percentage national coverage was 25%. The percentage coverage among the poorest was generally lower than the national average.

The outcomes of the analysis of avertible deaths by epidemiological cause and equity/operational frontier for under-five children in Burkina Faso are shown in Table 8. The three main diseases

responsible for the highest number of avertible under-five deaths by equity and operational frontiers are malaria, pneumonia, and diarrhoea. A total of 2053 and 2016 under-five diarrhoea deaths are avertible by equity and operational frontiers respectively (Table 8).

The outcomes of the analysis of avertible deaths by epidemiological cause and equity/operational frontier for maternal mortality are also shown in Table 8. The four main diseases responsible for the highest number of avertible maternal deaths by equity and operational frontiers are sepsis, hypertensive disorders, post-partum haemorrhage and intra-partum haemorrhage. In Burkina Faso a total of 2 and 47 maternal deaths due to post-partum haemorrhage are avertible by equity and operational frontiers respectively (Table 8).

Outcome of EQUIST scenario analysis

The number of amenable under-five deaths if the deprived population coverage value was equal to (i). the best performing countries (operational frontier) and (ii) the non-deprived population coverage value (equity frontier) are shown in Table 9. Diarrhoea, asphyxia, pneumonia and malaria were responsible for the highest number of amenable under-five deaths by operational and equity frontiers (Table 9) (Fig 11).

Ante-partum haemorrhage, intra-partum haemorrhage, post-partum haemorrhage and hypertensive disorders are the diseases responsible for the highest number of amenable maternal deaths among the poorest quintile in Burkina Faso (Table 9). The amenable maternal deaths caused by post-partum haemorrhage by operational and equity frontiers are 0.75 and 38 respectively (Table 9) (Fig 12).

The number of amenable neonatal deaths by operational and equity frontiers are shown in Table 9. Asphyxia is responsible for the highest number of amenable neonatal deaths by equity and operational frontiers in the country (155 vs. 604 respectively). Sepsis is responsible for the second highest number of amenable deaths by operational and equity frontiers. Prematurity is also a major contributor to amenable neonatal deaths by operational (60) and equity (58) frontiers (Table 9) (Fig 13).

Amenable deaths among the poorest by intervention package and equity/operational frontier for under-five and maternal mortality are shown in Table 10. Delivery by skilled professional is a major intervention capable of averting the highest number of under-five and maternal mortality in Burkina Faso. IMNCI, ITNs/Environmental safety, WASH and Immunization plus are capable of averting under-five deaths ranging from 66 to 653 in Burkina Faso (Table 10). Up to 96 (by operational frontier) maternal deaths are avertible through delivery by skilled professional intervention package (Fig 14, Fig 15).

The cost of intervention strategies to avert the mortality as provided by the EQUIST impact and cost analysis are presented in Table 11. The strategy with the highest costs in Burkina Faso is Redeployment/relocation of existing staff (\$2,327,896). The cost per capita of \$3.0 was recorded (Table 11) (Fig 16, Fig 17).

Policy Options and Implementation Strategies for Addressing the Problem

In this policy brief, different policy options are suggested to improve MNCH outcomes in Burkina Faso based on the results of the EQUIST analysis. These suggestions are based on the evidence provided by Black and colleagues [24], Santi and Weigert [25] and UNICEF EQUIST publications [14,19,20] and from EQUIST online tool [<http://equist.info/en/pages/home>].

Policy Option 1: Scaling up integrated packages of essential interventions across the continuum of care.

Progress could be accelerated and achieved by scaling up integrated packages of essential interventions across the continuum of care for MNCH. The intervention packages described in EQUIST capable of improving MNCH include: (i). Family Care Practices (WASH, ITN/Environmental safety, Neonatal and infant feeding and care); (ii). Preventive Services (Family planning, Antenatal care, Immunization plus); (iii). Curative services (Integrated management of neonatal and childhood illness IMNCI, Delivery by skilled professional, Emergency obstetrics and neonatal care EMONC). According to Black and colleagues, scaling up all interventions in the packages of maternal and newborn health, plus folic acid before pregnancy, and child health from the existing rate of coverage to 90 percent would avert 149,000 maternal deaths; 849,000 stillbirths; 1,498,000 neonatal deaths; and 1,515,000 child deaths [24]. It is important to determine coverage determinant, identification of the causes of bottleneck and strategy to address them. These are outlined in Table 3.

Interventions and strategies for improving MNCH outcomes are closely related and must be provided through a continuum of care approach [26]. This is because when linked together and included as integrated programs, these interventions can lower costs, promote greater efficiencies, and reduce duplication of resources [27]. Efforts must be made to identify synergies and integrate these interventions across the continuum of care and consensus must be developed on the content of MNCH packages of interventions at each level of the health system across the continuum of care; facilitating the scaling-up of these interventions; and identifying research gaps in the content of core packages of interventions [26].

Instead of competing calls for mother or child, policy and programme attention should shift towards an MNCH continuum of care with focus on universal coverage of effective interventions, integrating care throughout the lifecycle and building a comprehensive and responsive health system [28]. The MNCH continuum of care can be achieved through a combination of well-defined policies and strategies to improve home care practices and health care services throughout the lifecycle, building on existing programmes and packages [28].

Policy Option 2: Increasing budget allocation to the health sector to address the significant material and human resource shortages in the health systems:

The EQUIST analysis indicated that the rural and the poorest have the worst maternal and child health indicators, implying that sufficient resources are not invested in health in the rural and underserved areas. According to Santi and Weigert, the poor health and medical infrastructure network in West African countries reflects the inequalities in terms of access to health, especially between the rural and urban areas and between the poorest and the richest [25]. Adequate funding must be allocated to the health sector to engage more health workers in order to attain the critical threshold of 23 health workers (physicians, nurses, midwives) per 10,000 inhabitants stipulated by WHO as necessary to deliver essential maternal and child health services [29].

The health sector is known to be skilled-labour-intensive and the increase in human resources for health is critical to the overall improvement in the performance of the health systems. In this domain, emphasis must be laid on territorial equity in order to address the human resource shortage in rural areas, where the poorest people live but which still harbour the greatest health risks [25]. Underfunded investments in maternal, newborn, and child health (MNCH) are part of the impediment towards the implementation of feasible and cost-effective interventions exist to reduce maternal, newborn, and child mortality [30,31].

Effective interventions are not consistently used or available in LMICs, and accelerated investments are needed in health system infrastructure, intervention implementation, health worker training, and patient education to improve health outcomes for mothers and newborns [32]. In order to address the insufficiently diversified and autonomous financing of health, it is important to invest the growth dividend in health and look for more diversified and more stable financing sources like taxation (taxes on air traffic, mobile telephony, alcohol and tobacco) [25].

Policy Option 3: Making the Health sector market attractive to private sector

One of the ways to address the equity issue and bridge the gap among the wealth quintiles as indicated by the EQUIST analysis, is to encourage more private sector investment in health since the government sector cannot meet all the health needs of the population. It is important to develop a modern and structured private sector that works in tandem with government authorities. The government should provide enabling environment that will be attractive enough to private investors in the modern medicine sector so they can invest in it. Santi and Weigert, argued that the main obstacle to the involvement of private investors is the low solvency of demand, despite the growing need for increasingly diversified healthcare [25]. One of the ways to encourage private sector investment in the healthcare is to establish a robust health insurance mechanism.

Differences in essential newborn care at birth between private and public health facilities are well established [33]. In some countries including Kenya and Nigeria, available reports show that considerably more deliveries occur in private clinics and hospitals and in public ones [34-37]. Among the mandates of the newly launched Every Newborn Action Plan is coordinated support and effort amongst private sector providers of delivery services and newborn care [38]. In Nigeria, private maternity care was the preferred place of delivery because of the problems associated with public owned hospitals including low quality of facilities, absence of staff, poor perceived quality, long waiting times, and high costs [34]. It is therefore imperative for the enactment of policies that will facilitate the engagement of the private sector to increase accessibility to reproductive and child health care [33].

The Forum on Engaging the Private Sector in Child Health in an earlier report advised governments of low income settings to take urgent steps to engage the private sector in order to achieve health goals especially as they affect the child health [39]. The Forum made the following recommendations [39]: (1). Identify a suitable global-level host to act as a catalyst for developing public-private partnerships; (2). Carry out evidence-based advocacy at all levels to stimulate public-private partnerships for child health; (3). Develop a policy environment to support implementation at scale; (4). Include public-private partnerships in all health sector and multi-sectoral development plans; (5). Support implementation at scale by strengthening capacities of both public and private sectors; (6). Support improved organization of professional associations and coalitions; (7). Increase funding available to develop public-private partnerships for child health; (8). Monitor the effect of private sector partnerships on reaching the hard to reach and underserved; (9). Pay particular attention to incentives / motivating factors; (10). Conduct interventions to influence consumer demand for quality services; (11). Invest in better testing, monitoring, evaluation and operational research.

Policy Option 4: Establishing effective Health insurance schemes through strong health systems reforms.

Health insurance scheme is one of the intervention packages with a very high potential of improving the MNCH as shown by EQUIST. The objective of establishing functional and effective health insurance schemes is not to follow a universal coverage model that exists elsewhere, but rather to design one that is adapted to the needs of the region and evolves as progress is achieved [25]. In Africa, irrespective of the existence of multi-ethnic, cultural, tradition, lingual and religious diversity and differences, there is still a very strong social bonding which manifests in the establishment of homogenous social groups. The social groups are formed principally for the social benefits of members. Hence the existence of some sort of social insurance established by the groups to help members when they are need especially in case of ill-health.

In Burkina Faso as in any other African country, any health insurance scheme that is anchored on social bonding culture of the population is most likely to succeed. This is important because available reports have indicated that the so-called formal health insurance scheme has not really worked in most of the African countries [40-42]. Of all the types of health insurance schemes, the Community-Based Health Insurance (CBHI) and Mutual Health Insurance (MHI) schemes have been shown to have the highest potential of success in a population where strong social bonding exists [43-45]. A typical example of success is the case of Senegal where the pooling of resources helps to increase the solvency of the poorest patients, especially in rural areas, where mutual health organizations (*les mutuelles de santé*) have fuelled attendance in health institutions and a decline in health expenditure among the poorest members of the various communities [25,46].

Policy Option 5: Focusing the health systems on diseases and risks that affect the largest number of people and the poorest.

Through EQUIST, the diseases and risks that are responsible for the largest number of maternal and child deaths have been identified. It is important to concentrate on high-impact operations that have proven their worth, because although such operations have been identified, they are still under-utilized and inadequately financed [25]. Special attention has to be paid to the reduction of inequalities to ensure that the most disadvantaged communities benefit from public investments, considering income, gender and geographical (urban-rural and region) inequalities [25].

It is crucial to understand main the causes of deaths to enable improved planning and targeting of interventions. EQUIST analysis indicated that the four diseases responsible for most of the under-five deaths are neonatal causes, malaria, pneumonia and diarrhoea, while the six diseases responsible for

the highest maternal mortality included ante-partum haemorrhage, intra-partum haemorrhage, post-partum haemorrhage, hypertensive disorder, maternal sepsis and complicated abortion. Targeting interventions toward major causes of death and risk factors is a critical step toward achieving success [47]. Because much of the burden of maternal and child mortality and ill health is concentrated among the poorest populations, the highest mortality is observed among the marginalized and poor, who frequently reside in remote and rural areas with limited access to health care services [47]. Bhutta and Black [47] noted from an earlier study of Bocquier and colleagues [48] that the clustering of deaths among the rural and the poorest population also reflects the lack of access to quality health services in both rural and urban settings for a number of reasons, including the paucity of trained medical personnel and transportation facilities in rural populations and the lack of knowledge about health services among marginalized, socially isolated migrant families in urban slums.

In a recent Fact sheet on reducing mortality among children [49], the WHO calls on Member States to address health equity through universal health coverage so that all children irrespective of status (whether among the rural or poorest population) are able to access essential health services without undue financial hardship. WHO further noted that strategic direction and an optimal mix of community and facility-based care would be required to move from “business as usual” to innovative, multiple, and tailored approaches to increase access, coverage, and quality of child health services will [49]. Two very important ways of achieving this are: (i). provision of appropriate delivery platforms for scaling up coverage, especially in circumstances in which there is a widespread shortage of health workers [50]; (ii). removal of financial barriers that preclude the seeking of care and access to health services in areas in which such care is not freely available within the public health system [51].

Contributing to this discourse, Filippi and colleagues [52] suggested using the WHO health systems perspective to address maternal mortality and morbidity, noting that the maternal mortality level is one of the best criteria for assessing the relative performance of health systems. According to them focusing the health systems on diseases and risks that affect the largest number of people and the poorest entails ensuring the following [52,53]: (i). quality of service delivery and referral system; (ii). number, distribution, and training of the types of providers required, including midwives and obstetrician-gynecologists; (iii). completeness and responsiveness of the health information system, including the adequacy of the Maternal Death Surveillance and Response; (iv). ease of access to essential medications, such as magnesium sulfate, misoprostol, and oxytocin, and the supplies necessary for blood transfusions; (v). leadership and financing, a particularly relevant issue in several Sub-Saharan African countries that have ended user fees; and (vi). governance, including the capacity

of authorities at various levels of the health system to put policies and management systems in place so that women's health can improve.

Policy Option 6: Curbing population growth and making the improvement of the status of women an utmost priority

Empowerment of women through access to health and education will facilitate the reduction of the fertility rate. Creating opportunities for women to be socially and economically empowered will enable them to lead meaningful careers and earn resources to adequately take care of their health. According to Santi and Weigert, the demographic dividend would have increased considerably if women had greater access to education and health and the goals to be achieved are the reduction of fertility and procreation risks, increase of the average age of marriage and the introduction of women into the labour market [25]. In an earlier report, UNICEF argued that helping governments provide a quality primary school education, a UNICEF priority, will benefit maternal and infant health – particularly education for girls [54]. UNICEF also noted the following [54]: (i). educating girls for six years or more drastically and consistently improves their prenatal care, postnatal care and childbirth survival rates; (ii). educating mothers also greatly cuts the death rate of children under five; (iii). educated girls have higher self-esteem, are more likely to avoid HIV infection, violence and exploitation, and to spread good health and sanitation practices to their families and throughout their communities; and (iv). an educated mother is more likely to send her children to school.

In a recent report by the United Nations Foundation (UNF) on private sector action for women's health and empowerment, a call was made for the recognition of the centrality of gender equality and the health and rights of girls and women—as emphasized in SDG 5 [55]. As part of efforts to improve the health of women, the UNF made a strong case for the following [55]: (i). investment in women's health and empowerment information; (ii). investment in women's health and empowerment through expanded services and improved policies; (iii). incorporating women's health into corporate women's empowerment and gender equality initiatives; and (iv). integrating gender and women's health into corporate codes, assessments, supplier guidance, and checklists.

Policy Option 7: Establishing accountability mechanisms in order to restore confidence in health services and increase efficiency in the delivery of health care services.

it is very important for accountability mechanisms to be established. This is imperative because most maternal deaths are not simply biological phenomena; many are in part explained by the lack of freedom and entitlements experienced by women and service providers, as well as by the lack of accountability of providers, health systems, and countries toward women and their families [56,57]. To achieve the target of decreasing the maternal mortality ratio to less than 70 per 100 000 live births

under the Sustainable Development Goals (SDGs), renewed focus and accountability toward ending preventable maternal deaths are needed [58]. Accountability has been defined as a process that allows governmental and other stakeholders to assess progress, identify problems, and take corrective action where necessary, it ensures that these same actors are held responsible for the commitments they have made towards achieving health agenda [59]. Improving health sector accountability is primordial for several reasons: it would lead to better management of health structures, improve the performance of health staff, build community confidence in the health system and ensure more efficient use of the financial, technical and human resources allocated to the sector [25]. Like political will, health sector accountability, is a part of a larger construct or health systems thinking that depends on structural, managerial, and financial, as well as power interests (among others) to transform the health sector to deliver better quality of MNCH care [60].

Accountability mechanisms are important for the improvement of maternal and newborn health, but they cannot stand alone, because it requires a context in which it can function—democracy, functional institutions, reliable evidence, and effective advocacy are all needed [61]. Improving MNCH quality of care and outcomes is seen as dependent not only on commitments and investments generally, but also increasingly on the strength of accountability for investments in relevant, evidence-based strategies [60,62]. Accountability remains a central part of United Nations global strategy to accelerate progress for women’s, children’s, and adolescent’s health (<http://www.everywomaneverychild.org/global-strategy-2>). The accountability framework, developed under the 2010 global strategy to accelerate women’s and children’s health, included recommendations for improvements in resource tracking; international and national oversight; and data monitoring, including maternal mortality [63,64]

The health of a country’s women and children is a moral, political, economic, and social imperative [64]. Therefore, accountability mechanisms can be political, legal, social, financial, managerial, or professional; formal or informal; and vary in strength depending on the reach of their recourse or sanction processes [60]. Consequently, a continuous monitor–review–act cycle is recommended, which includes national oversight, monitoring of results, multi-stakeholder reviews, and action—all ingredients of surveillance and response systems [65,66]. To ensure the success of the accountability process which can improvement of the MNCH outcomes, two national functions are critical. First, a sound health information system to collect and report health data. Second, a national deliberative mechanism to review these data, measure progress for country decision-makers, hold those decision-makers accountable to their people and to the global community, hold the global community accountable to countries, and devise remedies for remaining predicaments and barriers [64].

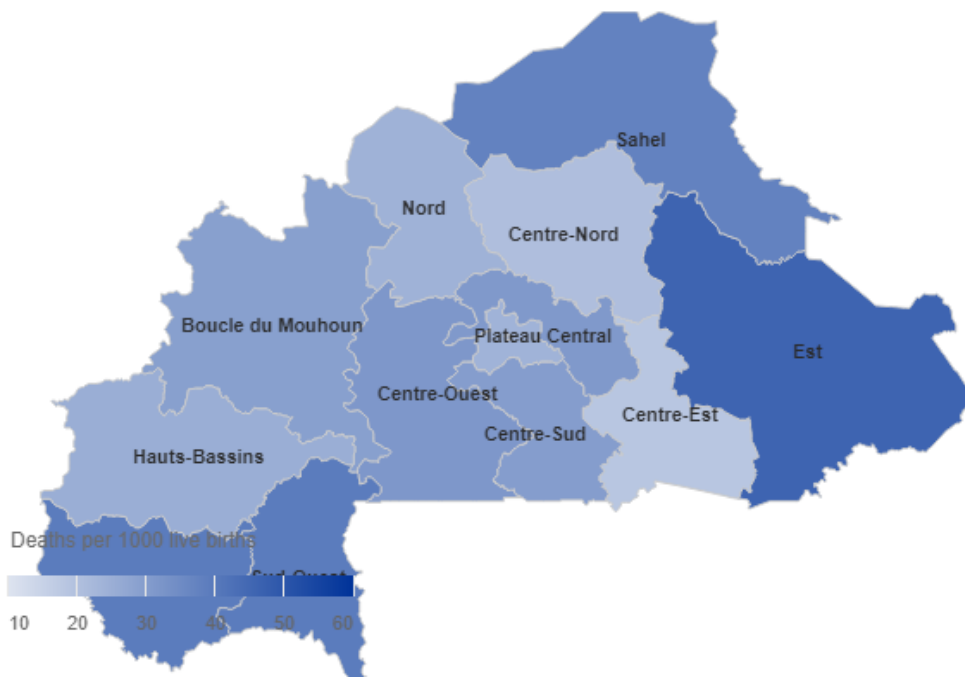


Fig 1. Map of Burkina Faso showing sub-national regions. Source: EQUIST

Table 1. Health profile of Burkina Faso

<i>Country parameters</i>	<i>Burkina Faso</i>
World bank income group	Low income
Total population in thousands (2015)	18,105.6
% Population under 15 (2015)	45.6
% Population over 60 (2015)	3.8
Life expectancy at birth (2015)	59.9 (Both sexes), 60.5 (Female), 59.1 (Male)
Neonatal mortality per 1000 live births (2016)	25.6 [18.7-34.8]
Under-five mortality rate per 1000 live births (2016)	84.6 [65.5-108.8]
Infant mortality rate per 1000 live births (2015)	54.4 [46.3-63.5]
Maternal mortality ration per 100 000 live births (2015)	371 [257 - 509]
Lifetime risk of maternal death (1 in N) (2010)	55
Total fertility rate (per woman) (2011)	5.8
Stillbirth rate (per 1000 total births) (2009)	26
Adolescent birth rate (per 1000 women) (2009)	130
% DTP3 Immunization coverage among 1-year-olds (2016)	91
% Births attended by skilled health workers (2010)	65.9
Infants exclusively breastfed for first 6 months of life (%) (2014)	50.1
Density of physicians per 1000 population (2012)	0.047
Density of nurses and midwives per 1000 population (2012)	0.63
Total expenditure on health as % GDP (2014)	4.96
General govt. expenditure on health as % of total government expenditure (2014)	11.16
Private expenditure on health as % of total expenditure on health (2014)	47.70
Adult (15+) literacy rate total (2007-2012)	29
Population using improved drinking-water sources (%) (2012)	82 (Total), 76 (Rural), 97 (Urban)
Population using improved sanitation facilities (%) (2017)	20 (Total), 50.4 (Urban) 6.7 (Rural)
Poverty headcount ratio at \$1.25 a day (PPP) (% of population) (2009)	44.6
Human Development Index rank (2014)	183

Table 2. Summary of intervention package to address the epidemiological issues responsible for maternal and under-five mortality among the poorest population in Burkina Faso

<i>Intervention package</i>	<i>Description</i>
Family care practices	
WASH	Improved water source Hand washing with soap
ITNs/Environmental safety	ITN/IRS - ownership of insecticide treated bednets (ITN) or household protected by indoor residual spraying
Neonatal & infant feeding & care	Exclusive breastfeeding
Preventive services	
Immunization plus	DTP3 Measles
Curative services	
Integrated Management of Neonatal & Childhood Illness (IMNCI)	Oral antibiotics for neonates
Delivery by skilled professional	Clean birth practices
Emergency Obstetric and Newborn Care (EMONC)	Case management of severe neonatal infection

Table 3. Description of the EQUIST coverage determinants, bottleneck, cause of the bottleneck and recommendations to address them.

Coverage Determinant	Bottleneck	Cause of bottleneck	Strategy to address bottleneck
Supply condition for utilization			
Availability of commodity	Availability of commodities	Delayed or insufficient procurement	Ensure timely and adequate procurement
		Inadequate storage and distribution	Ensure adequate storage and distribution
		Inadequate equipment for local storage and distribution	Improve equipment for local storage and distribution
Availability of human resources	Accessibility	Inadequate numbers/distribution of access points/ facilities	Increase the number and improve distribution of access points/facilities
		Inadequate accountability	Ensure accountability mechanisms
Geographical accessibility	Accessibility	Contextual challenges (insecurity, informal settlements, difficult terrain, nomadism)	Strategies for accessing hard-to-reach areas
Demand conditions for utilization			
Financial affordability	Affordability	Direct financial barriers (OOP at point of service)	Reduce direct financial barriers (OOP at point of service)
		Indirect financial barriers (transport, opportunity costs, etc.)	Reduce indirect financial barriers
Sociocultural acceptability	Acceptability	Lack of awareness and misconceptions regarding interventions/practices	Improve knowledge and awareness about key health behaviours
		Weak social support for desirable practices (traditional beliefs and social norms)	Improve social support for desirable practices
Measures of coverage			
Initial utilization	-	-	-
Adequate coverage	Continuity	Lack of awareness/ misconceptions about the importance of timely and continued care-seeking	Improve knowledge and awareness about timeliness and continuity of care seeking and family practices
		Inadequate management/ incentives for providers	Incentive mechanisms for providers for continuity and timeliness
Effective coverage	Quality	Provider lacking required equipment or infrastructure	Adequate equipment or infrastructure
		Provider lacking motivation to ensure quality of care	Monitoring, motivation and accountability mechanisms to ensure quality of care

Table 4. Description of the EQUIST coverage enabling environment and strategies to address bottlenecks.

<i>EQUIST coverage enabling environment</i>	
Enabling environment	Causes
Social Norms	Limited decision power of pregnant women and mothers Misconceptions about origin of disease and effectiveness of interventions Entrenched preference for traditional methods/practitioners
Legislation / Policy	Outdated policies/strategies (excludes current technologies/good practices) Inadequate/unclear policies/strategies Ineffective regulation for private providers
Budget / Expenditure	Insufficient/inadequate allocation due to low political priority Unpredictable/ insufficient flow of funds to lower levels Excessive dependency on donors
Management / Coordination	Inadequate/lacking mechanisms for coordination of partners/stakeholders Weak management capacities and processes Unclear institutional leadership and accountabilities
EQUIST strategies to address bottlenecks and their causes	
Strategies	Description
Financing	Vouchers Health insurance Supply-side financial incentives Conditional cash transfers
Service Delivery	Service integration Building/rehabilitations of facilities Quality improvement Community education and outreach
Medical products, vaccines and technologies	Pharmaceutical stock management Ensure timely procurement of key commodities Pharmaceutical cost control
Health workforce	Redeployment/relocation of existing staff Pre-service training and recruitment of new staff Task sharing/task shifting Leadership and Management training
Governance/ Leadership	Health System Accountability
Information	Patient reminders Health information systems strengthening

Table 5. Under-five and Neonatal mortality by Sub-National Regions, Wealth and Residence (IGME) in Burkina Faso (2010 DHS)

Parameter	National Average Deaths/1000 live births	By Sub-National Region Deaths/1000 live births (Number of deaths)		By Resident Deaths/1000 live births (Number of deaths)		By Wealth Deaths/1000 live births (Number of deaths)	
		Highest	Lowest	Rural	Urban	Poorest	Richest
Under-five mortality	114	Sahel: 181(9,573)	Centre-Est: 60(3,121)	120(58,279)	80(11,748)	134(17,071)	74(7,503)
Neonatal mortality	30	Est: 46(2920)	Centre-Nord: 21(1129)	31(15204)	26(3796)	29(3719)	22(2220)

Table 6. Six West African Countries Under-five mortality numbers by six major Epidemiological Causes in Burkina Faso (2010 DHS)

<i>Under-five mortality numbers by six major Epidemiological Causes</i>						
Situational description	Neonatal causes	Injuries	Malaria	Meningitis	Pneumonia (U5)	Diarrhoea (U5)
Sahel	1993	386	1997	352	2020	1480
Centre-Est	958	177	689	73	346	369
Rural	15205	2848	12623	1560	9109	8054
Urban	3796	669	2574	349	1557	795
Poorest	3720	787	3836	481	2935	2723
Richest	2220	454	1449	258	1254	507
<i>Neonatal mortality numbers by six major Epidemiological Causes</i>						
Situational description	Congenital	Tetanus	Prematurity	Asphyxia	Pneumonia	Sepsis
Est	166	83	812	820	206	605
Centre (exc.Ouag)	15	7	74	75	85	251
Rural	909	457	4457	4501	953	2800
Urban	239	120	1175	1186	203	627
Poorest	218	109	1073	1084	245	706
Richest	139	69	679	685	123	383
<i>Maternal mortality numbers by six major Epidemiological Causes</i>						
Situational description	Ante-partum	Intra-partum	Post-partum	Hypertensive	Maternal sepsis	Complicated abortion
Boude du Mou.	23	3	42	45	29	27
Centre (exc.Ouaga)	8	0.84	14	15	10	9
Rural	170	18	308	324	209	195
Urban	35	4	63	67	43	40
Poorest	44	5	80	85	55	51
Richest	36	4	65	68	44	41

Table 7. Percentage of health intervention effective coverage by residence and wealth in Burkina Faso (2010 DHS)

<i>Situational description</i>	<i>Family Care Practices</i>			<i>Preventive Services</i>	<i>Curative Services</i>		
	WASH (Improved water source)	ITNs (ITN ownership)	NIF (Excl breast feeding)	Immunization Plus (DTP3)	IMNCI (Oral antibiotic case mgt)	Delivery by skilled professionals (Essential care)	EMONC (Case Mgt of prematurity)
National average	17	47	25	90	42	ND	25
Rural	7	48	25	89	37	ND	25
Urban	53	45	25	92	60	ND	25
Poorest	100	42	25	83	29	ND	25
Richest	59	48	25	93	52	ND	25

Table 8. Avertible deaths among the poorest by epidemiological cause and equity/operational frontier for under-five and maternal mortality in Burkina Faso (2010 DHS)

<i>Main causes of deaths avertible</i>	<i>Frontier</i>	
	Equity	Operational
Under-five mortality		
Malaria	1313	1745
Measles	216	169
Pneumonia (U5MR)	1026	862
Diarrhoea (U5MR)	2053	2016
Tetanus	11	21
Prematurity	4	639
Asphyxia	5	635
Sepsis	144	563
Maternal mortality		
Complicated abortion	0	27
Sepsis	0	27
Hypertensive disorders	0	47
Post-partum haemorrhage	2	46
Intra-partum haemorrhage	0.1	2
Ante-partum haemorrhage	0.94	20

Scenario Analysis

Table 9. Amenable deaths among the poorest by epidemiological cause and equity/operational frontier for under-five, neonatal and maternal mortality in Burkina Faso (2010 DHS)

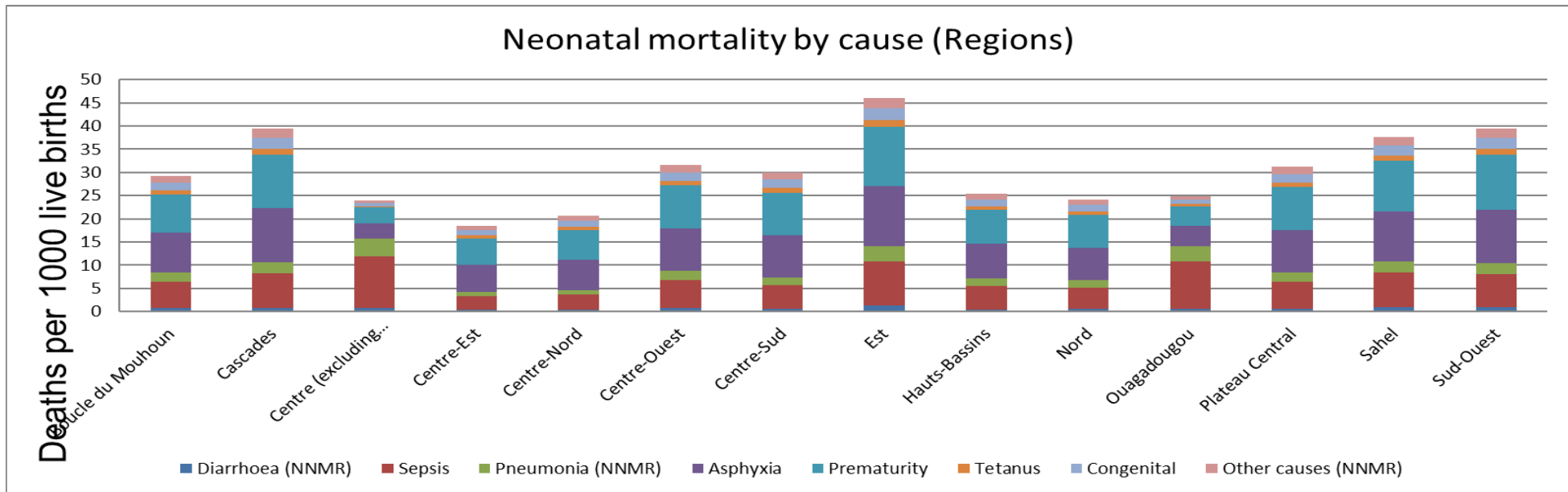
<i>Main causes of deaths avertible</i>	<i>Frontier</i>	
	Equity	Operational
Under-five mortality		
Pneumonia (U5MR)	600	613
Diarrhoea (U5MR)	842	638
Asphyxia	155	604
Malaria	193	440
Prematurity	58	60
Measles	135	67
Neonatal mortality		
Asphyxia	155	604
Sepsis	2	4
Prematurity	58	60
Pneumonia (NNMR)	-	1
Diarrhoea (NNMR)	28	21
Maternal mortality		
Ante-partum haemorrhage	-	21
Intra-partum haemorrhage	-	2
Post-partum haemorrhage	0.75	38
Hypertensive disorders	-	27

Table 10. Amenable deaths among the poorest by intervention package and equity/operational frontier for under-five and maternal mortality in Burkina Faso (2010 DHS)

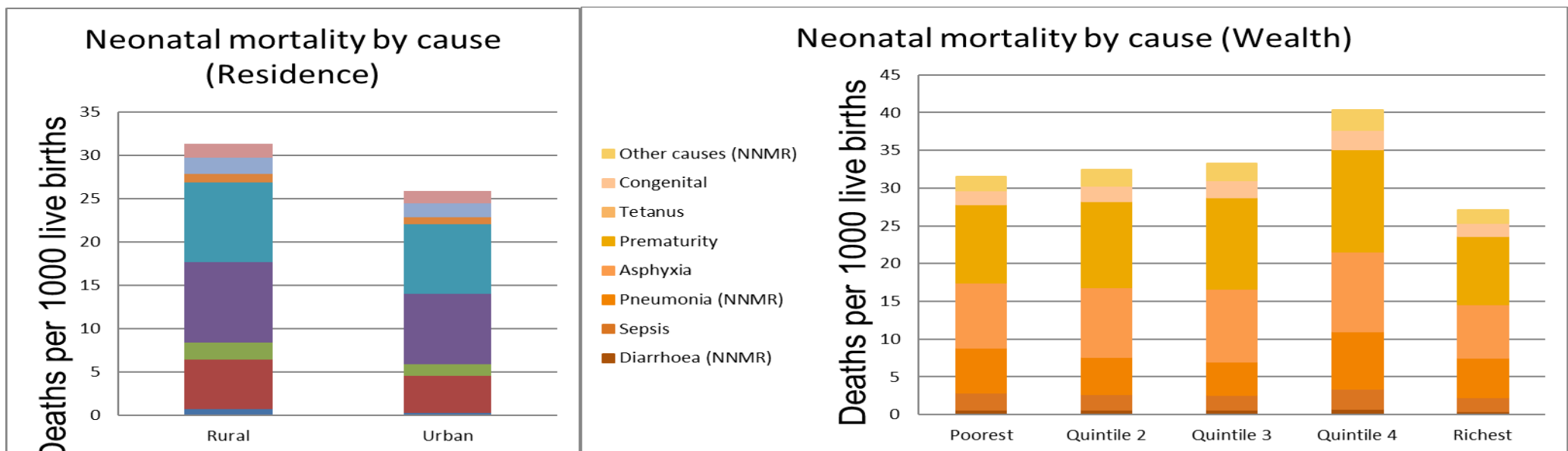
<i>Main intervention package</i>	<i>Frontier</i>	
	Equity	Operational
Delivery by skilled professional	208	653
IMNCI	554	576
ITNs/Environmental safety	202	462
WASH	941	711
Immunization plus	161	66
Amenable maternal deaths by package and equity/operational frontier among the poorest		
Delivery by skilled professional	-	96

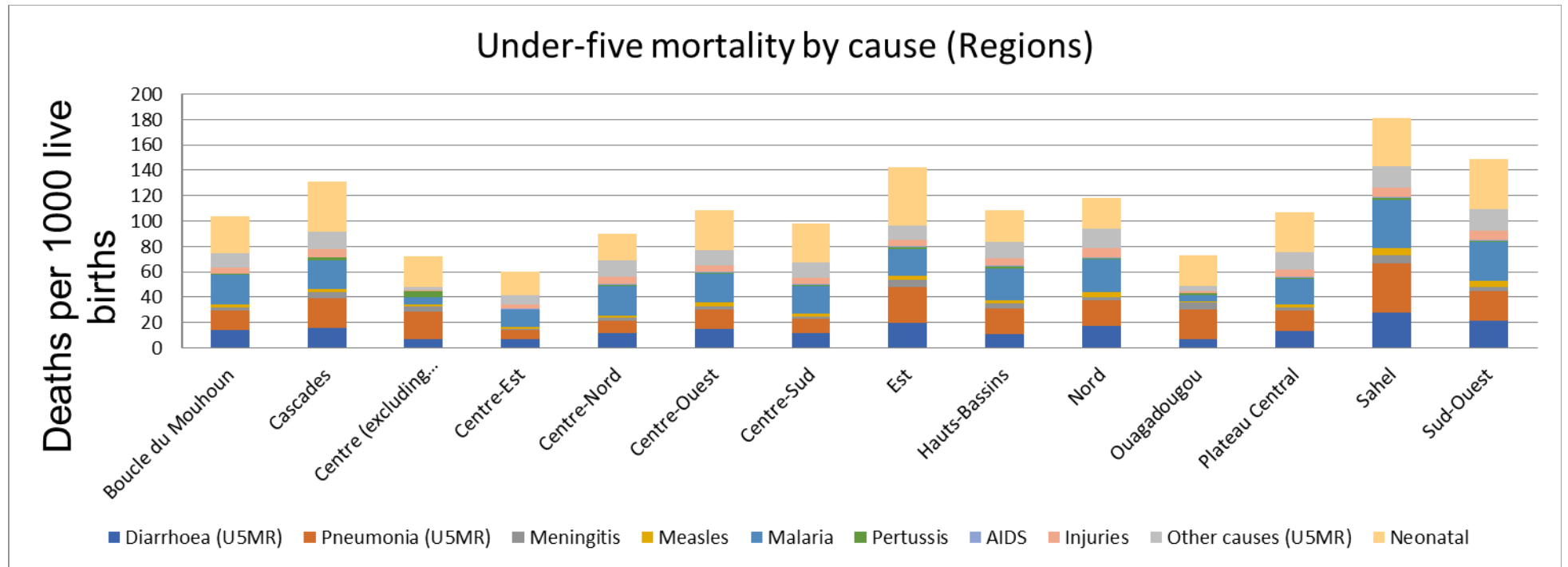
Table 11. Cost of intervention in USD (\$) to avert mortality among the poorest by in Burkina Faso (2010 DHS)

<i>Intervention strategy</i>	<i>Cost</i>
Conditional cash transfer	1,173,987
Vouchers	1,173,987
Health insurance	1,173,987
Supply-side financial incentives	499,389
Pharmaceutical cost control	-
Community education & outreach	131,753
Redeployment/relocation of existing staff	2,327,896
Leadership and management training	971,035
Health systems accountability	971,035
Task-shifting/task sharing	1,163,948
Ensure timely procurement of key commodities	-
Pharmaceutical stock management	-
Pre-service training/recruitment	11,272
Pharmaceutical quality regulation	-
Cost per capita	3.0

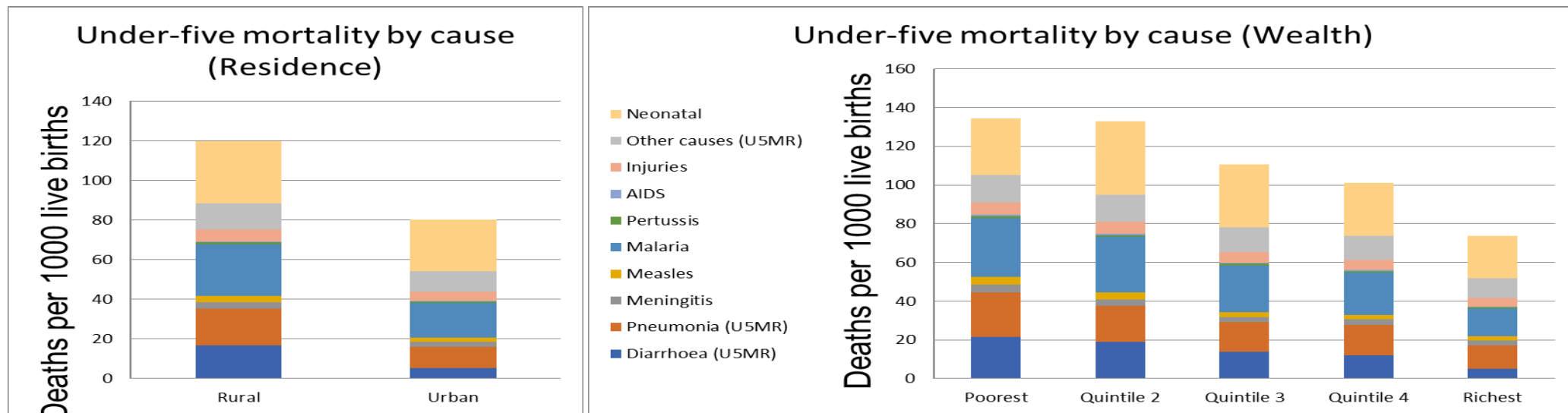


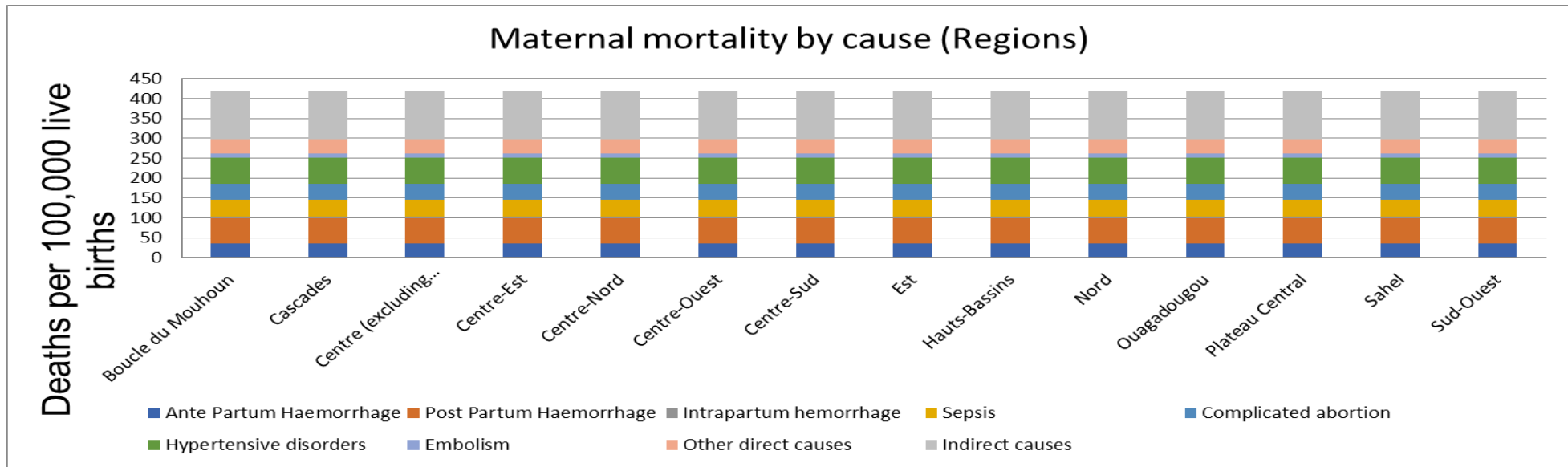
Figures 2-4. Burkina Faso Neonatal mortality by cause (Sub-National) (Figure 2), Residence (Figure 3) and Wealth (Figure 4)



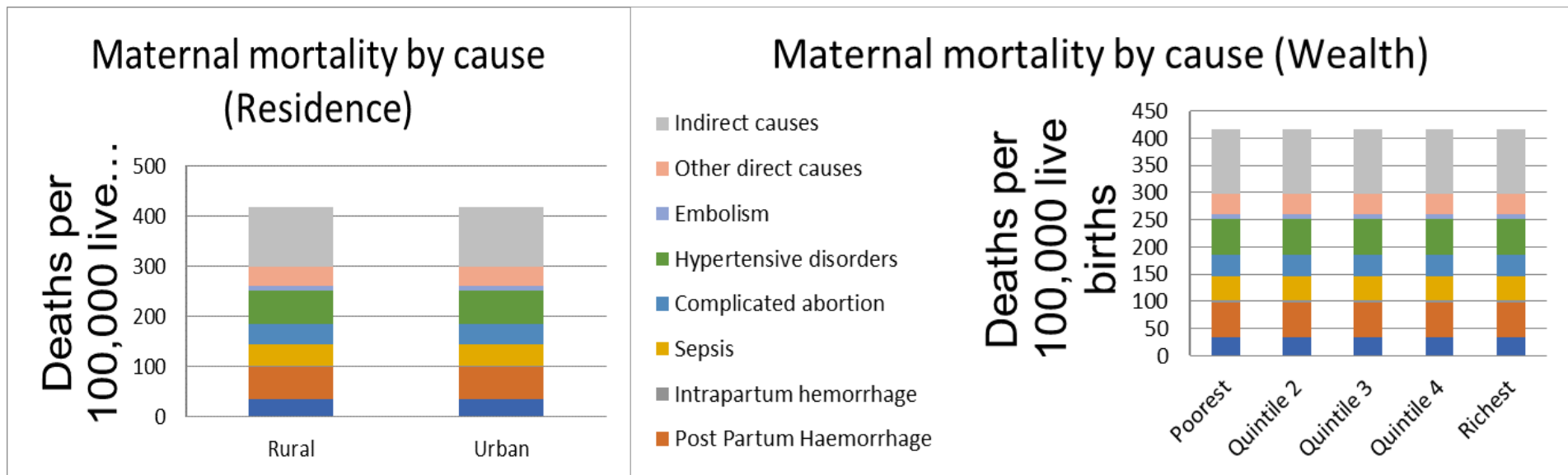


Figures 5-7. Burkina Faso Under five mortality by cause (Sub-National) (Figure 5), Residence (Figure 6) and Wealth (Figure 7)





Figures 8-10. Burkina Faso maternal mortality by cause (Sub-National) (Figure 8), Residence (Figure 9) and Wealth (Figure 10)



Outcome of EQUISIT Scenario analysis for poorest quintile in Burkina Faso

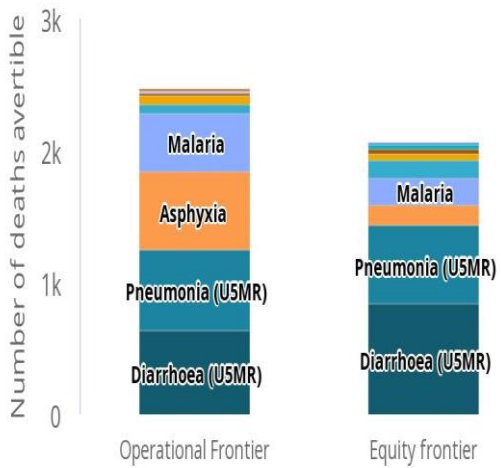


Fig 11. Avertible under-five mortality by cause

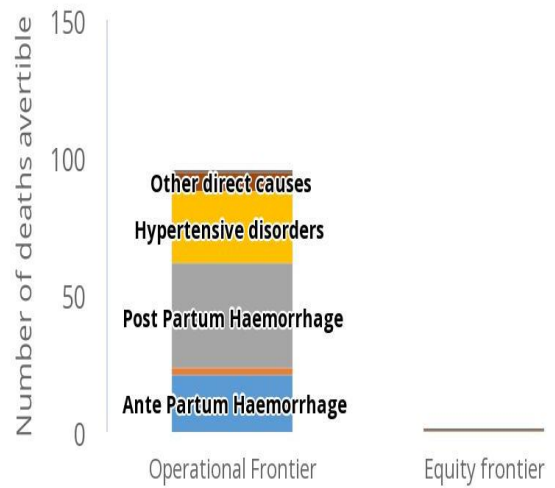


Fig 12. Avertible maternal mortality by cause

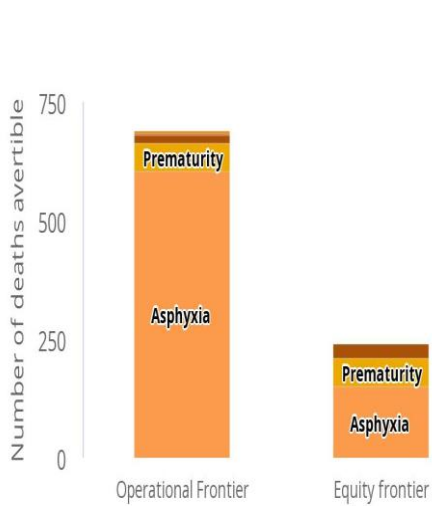


Fig 13. Avertible neonatal mortality by cause

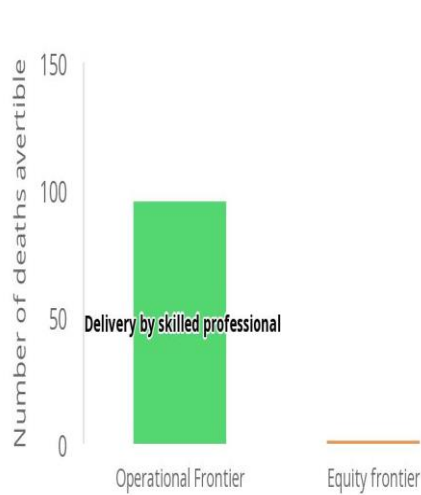


Fig 14. Avertible maternal mortality by intervention package

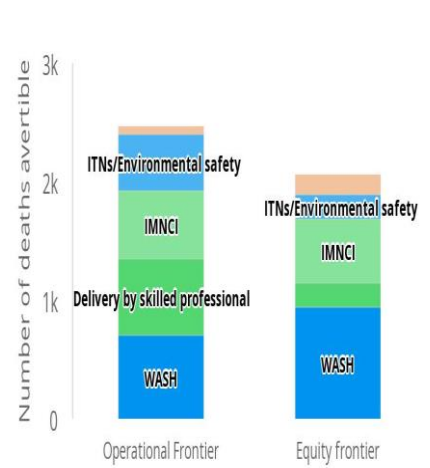


Fig 15. Avertible under-five mortality by intervention package

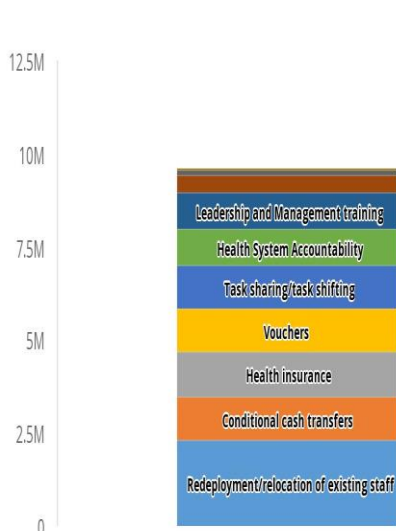


Fig 16. Estimates of cost generation for the analysis

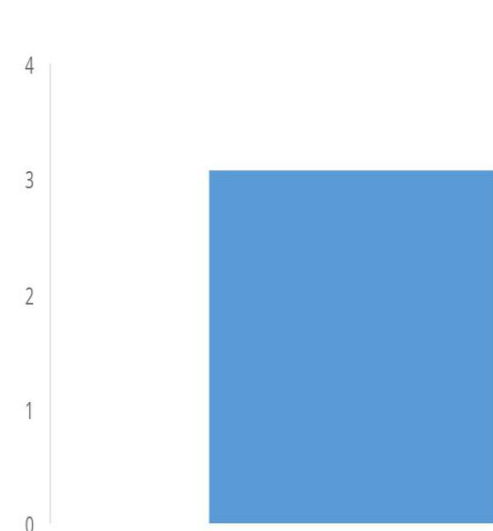


Fig 17. Cost per capita of avertible number of deaths in the scenario

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