The Cost and Impact of Integrated Community Case Management (iCCM) in Burkina Faso

Studies from the Nord, Centre-Nord, and Boucle du Mouhoun Regions

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Acronyms

ACT	Artemisinin-based combination therapy
AIS	Agent Itinéraire de Santé (Itinerant Health Agent)
ARI	Acute respiratory infection
ASBC	Agent de santé a base communautaire (community health worker)
BMGF	Bill and Melinda Gates Foundation
CAMEG	Centrale d'Achat des Médicaments Essentiels Génériques (Central Agency for the Purchase of Generic Essential Drugs)
CBHI	Community-based health insurance
CFA	West African CFA franc
CHW	Community Health Worker
COGES	Comité de Gestion (Community Health Management Committee)
CSPS	Centre de Santé et de Promotion Sociale (Center for Health and Social Promotion)
ECD	Equipe Cadre du District (District Health Management Team)
iCCM	Integrated Community Case Management
ICP	Infirmier Chef de Poste
IDE	Infirmier d'Etat
LiST	Lives Saved Tool
MBB	Marginal budgeting for bottlenecks
MDG	Millennium Development Goal
MOH	Ministry of Health
MSH	Management Sciences for Health
NGO	Non-government organization
ORS	Oral rehydration solution
PCIME-C	Prise en charge intégrée de la maladie de l'enfant au niveau communautaire (iCCM)
PMNCH	Project d'Accélération de la Réduction de la Mortalité Maternelle, Néonatale et Infanto-Juvénile (Partnership for maternal, neonatal and child health)
Tdh	Terre des Hommes
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Executive Summary

Integrated community case management (iCCM) is considered to be an effective strategy for expanding the treatment of diarrhea, pneumonia, and malaria, which are the leading causes of child mortality and result in nearly 44 percent of deaths worldwide in child under five years old.[1] Despite the success of this strategy in several low-income countries, iCCM programs in many other countries have yet to be implemented or expanded partly due to concern or uncertainty about the costs and financing of the intervention as well as the corresponding health outcomes from the investment.

At the request of the Bill and Melinda Gates Foundation (BMGF), MSH developed investment cases for scaling up iCCM programs in Burkina Faso and Nigeria. Using the USAID iCCM Costing and Financing Tool, MSH detailed the costs of investing in iCCM and CHWs, referred to as *agents de sante à base communautaire* (ASBCs), under certain condition as well as the estimated return on investment (e.g. quantitative health outcomes) by using the Lives Saved Tool (LiST).

Despite increasing investment into the country's primary healthcare system, Burkina Faso's population of more than 17 million persons[2] experience a significant unmet need for basic health services, particularly those living in rural hard-to-reach areas who face significant geographic and financial barriers. Consequently, Burkina Faso ranks fourteenth globally in under-five mortality with an average of 102 deaths per 1,000 live births.[3]

To reduce under-five mortality, the MOH, through funding from the BMGF and technical assistance from UNICEF, launched the Project d'Accélération de la Réduction de la Mortalité Maternelle, Néonatale et Infanto-Juvénile (PMNCH) in the Nord and Centre-Nord regions, which experience some of the highest rates of infant and child mortality in the country. To achieve this objective, the PMNCH implemented six strategies to improve maternal, neonatal, and infant health including the expansion of integrated management of childhood illness (IMCI) to all health facilities and the introduction of iCCM in two regions. The full package of iCCM treatment (diarrhea, malaria, and pneumonia) was introduced in all villages in two districts (Barsalogho and Gourcy) in the two regions while implementation of community-based malaria and diarrhea treatment was introduced in the villages of the seven remaining districts in the two regions. While financing for the PMNCH was projected to end in December 2013, certain activities continued into 2014 yet financing for future activities has remained uncertain.

The purpose of this exercise was to project the costs and impact of scaling-up the full package of iCCM in the Nord and Centre-Nord regions as well as projecting the costs and impact of the potential introduction of an iCCM program in the Boucle du Mouhoun region. This report is intended to help the Burkina Faso MOH understand the cost-effectiveness of iCCM and to provide an evidence base for it to advocate with the Ministry of Finance, stakeholders, and donors, such as Global Fund Against AIDS, TB, and Malarai (GFATM) for funding to maintain and expand these services.

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[1] Black RE, Cousens S. Johnson HL, Lawn JE, Rudan I, Bassani DG, et al. Global, regional, and national causes of child mortality in 2008 : a systemic analysis. Lancet. 2010; 375: 1969-87. Medline: 20466419 doi: 10.1016/S0140-6736(10)60549-1

[2] World Bank, 2014. http://data.worldbank.org/country/burkina-faso

[3] UNICEF, 2013. http://www.unicef.org/infobycountry/burkinafaso_statistics.html

This analysis includes projections of the numbers of under-five cases of diarrhea, fever, malaria, and pneumonia occurring in these regions, identification of systemic bottlenecks, as well as the estimated costs and impact (i.e. lives saved) of treating these cases under service delivery coverage scenarios. To understand the costs and impact of iCCM in these regions, this analysis includes three service delivery coverage scenarios: low, medium and high utilization of iCCM services. Only additional costs – i.e. those needed to supplement the programmatic costs already covered by the government are shown. These include costs related to medicines and supplies, BCC/IEC and communications support, refresher training of ASBCs, training of replacement ASBCs, and supervision and meeting costs. MOH staff salaries are excluded from this analysis as it is assumed that they are already covered by the government; however, this analysis does include the newly-proposed ASBC salaries (20,000 CFA/month)[4] as they will have a major impact on program costs and it is not yet clear if the government will be able to fund these moving forward. All iCCM medicine costs are included even though patients currently pay for medicines under the PMNCH. The reason for this inclusion is because the availability of free medicines is important to achieve full iCCM coverage and because stock-outs are, reportedly, common. Such assumptions can be easily adjusted in the model to show the results of policy changes. Note that the costs in Nord and Centre-Nord regions assume that start-up training and equipping of ASBCs does not have to be repeated due to any interruption in the program.

The analysis shows the estimated actual additional costs for 2013 and the projected the numbers and services from 2014 through 2018. If the additional programmatic funding is not available for 2014, then the projections for 2014 and subsequent years could be applied to 2015; however, population growth should be taken into consideration. Projections are based on two changes in the iCCM package – the scale up of pneumonia treatment to the entire region (beyond the two districts) and the introduction of rapid diagnostic tests (RDTs) for malaria case management.

The figures shown in the following summary are also shown in Table 12 for easy comparison.

Nord Region

In 2013, a total of 133,937 cases of diarrhea, malaria, and pneumonia[5] were seen by ASBCs in the Nord region and the estimated recurrent cost of the program in that year was USD 517,685. The results of the three service delivery scenarios are:

- Low Utilization: by 2018 the number of cases would increase to 181,256. The additional cost would be USD 1,124,988 and the under-five child mortality rate would remain at 143.61 deaths per 1,000 live births.
- Medium Utilization: by 2018 the number of cases would increase to 420,245. The additional cost would be USD 1,301,414 and the under-five child mortality rate would fall from 143.61 to 137.13 deaths per 1,000 live births.
- High Utilization: by 2018 the number of cases would increase to 974,416. The additional cost would be USD 1,718,756 and the under-five child mortality rate would fall from 143.61 to 124.98 per 1,000 live births.

[4] Burkina Faso MOH, June 2014. Profil de l'agent de santé a base communautaire.
[5] UNICEF, 2013. The number of cases at the community level treated and referred by ASBCs in the Nord region (January to December, 2013). Pneumonia cases treated in 2013 are only for Gourcy district.

Centre-Nord Region

In 2013, a total of 48,252 cases of diarrhea, malaria, and pneumonia[6] were seen by ASBCs in the Centre-Nord region and the estimated recurrent cost of the project in that year was USD 400,455. The results of the three service delivery scenarios are:

- Low Utilization: by 2018 the number of cases would increase to 68,786. The additional cost would be USD 1,090,440 and the under-five child mortality rate would remain at 112.72 deaths per 1,000 live births.
- Medium Utilization: by 2018 the number of cases would increase to 321,520. The additional cost would be USD 1,277,013 and the under-five child mortality rate would fall from 112.72 to 107.40 deaths per 1,000 live births.
- High Utilization: by 2018 the number of cases would increase to 812,122. The additional cost would be USD 1,639,184 and the under-five child mortality rate would fall from 112.72 to 97.37 deaths per 1,000 live births.

Boucle du Mouhoun Region

In the Boucle du Mouhoun region, some ASBCs provide community-based malaria case management through funding from the GFATM. While the malaria case management program is in place nationwide, there was not enough information on costs and cases treated to be included in this exercise. Since there is no iCCM program in Boucle du Mouhoun, there is no historical programmatic cost shown. Therefore it assumed that the full need for community level malaria care would be met through the introduction of the full iCCM package. If available, the treatment and cost assumptions could be taken into consideration in the projected costs and impact modelling. The results of the three scenarios are:

- Under the Low Utilization Scenario, the number of cases would be 151,921 in 2014 and would increase to 170,326 in 2018. The additional cost would be USD 1,247,529 in 2015 plus USD 581,663 for start-up costs (i.e initial training and equipping of ASBCs). The total recurrent cost by 2018 would be USD 1,229,266. The under-five child mortality rate would be 131.84 per 1,000 live births in 2013 and would remain unchanged in 2018.
- Under the Medium Utilization Scenario, the number of cases would increase from 151,921 in 2014 to 401,969 in 2018. The additional recurrent cost would be USD 1,400,269 in 2018. The under-five child mortality rate would fall from 131.84 per 1,000 live births in 2014 to 127.55 in 2018.
- Under the High Utilization Scenario, the number of cases would rise from 151,921 in 2014 and increasing to 851,629 in 2018. The additional recurrent cost would be USD 1,732,217 in 2018. The under-five child mortality rate would fall from 131.84 in 2014 to 119.48 deaths per live births in 2018.

The bottlenecks to iCCM (i.e. inputs hampering the number of children receiving timely and appropriate treatment for pneumonia, diarrhea, and malaria) were identified through interviews with stakeholders at

[6] UNICEF, 2013. The number of cases at the community level treated and referred by ASBCs in the Centre-Nord region (January to December, 2013). Pneumonia cases treated in 2013 are only for Barsalogho district.

all levels of the health system including a small sample of the ASBCs and CSPS staff in the three regions. The key bottlenecks at were identified as:

- Stock-outs of essential medicines – sometimes lasting for up to months at a time – often resulting in a low utilization of iCCM services;
- Inability of some patients to pay for medicines, resulting in the inability of ASBCs to replenish their medicine stocks,
- Unwillingness of patients to pay for treatment from ASBCs resulting in a patient preference for accessing services at the CSPS (even if they are far away), which may result in delays in treatment;
- Low levels of supervision, untrained supervisors, and lack of funding for fuel;
- ASBCs unavailable to provide services due to the need to prioritize gainful work (i.e. income-generating activities);
- ASBCs discontinuing service provision due to lack of financial incentives compared with other projects, which also results in a loss of expertise and high costs or training and re-training new ASBCs;
- Insufficient numbers of ASBCs in many areas;

There are some limitations to the identification of bottlenecks due to the small sample size of those interviewed. Also, it is important to note that the estimated the cost of removing the bottlenecks was not included; for example, strengthening the supply chain to minimize the stockout of medicines. Therefore, the costs shown in the findings assume that the bottlenecks have been resolved and are only the costs of implementing iCCM – ASBC salaries, medicines, supplies, and equipment; ASBC training and deployment; and supervision. To some degree, if the reason for the bottleneck was lack of drugs, the provision of funding for iCCM medicines and supplies included in this costing analysis would remove this bottleneck. If the bottleneck is more systemic – e.g., a lack of secure storage or transport from the state level then additional resources would be needed. Moreover, the proposed payment of salaries to the ASBCs should address the above bottleneck on the need to for ASBCs to prioritize gainful work. The costs of supervision shown here exclude government salaries and only cover transport and per diem costs. If there are insufficient numbers of staff to supervise iCCM adequately then further investment in human resources may be needed.

This analysis provided insight into the historical costs as well as projected costs of scaling-up iCCM; however, there may be a need for additional research to better understand the following:

- An analysis of the cost of removing iCCM bottlenecks.
- A more detailed analysis of cost-effectiveness, taking into account financial and economic costs for both providers and patients.
- A study of the payment of ASBC incentives and the use of medicine mark-ups as effective incentives.
- A study of the ability of ASBCs to pay for refilling their medicine stocks and ways to reimburse ASBCs for losses of medicine mark-up revenue for patients who cannot pay.
- An analysis of the reasons for medicine stock-outs and ways to prevent them from occurring.

Background

Objective

Diarrhea, malaria, and pneumonia remain the leading causes of child mortality in sub-Saharan Africa and cause nearly 44 percent of deaths worldwide in children under five years old.[7] To improve access to life-saving treatment among children, many developing countries have begun implementing and scaling-up integrated community case management (iCCM), an effective strategy that focuses on the delivery of timely and low-cost interventions at the community level by trained community health workers. Despite the success of this strategy in several low-income countries, many countries have yet to implement or expand iCCM programs partly due to concern or uncertainty about the costs and financing of iCCM programs and the health outcomes that will result from the investment.

Through funding from the BMGF and technical assistance from UNICEF and the MOH, the three-year PMNCH began in July 2008 with the overall objective of contributing to reducing under-five mortality by 25 percent in all nine districts of the Nord and Centre-Nord regions by the end of 2011. Two principal strategies of the PMNCH is to expand IMCI to all health facilities and extend iCCM coverage to all villages in the Nord and Centre-Nord regions. The Nord and Centre-Nord regions were chosen as the two focus regions based on their high rates of infant and child mortality (231 and 198 deaths per live births, respectively, in 2003).[8] Due to a delayed start of operational activities, the project received an extension until the end of 2013 and at the time of this cost analysis, project activities were still ongoing; however, there was some uncertainty over future funding support for areas such as refresher training and supervision. To date, project funding has been managed by the MOH and the Programme d'Appui au Developpement Sanitaire (PADS).

With support from the BMGF's Treatment of the Sick Child Initiative,[9] MSH conducted a cost analysis of introducing and scaling-up iCCM in three regions of Burkina Faso: Nord, Centre-Nord, and Boucle du Mouhoun. MSH staff gathered costing data from the PMNCH which has been operating in Nord and Centre-Nord regions. For the Boucle du Mouhoun region, where the full package of iCCM has not been implemented, projected costs were based on the demographics of the region and the program design used in the PMNCH.

In addition to collecting this costing data, MSH conducted a bottleneck analysis of Burkina Faso's health system as it relates to the iCCM program in Nord and Centre-Nord regions. MSH staff identified barriers to accessing health care and potential constraints to the iCCM program (i.e. inputs hampering the number of children receiving timely and appropriate treatment for pneumonia, diarrhea, and malaria).

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[7] Black RE, Cousens S. Johnson HL, Lawn JE, Rudan I, Bassani DG, et al. Global, regional, and national causes of child mortality in 2008 : a systemic analysis. Lancet. 2010; 375: 1969-87. Medline: 20466419 doi: 10.1016/S0140-6736(10)60549-1

[8] EDS 2003. MOH. Rapport de mise en œuvre au 31 Decembre 2012. Projet d'appui à la accélération de la réduction de mortalité maternelle, néonatale et infanto-juvénile dans les régions sanitaires du Nord et du Centre-nord. Janvier 2013.

[9] The goal of the Treatment of the Sick Child Initiative is to reduce under-five child mortality by developing, testing, and expanding a package of cost-effective interventions to generate demand improve access to safe, appropriate, and timely treatment of childhood illness.

All estimated inputs were calculated using the Burkina Faso iCCM costing model which was adapted from the generic USAID iCCM Costing and Financing Tool developed under the USAID-funded Translating Research into Action (TRAction) project. The programmatic costs comprise start-up costs, service delivery costs at the community level, and support, supervision, and management costs. Programmatic costs do not include government salaries nor vehicles or equipment for supervisors and managers on the assumption that these costs are covered by the government. The newly-proposed ASBC salaries (20,000 CFA/month) were included in the costs assumptions as they will have a major impact on iCCM program costs and it is not yet clear if the government will be able to fund these salaries. We also included the costs of all iCCM medicines even though patients are currently supposed to pay for these. The reason for the inclusion of medicine costs is because the availability of free medicines is important to achieve full coverage and because stock-outs are, reportedly, common. All of the aforementioned assumptions can be easily adjusted in the model to show the results of policy changes. The results represent, therefore, the additional resources that may be needed to supplement existing government expenditure to implement iCCM.

As part of the exercise, MSH staff met with local stakeholders (MOH, UNICEF, WHO, implementing NGOs, etc.) and collected and compiled data on key health system inputs (e.g. human resource availability, supervision structures, supply chain systems, availability of medicines, health information systems, quality assurance, etc.) as well as relevant health information (e.g. incidence rates, population data, etc.) and costs associated with current iCCM programs and strategies (e.g. cost of medicines, supplies, equipment, trainings, salaries, supervision, etc.). In conjunction with these meetings, MSH staff conducted visits to the three target regions and, using a series of questionnaires, interviewed personnel at the regional level (Direction Régional), District level (District Sanitaire), and health clinic level (CSPS - Centre de Santé et de Promotion Sociale), as well as ASBCs working at the community level. The stakeholder meetings and data collection served as a 'reality check,' providing on-the-ground context for the costing analysis, the development of the investment case, as well for identifying bottlenecks relevant to an iCCM program (i.e. inputs hampering the number of children receiving timely and appropriate treatment for pneumonia, diarrhea, and malaria).

The results of this analysis will allow for a better understanding of the costs of continuing the full package of iCCM in the Nord and Centre-Nord regions and of the potential introduction of an iCCM program in the Boucle du Mouhoun region. The specific results will assist the MOH and donors in seeking a continuation of funding to maintain, re-start, or expand the work of the PMNCH in the Nord and Centre-Nord regions and to seek new funding to introduce an iCCM program in the Boucle du Mouhoun. The iCCM projection models for all regions can also be used quickly and easily to estimate the costs of implementing a new iCCM project in other regions of the country, on a national scale, or to prepare a full financing gap analysis. This includes helping the MOH and stakeholders to make a case to the GFATM for support of iCCM implementation.

Methodology

Data collection and sites visited

Data for this analysis were collected at five levels of the health system:

- At the central level, from the MOH's Direction de la Santé de la Famille as well as from key partners (UNICEF, WHO, and implementing NGOs);
- At the regional level (Direction Régional);
- At the district level (District Sanitaire), from the MOH's Equipe Cadre du District (ECD);
- At the health center (CSPS - Centre de Santé et de Promotion Sociale) with staff including ASBC supervisors; and
- At the village level with ASBCs.

Assumptions

Period of Analysis

The data collection visits took place in February and March 2014. For the Nord and Centre-Nord regions, actual reported iCCM caseload data and numbers of ASBCs are included for the baseline year of 2013. Projection figures, including the frequency of refresher trainings and resupplying of ASBC equipment, for the years 2014-2018 are based on input from MOH staff. For the Boucle du Mouhoun region, iCCM programmatic assumptions and structure are based on the PMNCH in order to project the introduction of a new iCCM program over five years, 2014-2018.

iCCM Package of Services

ASBCs implicated in the iCCM program in the Nord and Centre-Nord regions are trained to identify and treat non-severe cases of diarrhea and malaria as well as identify cases of malnutrition. ASBCs working in Gourcy and Barsalagho districts are also trained to identify and treat non-severe cases of pneumonia. In the event of any danger signs, the ASBC is supposed to refer the patient to the nearest CSPS.

According to the MOH, suspected pneumonia cases are assessed for rapid breathing using an ARI timer; positive cases (50+ breathes per minute in children 2-12 months or 40+ breathes per minute in children 12-59 months) are treated with cotrimoxizole, and negative cases are designated as cough and are not treated. Diarrhea is defined as a child who has three or more watery stools within 24 hours. Children 2-59 months with diarrhea are treated with ORS and zinc. All children with fever and corresponding malaria symptoms are treated presumptively with ACTs.[10]

For this analysis, the costs and impact of providing all three treatments for diarrhea, malaria, and pneumonia are modelled for the three regions. However, the standard treatment guidelines have been modified to be in compliance with WHO and international recommendations for iCCM. Therefore,

[10] There is currently a PECADO program that supports ASBCs who only provide malaria treatment. This program has been carried out throughout the country through assistance from NGOs. In the past, the PECADO programs have provided monetary payments to CHWs.

pneumonia treatment with cotrimoxazole has been replaced with amoxicillin. In addition, the provision and use of rapid diagnostic tests (RDTs) at the community level has been included to improve malaria case management. Table 1 below shows a summary of the treatment protocols and estimated treatment times for each intervention in the iCCM package.

The unit costs of medicines were provided by the MOH and UNICEF; the MOH through the CAMEG - Centrale d'Achat des Médicaments Essentiels Génériques (Central Agency for the Purchase of Generic Essential Drugs) led the iCCM drug procurement in 2013. These unit costs exclude the cost of procurement and transport.[11]

Table 1: Treatment protocols and costs for diarrhea, pneumonia, and malaria (USD)[12]

	Medicines **and s**upplies needed	Average medicine cost per episode (USD)
Pneumonia	Amoxicillin 250mg	0.85
Diarrhea	ORS + Zinc 20mg	0.20
Malaria	RDT + ACT (Artemether 20mg+Lumefantrine120mg)	1.49
Fever (RDT-negative)	RDT + paracetamol 100mg	0.80

Population and Geographic Coverage Targets

The total population covered by the MOH's iCCM program in Nord and Centre-Nord regions in 2013 was 1,421,253 and 1,502,994, respectively covering a total combined population of 2,924,247 persons. Through funding from the BMGF, the PMNCH covered all the villages in the nine districts which comprise the two regions.

Initially, only ABSCs located five km and more from the CSPS were supposed to provide iCCM services while ASBCs living within five km from the CSPS were to conduct outreach education and provide referrals only. However, it was found that villages less than five km from the CSPS are often inaccessible during the year and such a policy would limit the availability of iCCM service provision. Therefore, the MOH and stakeholders decided that all ASBCs, except for those living in a village with a CSPS, were to provide both iCCM services, education awareness, and referrals.[13]

The village-based ASBCs work in their own village and in most cases there are two ASBCs per village (one male and one female). The villages covered by ASBCs vary considerably in terms of access to CSPS with some villages nearby the CSPS and others reportedly more than 20 km away (sometimes more

[11] Note – the cost of transport and storage was accounted for by adding 10% onto the total medicines cost. Cost of buffer stock and wastage was also calculated at 10%.
[12] These prices were obtained from various sources in country and would need to be reviewed depending on the procurement source and in country handling mark-up.
[13] Kabore Ferdinand (Attaché de Santé – Direction de la Santé de la Famille), E-mail correspondance to Colin Gilmartin (Management Sciences for Health, Arlington, VA, USA). July 23, 2014.

than 40 km). In 2013, in the two regions, there were 4,084 ASBCs working in 366 CSPS catchment areas, which consist of a total of approximately 2,078 villages. The MOH anticipates maintaining the same number of ASBCs, CSPS, and villages in the future, and therefore these assumptions were reflected in the iCCM costing model. In other words, the number of CSPS and villages is maintained and it assumed that 4,064 ASBCs will be adequate to cover the geographic areas. Only the population increases due to the annual population growth rate of 2.9 percent.[14]

For the Nord and Centre-Nord regions, the actual 2013 PMNCH coverage and estimated cost was used as the baseline and then projected an additional five years using the same geographic coverage, but increasing the population based on the growth rate mentioned above. It was assumed that pneumonia treatment would be scaled up to all villages in the Nord and Centre-Nord regions in 2014 and that RDTs would be introduced in the same year. For the Boucle du Mouhoun region, the existing number of ASBCs was used (although they are not currently providing iCCM), as reported by the MOH. Table 2 shows the assumptions used for baseline coverage in 2013.

Table 2. Coverage assumptions, Nord, Centre-Nord, and Boucle du Mouhoun regions[15]

	Nord	Centre-Nord	Boucle du Mouhoun
Number of districts with iCCM coverage	5	4	6
Number of CSPS supervising iCCM	219	147	164
Number of Villages providing iCCM	1,020	1,058	1,194
Target population covered by iCCM (all ages)	1,421,253	1,502,994	1,771,896
Target population covered by iCCM (2-59 months)	262,932	278,054	327,801
Total Number of ASBCs	1,926	2,158	2,368

Incidence Rates

Incidence rates are input into the iCCM Costing and Financing Tool as the number of episodes per child per year. The following rates were provided by the MOH for use in the iCCM costing analysis: two episodes of malaria per child per year, and three episodes of diarrhea per child per year. The source for the pneumonia incidence figure of 0.35 episodes per child per year was a study by Rudan et al, 2010. Malaria incidence is similar throughout the Nord and Centre-Nord regions but is ostensibly higher in the rainy season during which physical access to health centers can be challenging.

Table 3 shows the summary of incidence rates input into the tool. The tool allows different incidence rates to be input for each year of the iCCM program – for example, if malaria incidence was expected to decline due to preventive activities, this could be reflected in the tool. However, in this case the incidence rates have been kept constant. In addition, the model anticipates that an estimated 10 percent of all cases seen by an ASBC will be referred to the health center.

[14] World Bank, 2014. http://devdata.worldbank.org/AAG/bfa_aag.pdf
[15] iCCM coverage was only for malaria and diarrhea except for two districts which included pneumonia.

Table 3. Incidence Rates for diarrhea, pneumonia, and malaria (episodes per child year)

iCCM service	Incidence rate (episodes / child / year)	Source
Pneumonia	0.35	Rudan et al. 2010
Diarrhea	3.00	Provided by MOH / DSF
Malaria	2.00	Provided by MOH / DSF
Fever (RDT-negative)	3.38	Source: WHO Malaria World Report 2008

Baseline Coverage

Actual caseload data for the baseline year, 2013, were provided by the MOH and UNICEF and input into the tool (see Table 4 below).

We calculated the percentage of actual iCCM coverage achieved in the baseline year by dividing total actual caseloads in 2013 by the expected number of cases for the same year. Expected numbers of cases are determined by multiplying the target population of children by the incidence rate of each disease. Percentage coverage is calculated by dividing the number of cases treated in 2013 by the expected number of cases. The numbers of cases are the total that require treatment and relate to all levels of treatment – not just at the community level.

In the case of pneumonia treatment in Nord region, for example, 29 percent of all cases were seen at the iCCM level and this is separate from the percentage that was treated at the CSPS and hospital level or by private providers. These percentages are, therefore, indicative of actual coverage rates rather than definitive. Malnutrition screening figures are reported separately but for the purposes of this analysis we have assumed that this is part of the routine screening provided when a child is examined for diarrhea, malaria, or pneumonia.

Table 4. iCCM cases treated, Nord and Centre-Nord regions, 2013

	Cases Actually Treated	Incidence Rate	Cases Expected	% Coverage
Nord				
Pneumonia*	3,854	0.35	13,287	29%
Diarrhea**	54,918	3.00	788,795	7%
Fever treated as malaria***	73,482	5.38	1,414,573	5%
Centre-Nord				
Pneumonia*	1,634	0.35	11,913	14%
Diarrhea**	5,572	3.00	834,162	1%
Fever treated as malaria***	39,725	5.38	1,495,272	3%

**Note: pneumonia treatment was provided in only one district per region, therefore the denominator used to determine coverage was smaller than the population for diarrhea and malaria coverage.*
***: Some diarrhea cases may be treated by family members at home, especially where training was provided.*

****Note: Because fever is treated symptomatically as malaria we showed the total of fever cases as the incidence rate for malaria.*

Using actual coverage for 2013, projections for the Nord and Centre-Nord regions were made assuming the expansion of pneumonia treatment to all districts and assuming a small increase in coverage to reflect population growth and increases in utilization. The projections for Boucle du Mouhoun are based on the start-up and expansion assumptions used in Nord and Centre-Nord regions.[16]

ASBC Availability and iCCM Service Delivery Assumptions

ASBCs were unpaid volunteer community health workers at the time of the analysis and they were not expected to work a standard number of hours per day or days per year. However, according to the *Profil de l'Agent de Santé a Base Communautaire* (June, 2014), ASBCs should be paid in the future (20,000 CFA/month) and therefore this salary information was included in the cost projections. As mentioned previously, ASBCs primarily serve their own village and are available upon request. ASBCs reported that the majority of patients would travel to the ASBC's house for treatment and that the ASBCs would typically conduct follow-up visits three days later, depending on the treatment provided.

For the purposes of this analysis, the actual number of ASBCs in Nord and Centre-Nord regions in 2013 was included in the tool. The MOH indicated its intention of maintaining the current ASBC levels at least through 2017 and thus the same number of ASBCs was included in projections for 2014-2017. In the case of Boucle du Mouhoun, the existing number of 2,368 ASBCs in 2013 was used in the projected years. An annual attrition rate of 5 percent for ASBCs was assumed as this was estimated by the MOH based on the number of ASBCs that left the program after being trained.

Based on the MSH questionnaires, the majority of ASBCs described themselves as available at all times of the day, and all days in the year (except for infrequent travel outside of the village), since patients are typically brought to their houses for treatment as needed. Since it is proposed that the ASBCs will be paid in future, a 40 hour working week has been assumed and that approximately 50 percent of the ASBC's time would be spent specifically providing iCCM-related services. The remaining time would be spent on other activities, such as health promotion and prevention activities, including, but not limited to vaccination campaigns, educational *causeries*, and accompanying women for delivery at the health center. It should be noted that the percent of time spent on iCCM is a key cost driver and significantly affects the costs, especially assuming the ASBCs will now receive a salary.

Management, Supervision, Meetings, and Trainings

Costs of management, supervision, meetings and trainings were primarily provided by the MOH (at the central, regional, and district levels) and UNICEF. For this analysis, only unfunded costs that would require an additional investment were included; therefore, MOH salary costs that are already funded have not been included. The salaries of MOH staff who manage and supervise the iCCM program at all levels are financed by the state and has been assumed the same moving forward. Thus, the costs of supervision and management relate only to the activity costs, comprising per diem, fuel, and incentives.

[16] At the time of the analysis, the MOH had no targets for implementation in Boucle du Mouhoun.

ASBCs are supposed to attend monthly meetings at the CSPS in order for the ASBC supervisor to receive reports from the ASBCs, give feedback to ASBCs, and replenish ASBCs' drug stock, if necessary. ASBCs submit monthly reports to the CSPS, which are then compiled and sent to the district, and then onto the regional level, and finally to the national level. Although there were no reported meeting costs, based on discussions with the ASBCs and their supervisors, greater incentive is required to ensure the monthly meetings take place and ASBCs attend. Therefore, the modelled costs include the provision of a standard per diem of 3,000 CFA per day per ASBC for each meeting or training.

Training costs in the iCCM tool are split between start-up trainings and refresher trainings. Start-up trainings are assumed to occur a single time for each new ASBC, whereas refresher trainings would be applied to the entire pool of ASBCs that are working in a given year. Start-up trainings also include an ASBC supervisor training. For purposes of this analysis, it is assumed that all ASBCs would require a new five-day iCCM training, since the majority were not trained in the three disease areas (pneumonia was only provided in two districts). A bi-annual three-day refresher training would also be provided.

Results

Bottlenecks

The following is a synthesis of responses describing iCCM bottlenecks, based on interviews in the Nord, Centre-Nord, and Boucle du Mouhoun regions of 32 ASBCs, CSPS staff, MOH staff at the district and regional level, in addition to MOH staff at the central level. The responses are organized according to the Tanahasi framework. This is an analysis of the bottlenecks of the existing iCCM programs (in the Nord and Centre Nord regions) and community-based health programs in Boucle du Mouhoun which are relevant to the potential future implementation of iCCM in the region.[17]

- **Availability of essential commodities**
  - All 32 ASBCs reported stockouts of essential commodities (e.g. ORS, Zinc, ACTs, paracetemol, and cotrimoxizole). According to those ASBCs interviewed, stock-outs have sometimes lasted up to several months at a time.
  - Many ASBCs reported requesting a new supply of medicines from their respective CSPS; however, due to stock-outs at the District level, ASBCs were forced to refer patients to the CSPS where they were treated with other supply stocks of anti-malarial drugs. Prolonged periods of stockouts reportedly can result in infrequent visits from sick patients seeking treatment from the ASBC.
  - The vast majority of ASBCs reported that when treatments are available, they are often forced to provide free treatment if the parent is unable to pay for the medications. Frequently, mothers come seeking treatment for their child and the ASBC must wait for their husband to pay, as mothers do not control or have access to family finances. Many patients ultimately do not pay for treatment and the ASBC loses money to refill his/her supply of medicines.
- **Availability of human resources**
  - All 32 ASBCs interviewed had reported receiving at least one supervision visit in the past year; the majority of whom received a supervision visit by CSPS during the last month (at the time of the interview).
  - Many ASBCs noted that there is high turnover of CSPS staff resulting in supervisors who have not received training on IMCI at the clinic level or training on iCCM at community level resulting in poor quality of ASBC supervision.
  - Regional and district offices reported high rates of ASBC abandonment due to insufficient financial motivation. Consequently, district health offices and ICPs are required to train new replacement ASBCs. In addition, CSPS motivation is often insufficient because there are staff who work long hours seven days per week for a minimal salary. Consequently, CSPS staff are sometimes not motivated to provide adequate ASBC supervision.

[17] As opposed to an analysis of the bottlenecks at the health center and district level that are the justification for implementing the iCCM programs.

- Several districts reported delays in the financing the ASBC supervision (to cover gas and per diem for the Equipe Cadre du District and CSPS staff). As a result, District staff were unable to plan for their annual activities and sometimes delayed supervision visits to ASBCs. CSPS staff reported integrating ASBC supervision with vaccination campaigns but recognized that integrated visits did not allow for sufficient time to conduct quality supervision of ASBCs.

- **Physical access to services**
  - In many areas, patient access to ASBCs remains limited. For example, according to MOH staff interviewed in Kaya district, there are 684 ASBCs in Kaya district, but there should perhaps be at least 300 more given that many people live in areas eight to 10 kilometers from the ASBCs.
  - Many CSPS staff reported that there is not enough money to pay for fuel for transport for ASBC supervision to cover all the villages in their respective aire de santé.

- **Initial utilization**
  - In areas where user-fee exemption programs are being implemented, ASBCs have reported that some parents of sick children prefer accessing free healthcare services at the CSPS rather than paying for treatment from the ASBCs. According to Terre des Hommes (TDH) which serves as a substitute third party payer, attendance of children under five years has multiplied by seven in Tougan (in Boucle du Mouhoun) and Seguenega districts. Meanwhile the cost of health care services has decreased by 36 percent.[18]

- **Timely continuous utilization**
  - The majority of ASBCs stated that they are always available to provide iCCM services; however, because ASBCs are unpaid, they more often prioritize work in which they receive financial incentives (e.g. working in gold mines, farming, animal husbandry, small commerce, and other income-generating activities.).

Scenarios

For the Nord and Centre Nord programs, the following assumptions were made:[19]

- Pneumonia services would be scaled up from one district in each region to all districts from the beginning of 2014;
- RDTs would be introduced at the beginning of 2014 and the number of fever cases treated for malaria would be reduced (depending on the scenario);

The three utilization scenarios are as follows:

[18] Blancet K., Adannou-Zonon N., Nébié B., Agagliate T., Viala G. 2011. Free Health Care : fur universal access to healthcare for children under five and pregnant women. Good practices in Burkina Faso. Terre des homes. Ouagadougou, Burkina Faso.
[19] The dates for these changes are not firm and these assumptions are, therefore, illustrative.

- ***Low Scenario***: In this scenario, the current level of coverage is maintained and only increases with the population growth of 2.9 percent per year.
- ***Medium Scenario***: In addition to the population growth rate of 2.9 percent, there would be an annual increase of 1.7 percent of the expected number of cases. The figure of 1.7 percent was based on the average increase in coverage in the Nord and Centre-Nord regions for diarrhea and malaria treatment over the course of the PMNCH.
- ***High Scenario***: In addition to the population growth rate of 2.9 percent, there would be an annual increase of 5 percent of the expected number of cases. This figure is based on the assumption that the key service delivery bottlenecks will be reduced. Different coverage options for this scenario were determined in discussions with the MOH and other key stakeholders, through a Delphi process.

For the Boucle du Mouhoun region, full geographical coverage was assumed beginning in 2014. For service delivery targets, the following scenarios were assumed:

- ***Low scenario:*** An initial 5 percent service delivery target in 2014 was assumed and no additional service delivery coverage increases in the following years were included except to cover for population growth (2.9 percent).
- ***Medium scenario:*** In addition to population growth rate of 2.9 percent, a 5 percent service delivery target was assumed in 2014 followed by an annual coverage increase of 1.7 percent of the expected number in each of the following years. In other words, the target for pneumonia treatment would increase from 5 percent in 2014 to 6.7 percent in 2015.
- ***High scenario:*** In addition to population growth rate of 2.9 percent, a 5 percent service delivery target in 2014 was assumed in 2014 followed by an annual coverage increase of 5.0 percent in each of the following years. In other words, the target for pneumonia treatment would increase from 5 percent in 2014 to 10 percent in 2015.

iCCM Utilization and Coverage

Tables 6-8 below show the projected cases to be treated by the iCCM program from 2014-2018, based on the high, medium, and low utilization scenarios described earlier. It is assumed that iCCM services are provided in all villages, even those that are close to the CSPS and that all patients will be seen in the public health sector.

The actual iCCM utilization in the Nord and Centre-Nord regions varied significantly; in 2013, there were 0.5 iCCM treatments per child in the Nord, and 0.2 iCCM treatments per child in the Centre-Nord. The population size is very similar in the two regions, yet there were almost three times as many reported treatments and referrals – 133,937 in the Nord compared with 48,252 in the Centre-Nord. As a result, the projections made based on the 2013 data result in a significantly higher number of treatments in the Nord than in the Centre-Nord.

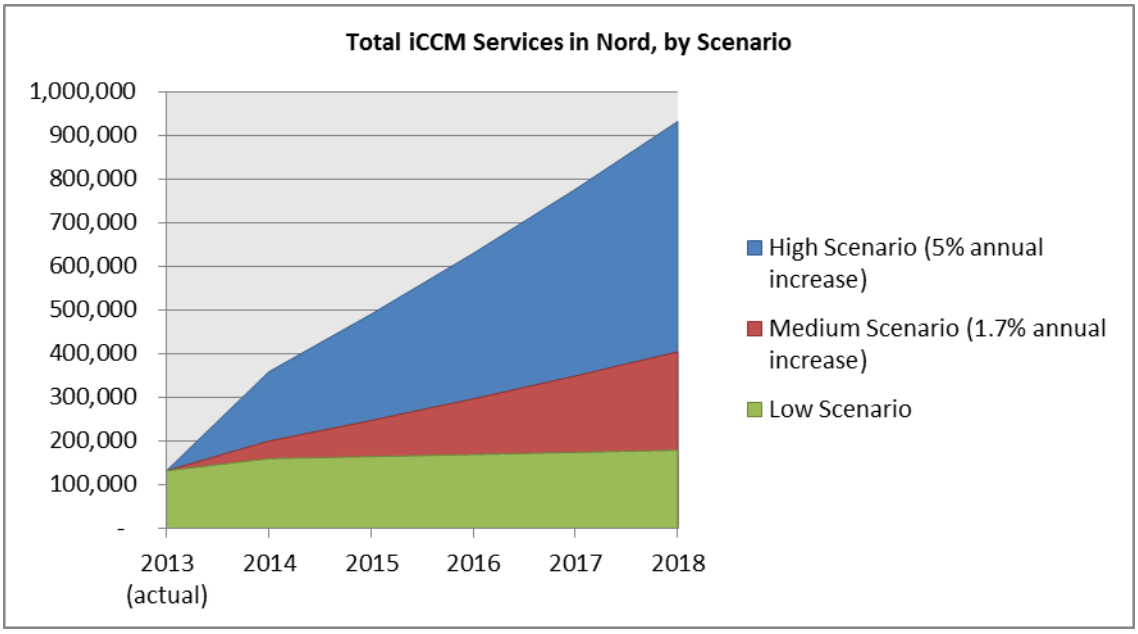
For the Nord region, it assumed that the total number of cases treated and referred to the CSPS would increase from 133,937 in 2013 to 181,256 in 2018 under the Low Utilization Scenario, to 420,245 in 2018 under the Medium Utilization Scenario and to 974,416 in 2018 under the High Utilization Scenario (Table 5 and Figure 1). These assumptions would change if there is a gap in implementation due to lack of donor funding in the future. Apart from increases in population and increases in targets the main

changes are the scaling up of pneumonia treatment and the introduction of RDTs. The 2018 high-level scenario scale-up targets for utilization are set at 30 percent for diarrhea, 54 percent for pneumonia and 71 percent for fever (32 percent for malaria and 39 percent for non-malaria).

Table 5: Nord Region - iCCM projected cases for 2014 – 2018 under three scenarios

Nord Region	2013 (actual)	2014	2015	2016	2017	2018
Population covered by iCCM (2-59 months)	262,932	270,557	278,403	286,477	294,784	303,333
LOW INCREASE IN UTILIZATION RATE						
Pneumonia	3,854	27,815	28,622	29,452	30,306	31,185
Diarrhea	54,918	56,511	58,149	59,836	61,571	63,357
Malaria	73,482	28,113	28,928	29,767	30,630	31,518
RDT negative fever	-	47,500	48,878	50,295	51,754	53,255
Referrals	1,683	1,732	1,782	1,834	1,887	1,942
Total iCCM cases	133,937	161,670	166,359	171,183	176,147	181,256
MEDIUM INCREASE IN UTILIZATION RATE						
Pneumonia	3,854	29,445	31,976	34,630	37,410	40,323
Diarrhea	54,918	70,309	86,547	103,667	121,707	140,707
Malaria	73,482	37,312	47,859	58,988	70,721	83,085
RDT negative fever	-	63,043	80,865	99,667	119,492	140,383
Referrals	1,683	4,195	6,850	9,657	12,620	15,747
Total iCCM cases	133,937	204,303	254,098	306,608	361,950	420,245
HIGH INCREASE IN UTILIZATION RATE						
Pneumonia	3,854	32,609	38,489	44,682	51,201	58,061
Diarrhea	54,918	97,094	141,670	188,750	238,442	290,856
Malaria	73,482	55,168	84,609	115,710	148,544	183,185
RDT negative fever	-	173,714	225,792	280,744	338,693	399,768
Referrals	1,683	8,975	16,689	24,842	33,455	42,546
Total iCCM cases	133,937	367,561	507,248	654,728	810,335	974,416

Figure 1. Projected iCCM utilization, Nord Region, 2014-2018

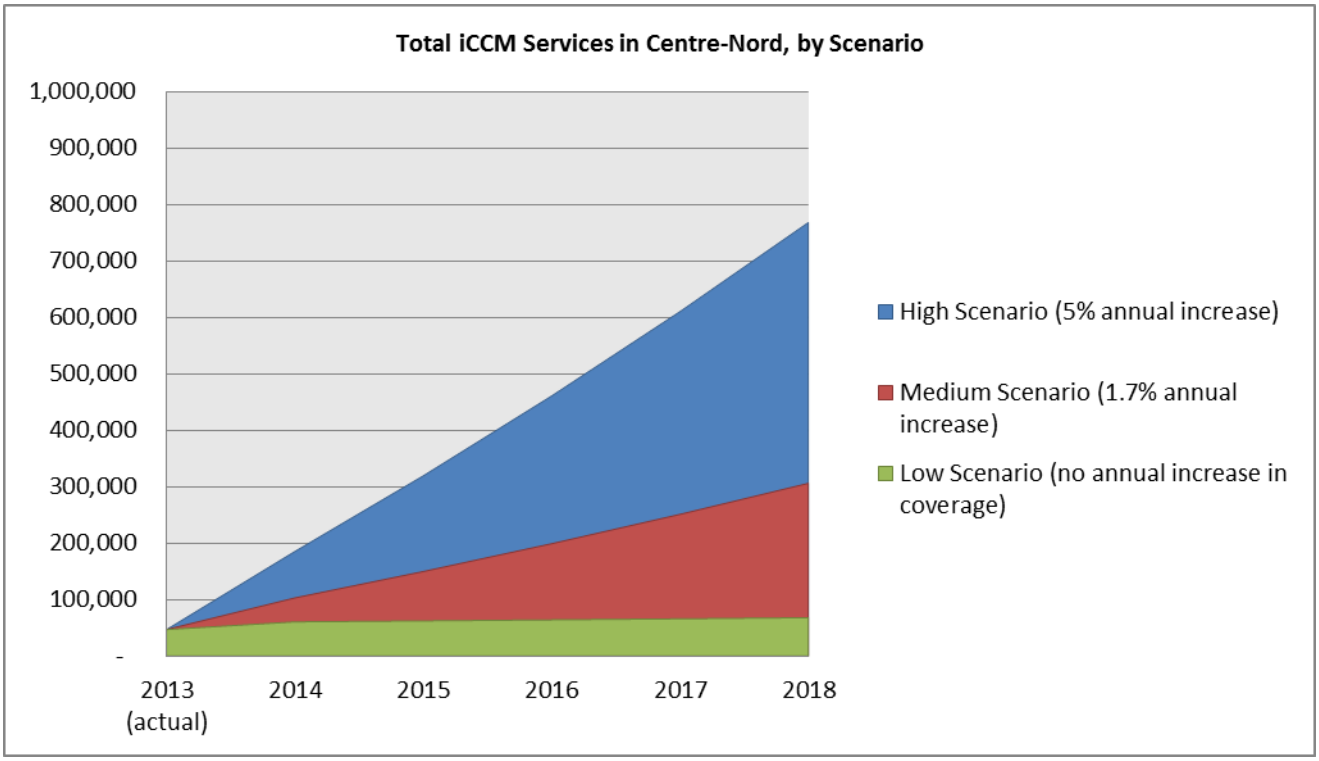


For the Centre-Nord region, the total number of cases treated and referred would increase from 48,252 in 2013 to 68,786 in 2018 under the Low Coverage Scenario, to 321,520 in 2018 under the Medium Utilization Scenario and to 812,122 in 2018 under the High Utilization Scenario (Table 6 and Figure 2.) Apart from increases in population and increases in targets, the main changes are the scaling up of pneumonia treatment and the introduction of RDTs. The 2018 high-level scale-up targets for utilization are set at 26 percent for diarrhea, 39 percent for pneumonia and 56 percent for fever (28 percent for malaria and 28 percent for non-malaria).

Table 6: Centre-Nord region - iCCM projected cases for – 2014 - 2018 under three scenarios

Centre-Nord Region	2013 (actual)	2014	2015	2016	2017	2018
Population covered by iCCM (2-59 months)	278,054	286,117	294,415	302,953	311,739	320,779
LOW INCREASE IN COVERAGE RATE						
Pneumonia	1,634	13,909	14,313	14,728	15,155	15,594
Diarrhea	5,572	5,734	5,900	6,071	6,247	6,428
Malaria	39,725	15,198	15,639	16,092	16,559	17,039
RDT negative fever	-	25,679	26,424	27,190	27,979	28,790
Referrals	1,321	833	858	882	908	934
Total iCCM cases	48,252	61,353	63,133	64,963	66,847	68,786
MEDIUM INCREASE IN UTILIZATION RATE						
Pneumonia	1,634	15,633	17,861	20,204	22,668	25,258
Diarrhea	5,572	20,326	35,930	52,423	69,842	88,227
Malaria	39,725	24,926	35,659	46,993	58,955	71,572
RDT negative fever	-	42,116	60,251	79,402	99,613	120,930
Referrals	1,321	3,438	6,217	9,155	12,258	15,534
Total iCCM cases	48,252	106,438	155,918	208,177	263,337	321,520
HIGH INCREASE IN UTILIZATION RATE						
Pneumonia	1,634	18,980	24,747	30,834	37,252	44,017
Diarrhea	5,572	48,651	94,224	142,400	193,290	247,012
Malaria	39,725	43,810	74,522	106,978	141,254	177,429
RDT negative fever	-	74,022	125,914	180,754	238,668	299,790
Referrals	1,321	8,493	16,622	25,214	34,292	43,874
Total iCCM cases	48,252	193,956	336,030	486,180	644,757	812,122

Figure 2. Projected iCCM utilization, Centre-Nord Region, 2014-2018



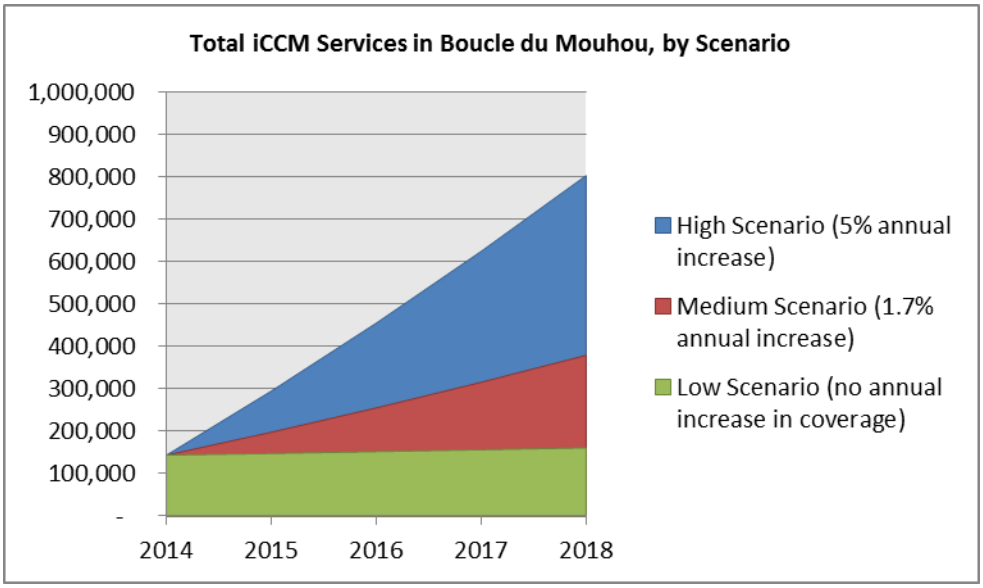
In Boucle du Mouhoun region, where the iCCM program would be newly introduced, it is assumed that the total numbers of cases treated and referred would be 151,921 in 2014 and by 2018 that figure would increase to 170,326 under the Low Utilization Scenario, to 401,969 under the Medium Coverage Scenario, and to 851,629 under the High Utilization Scenario. (Table 7 and Figure 3)

It is important to note that the projections of numbers of referrals were based on the same rate of increase as for the treatments. Ideally, however, the rate of referrals should be approximately 10 percent of all cases.

Table 7. Boucle du Mouhoun region - iCCM projected cases for 2014-2018 under three scenarios

Boucle du Mouhoun	2013 (actual)	2014	2015	2016	2017	2018
Population covered by iCCM (2-59 mos)	-	327,801	337,307	347,089	357,154	367,512
LOW INCREASE IN UTILIZATION RATE						
Pneumonia	-	5,809	5,977	6,151	6,329	6,513
Diarrhea	-	49,170	50,596	52,063	53,573	55,127
Malaria	-	32,780	33,731	34,709	35,715	36,751
RDT negative fever	-	55,386	56,993	58,645	60,346	62,096
Referrals	-	8,776	9,030	9,292	9,562	9,839
Total iCCM cases	-	151,921	156,327	160,861	165,526	170,326
MEDIUM INCREASE IN UTILIZATION RATE						
Pneumonia	-	5,809	8,010	10,333	12,785	15,370
Diarrhea	-	49,170	67,799	87,466	108,218	130,099
Malaria	-	32,780	45,199	58,311	72,145	86,733
RDT negative fever	-	55,386	76,370	98,524	121,899	146,547
Referrals	-	8,776	12,101	15,611	19,315	23,220
Total iCCM cases	-	151,921	209,478	270,246	334,362	401,969
HIGH INCREASE IN UTILIZATION RATE						
Pneumonia	-	5,809	11,955	18,452	25,317	32,563
Diarrhea	-	49,170	101,192	156,190	214,293	275,634
Malaria	-	32,780	67,461	104,127	142,862	183,756
RDT negative fever	-	55,386	113,985	175,936	241,384	310,481
Referrals	-	8,776	18,061	27,877	38,247	49,195
Total iCCM cases	-	151,921	312,654	482,582	662,102	851,629

Figure 3. Projected iCCM utilization, Boucle du Mouhoun Region, 2014-2018



Costs

Tables 8-10 below show the projected investment costs of the iCCM program from 2014-2018, based on the low, medium, and high utilization scenarios described earlier. As indicated in the methodology, only additional costs have been calculated, excluding capital costs and government salary costs which would be funded by the government. It is assumed that existing MOH staff are available and have the time required to provide quality supervision; if this is not the case in reality, then additional investment may be required.

The costs shown below comprise medicines and supplies; supervision (cost of visits, including per diem, fuel, etc.[20]); meetings (monthly meetings for data validation and resupply); refresher trainings; and other recurrent program costs (IEC/BCC, etc.). The initial start-up costs (initial training and equipping of ASBCs) for the Nord and Centre-Nord regions were incurred in 2013 and are not shown in the tables as it is assumed that these costs do not need to be repeated. For Boucle du Mouhoun, it is assumed that the initial start-up costs would be incurred in 2014. Total start-up costs in the years after the initial year of the iCCM program relate to new ASBCs to replace those who have abandoned their position as an ASBC or who have stopped providing iCCM services.

As discussed in the assumptions section, these costs are based on PMNCH implementation in the Nord and Centre-Nord. It should be noted that the start-up costs in the first year are the same under each scenario based on the number of ASBCs included in the program.

The costs of continuing the program in the Nord region depend on the degree to which it would be scaled up. Under the Low Utilization Scenario, services will only increase in line with population growth, apart from the full geographical scale-up of pneumonia in 2014 and the introduction of RDTs in the same year. Total recurrent costs and replacement ASBC costs would be USD 1,110,543 in 2014, increasing to USD 1,124,988 in 2018. Under the Medium Utilization Scenario those costs would increase

[20] Excluding vehicles on the assumption that the government would provide these.

from USD 1,142,016 in 2014 to USD 1,301,414 in 2018. Under the High Utilization Scenario, the costs would increase from USD 1,269,887 in 2014 to USD 1,718,756 in 2018.

Table 8. Nord Region - projected iCCM investment costs under three scenarios, 2014-2018, USD

	2014	2015	2016	2017	2018
LOW UTILIZATION SCENARIO					
Total Recurrent Cost	1,087,275	1,090,732	1,094,291	1,097,952	1,101,719
Total Start-up and ASBC Replacement Cost	23,269	23,269	23,269	23,269	23,269
Total iCCM Program Cost (recurrent + start-up)	1,110,543	1,114,001	1,117,559	1,121,221	1,124,988
Average recurrent cost per capita (2-59 months)	4.02	3.92	3.82	3.72	3.63
Startup cost per ASBC (Training and Equipment)	240	240	240	240	240
MEDIUM UTILIZATION SCENARIO					
Total Recurrent Cost	1,118,747	1,155,503	1,194,264	1,235,115	1,278,146
Total Start-up and ASBC Replacement Cost	23,269	23,269	23,269	23,269	23,269
Total iCCM Program Cost (recurrent + start-up)	1,142,016	1,178,772	1,217,533	1,258,384	1,301,414
Average recurrent cost per capita (2-59 months)	4.13	4.15	4.17	4.19	4.21
Startup cost per ASBC (Training and Equipment)	240	240	240	240	240
HIGH UTILIZATION SCENARIO					
Total Recurrent Cost	1,246,618	1,349,948	1,459,036	1,574,130	1,695,487
Total Start-up and ASBC Replacement Cost	23,269	23,269	23,269	23,269	23,269
Total iCCM Program Cost (recurrent + start-up)	1,269,887	1,373,216	1,482,305	1,597,399	1,718,756
Average recurrent cost per capita (2-59 months)	4.61	4.85	5.09	5.34	5.59
Startup cost per ASBC (Training and Equipment)	240	240	240	240	240

Figures 4-6 provide a breakdown of the costs by resource type. Start-up costs remain the same throughout the three coverage scenarios because it is assumed the number of ASBCs would be maintained. With the proposed introduction of salaries for the ASBCs, these become the highest single component of the total program costs. Included are the costs of an annual refresher training, in addition to the one-time start-up training for replacement ASBCs. As the number of services increases in the medium and high scenarios, the variable costs of medicines and supplies become a higher proportion of the costs over time.

Figure 4. iCCM costs by resource type, Nord Region, low coverage scenario, USD

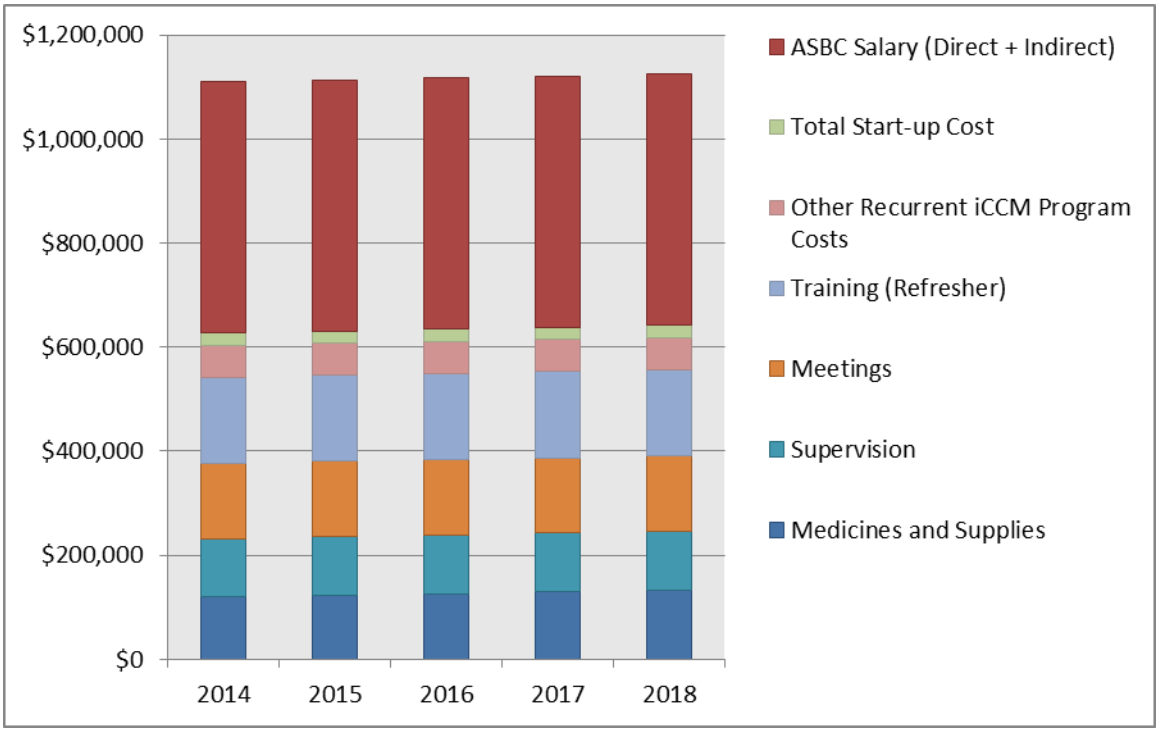


Figure 5. iCCM costs by resource type, Nord Region, medium coverage scenario, USD

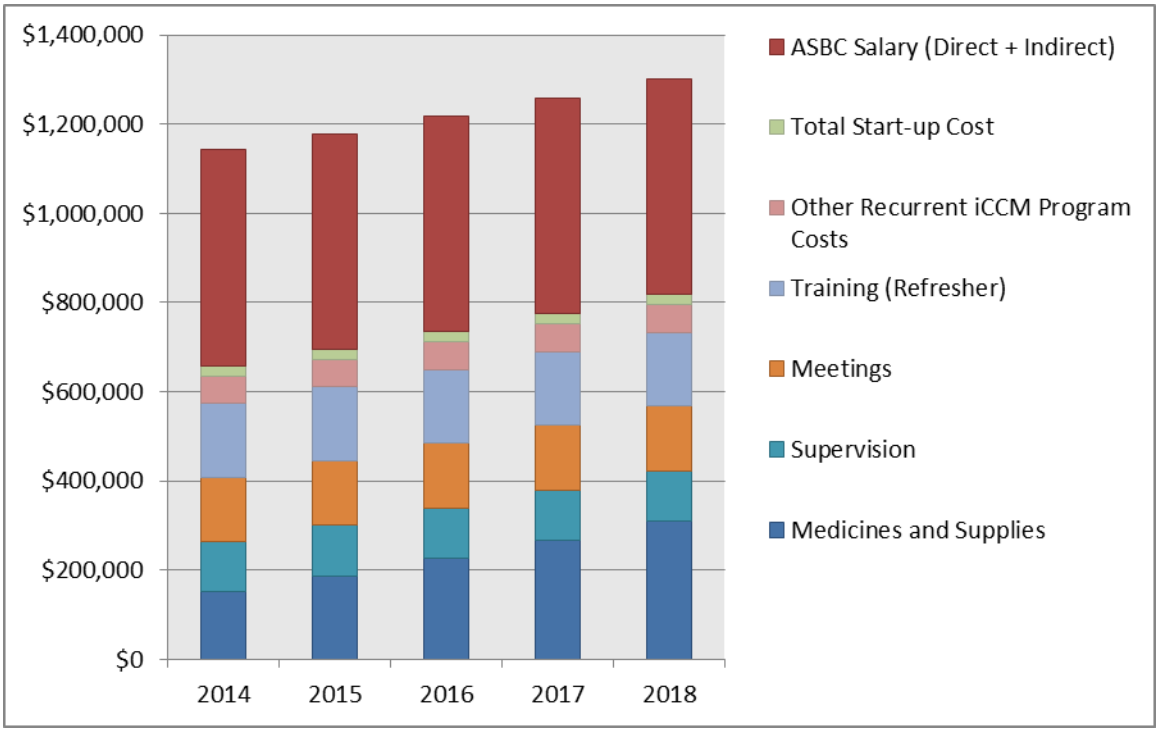
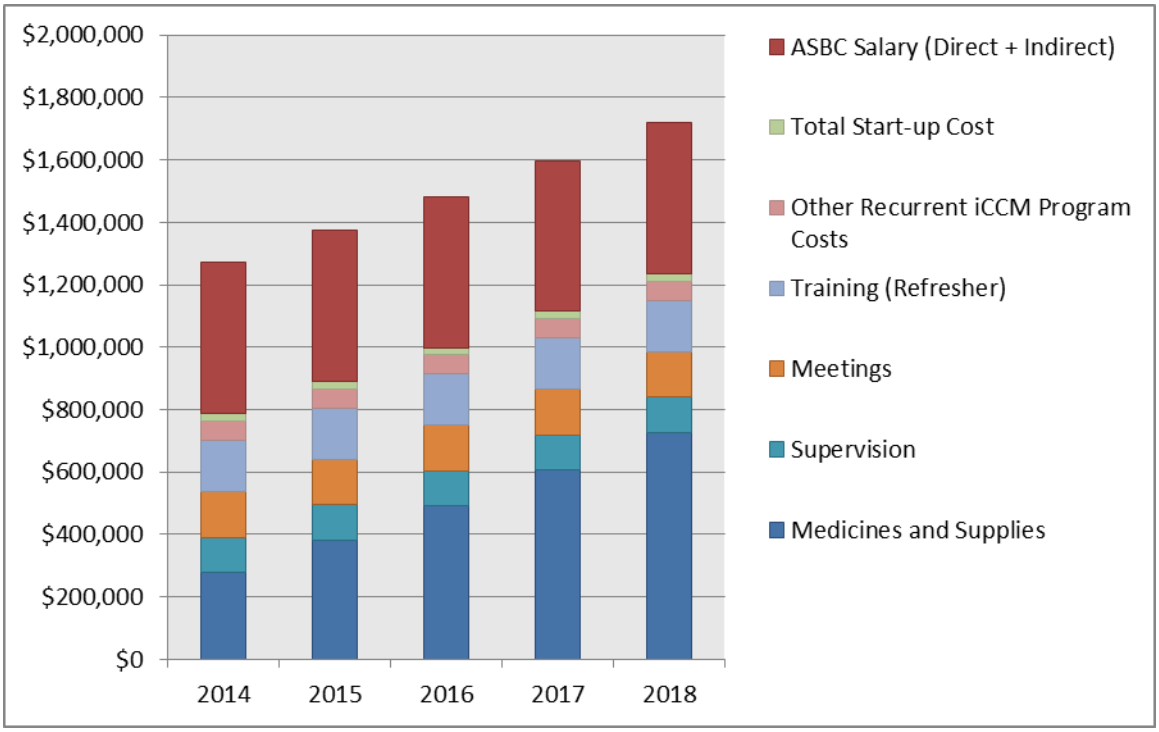


Figure 6. iCCM costs by resource type, Nord Region, high coverage scenario, USD



The situation in the Centre-Nord region would be similar to those in the Nord region; however, the costs would be considerably less as initial utilization rates were lower. Total recurrent costs and replacement ASBC costs would be USD 1,083,508 in 2014 under the Low Utilization Scenario and increasing to USD 1,090,440 in 2018. Under the Medium Utilization Scenario. Those costs would rise from USD 1,116,790 in 2014 to USD 1,277,013 in 2018. Under the High Utilization Scenario, the costs would rise from USD 1,181,398 in 2014 to USD 1,639,184 in 2018. Again, the start-up costs were actually incurred in previous years.

Table 9. Centre-Nord Region - Projected iCCM investment costs under three scenarios, 2014-2018, USD

	2014	2015	2016	2017	2018
LOW UTILIZATION SCENARIO					
Total Recurrent Cost	1,057,496	1,059,155	1,060,863	1,062,620	1,064,428
Total Start-up and ASBC Replacement Cost	26,012	26,012	26,012	26,012	26,012
Total iCCM Program Cost (recurrent + start-up)	1,083,508	1,085,167	1,086,875	1,088,632	1,090,440
Average recurrent cost per capita (2-59 months)	3.70	3.60	3.50	3.41	3.32
Startup cost per ASBC (Training and Equipment)	241	241	241	241	241
MEDIUM UTILIZATION SCENARIO					
Total Recurrent Cost	1,090,779	1,127,651	1,166,586	1,207,672	1,251,001
Total Start-up and ASBC Replacement Cost	26,012	26,012	26,012	26,012	26,012
Total iCCM Program Cost (recurrent + start-up)	1,116,790	1,153,663	1,192,598	1,233,684	1,277,013
Average recurrent cost per capita (2-59 months)	3.81	3.83	3.85	3.87	3.90
Startup cost per ASBC (Training and Equipment)	241	241	241	241	241
HIGH UTILIZATION SCENARIO					
Total Recurrent Cost	1,155,386	1,260,613	1,371,813	1,489,243	1,613,172
Total Start-up and ASBC Replacement Cost	26,012	26,012	26,012	26,012	26,012
Total iCCM Program Cost (recurrent + start-up)	1,181,398	1,286,625	1,397,825	1,515,255	1,639,184
Average recurrent cost per capita (2-59 months)	4.04	4.28	4.53	4.78	5.03
Startup cost per ASBC (Training and Equipment)	241	241	241	241	241

Figures 7-9 provide a breakdown of the costs by resource type. Start-up costs remain the same throughout the three coverage scenarios because it is assumed the number of ASBCs would be maintained. Again, with the proposed introduction of salaries for the ASBCs, these become the highest single component of the costs. As the number of services increases in the medium and high scenarios, the variable costs of medicines and supplies become a higher proportion of the costs over time.

Figure 7. iCCM costs by resource type, Centre-Nord Region, low coverage scenario, USD

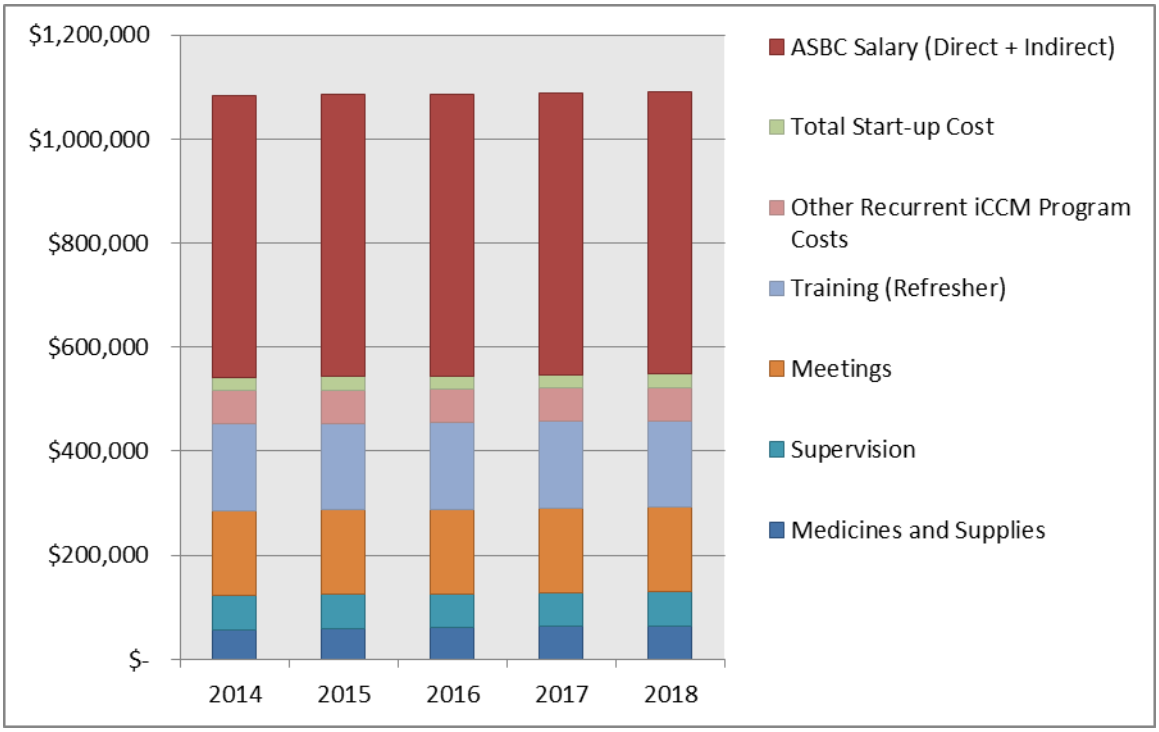


Figure 8. iCCM costs by resource type, Centre-Nord Region, medium coverage scenario, USD

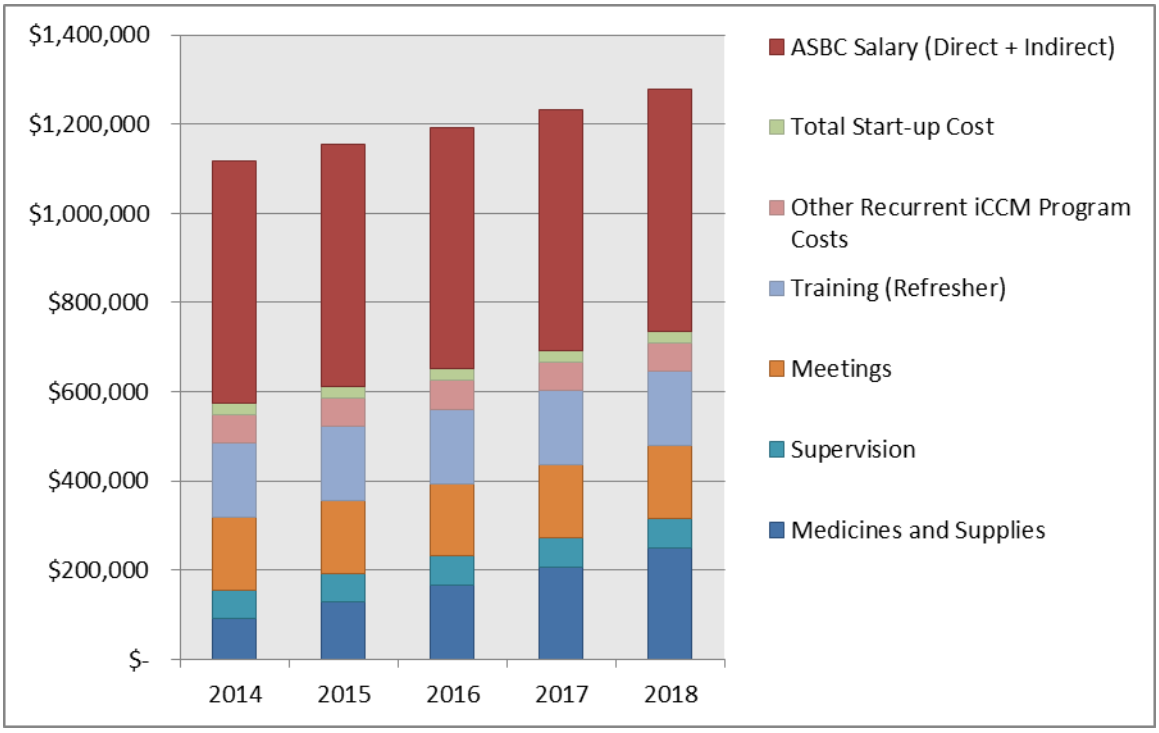
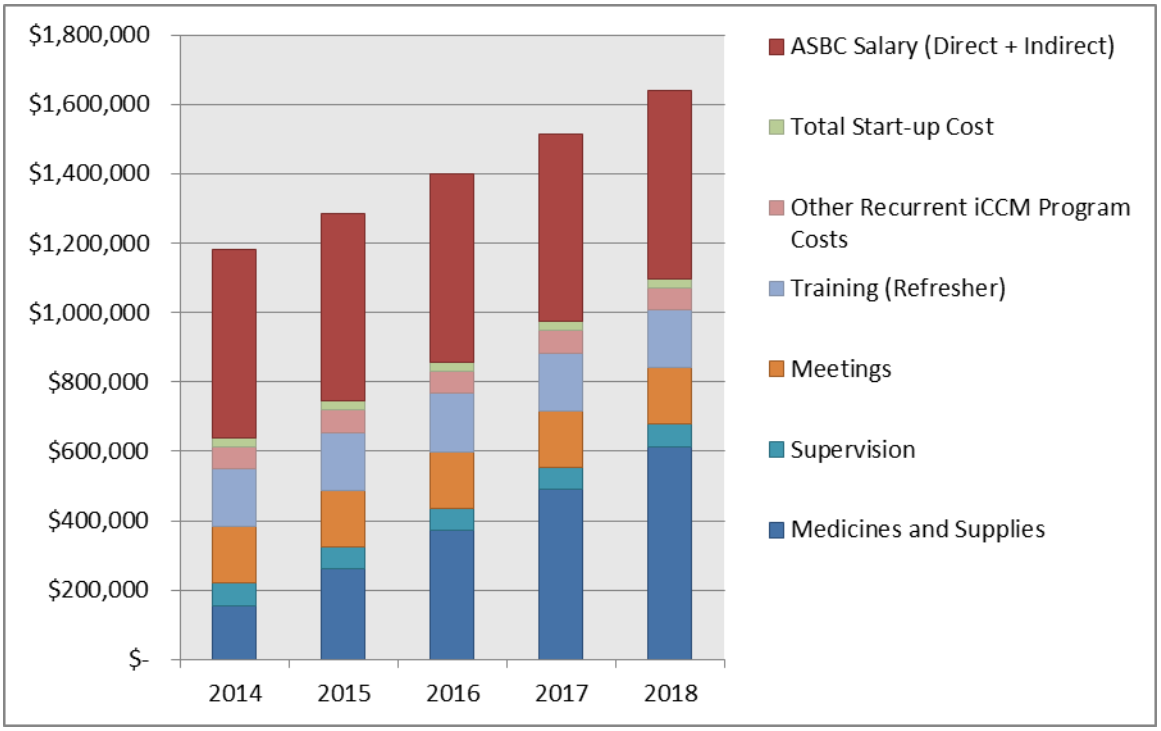


Figure 9. iCCM costs by resource type, Centre-Nord Region, high coverage scenario, USD



Boucle du Mouhoun

In the Boucle du Mouhoun region, the modelling is different because there is currently no iCCM program in place. The start-up costs of a program would be USD 581,663; however, these costs are not shown in Table 10 because they would have to be incurred before the program implementation could begin. The recurrent costs and replacement ASBC costs under the Low Utilization Scenario would amount to USD 1,247,529 in 2015 to USD 1,257,863 in 2018. Under the Medium Utilization Scenario, those costs would increase from USD 1,258,169 in 2015 to USD 1,428,866 in 2018. Under the High Utilization Scenario, the costs increase from USD 1,362,933 in 2015 to USD 1,760,814 in 2018.

Table 10. Boucle du Mouhoun Region - Projected iCCM investment costs under three scenarios excluding initial start-up costs, 2015-2018, USD

	2015	2016	2017	2018
LOW UTILIZATION SCENARIO				
Total Recurrent Cost	1,218,932	1,222,279	1,225,722	1,229,266
Total Start-up and ASBC Replacement Cost	28,597	28,597	28,597	28,597
Total iCCM Program Cost (recurrent + start-up)	1,247,529	1,250,876	1,254,319	1,257,863
Average recurrent cost per capita (2-59 months)	3.61	3.52	3.43	3.34
Startup cost per ASBC (Training and Equipment)	240	240	240	240
MEDIUM UTILIZATION SCENARIO				
Total Recurrent Cost	1,258,169	1,303,029	1,350,361	1,400,269
Total Start-up and ASBC Replacement Cost	28,597	28,597	28,597	28,597
Total iCCM Program Cost (recurrent + start-up)	1,286,766	1,331,626	1,378,957	1,428,866
Average recurrent cost per capita (2-59 months)	3.73	3.75	3.78	3.81
Startup cost per ASBC (Training and Equipment)	240	240	240	240
HIGH UTILIZATION SCENARIO				
Total Recurrent Cost	1,334,336	1,459,779	1,592,305	1,732,217
Total Start-up and ASBC Replacement Cost	28,597	28,597	28,597	28,597
Total iCCM Program Cost (recurrent + start-up)	1,362,933	1,488,376	1,620,902	1,760,814
Average recurrent cost per capita (2-59 months)	3.96	4.21	4.46	4.71
Startup cost per ASBC (Training and Equipment)	240	240	240	240

Figures 10-12 provide a breakdown of the costs by resource type. Start-up costs remain the same throughout the three coverage scenarios, because it assumed the number of ASBCs would be maintained. Again, with the proposed introduction of salaries for the ASBCs, these become the highest single component of the costs. As the number of services increases in the medium and high scenarios the variable costs of medicines and supplies become a higher proportion of the costs over time.

The projected average additional recurrent cost per service (excluding government salaries) is shown in Table 11. Since input prices are the same, the differences across the years and across the regions are mainly due to economies of scale. From 2015 to 2018, these unit costs decline because the fixed costs of ASBC salaries, etc. reduce as the number of cases seen increase. The marginal costs are generally only the costs of the medicines and medical supplies. And Nord region has lower unit costs per service than the other two regions because higher utilization rates are projected.

Table 11. Cost per service excluding government salaries, 2015-18 (USD)

	2015	2016	2017	2018
NORD				
Pneumonia	2.78	2.35	2.06	1.86
Diarrhea	2.18	1.75	1.46	1.26
Malaria	3.42	2.99	2.70	2.50
Fever (RDT-negative)	2.76	2.33	2.04	1.84
Referrals	1.29	1.00	0.81	0.67
CENTRE-NORD				
Pneumonia	3.88	2.94	2.43	2.10
Diarrhea	3.28	2.35	1.83	1.51
Malaria	4.52	3.58	3.07	2.74
Fever (RDT-negative)	3.86	2.92	2.41	2.08
Referrals	2.02	1.40	1.05	0.84
BOUCLE DU MOUHOUN				
Pneumonia	4.45	3.18	2.55	2.17
Diarrhea	3.85	2.58	1.95	1.57
Malaria	5.09	3.82	3.19	2.81
Fever (RDT-negative)	4.43	3.16	2.53	2.15
Referrals	2.40	1.55	1.13	0.88

Figure 10. iCCM costs by resource type, Boucle du Mouhoun Region, low coverage scenario, USD

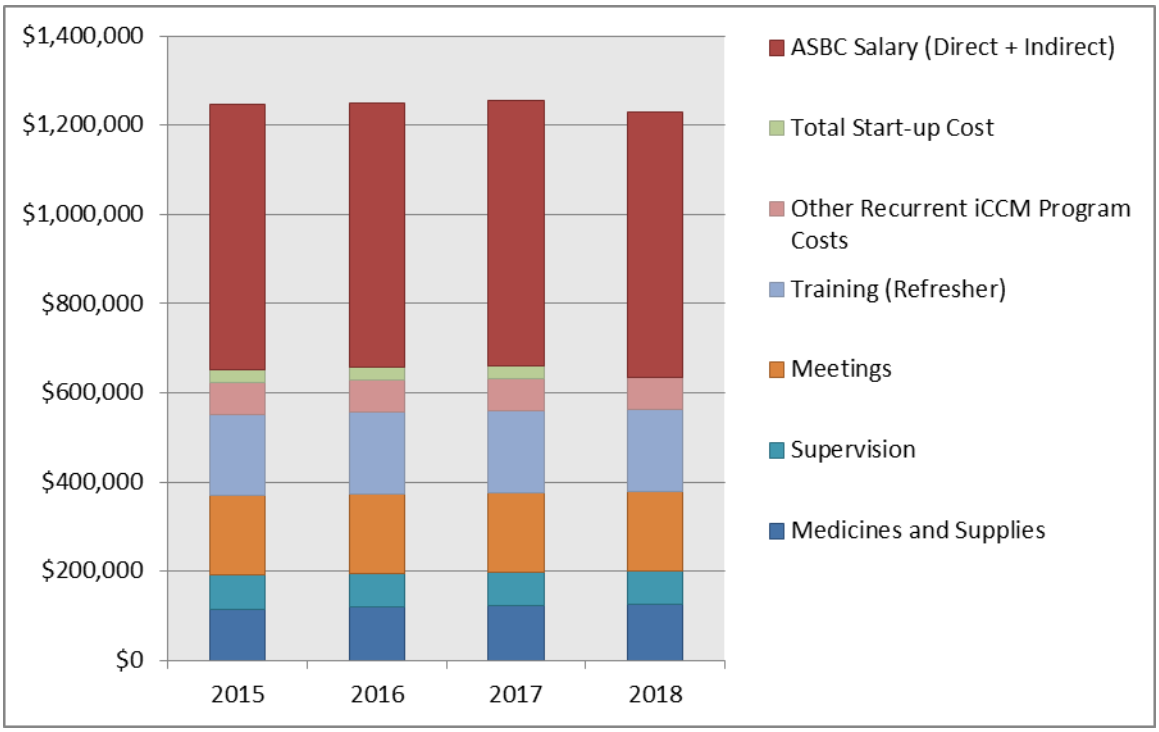


Figure 11. iCCM costs by resource type, Boucle du Mouhoun Region, medium coverage scenario, USD

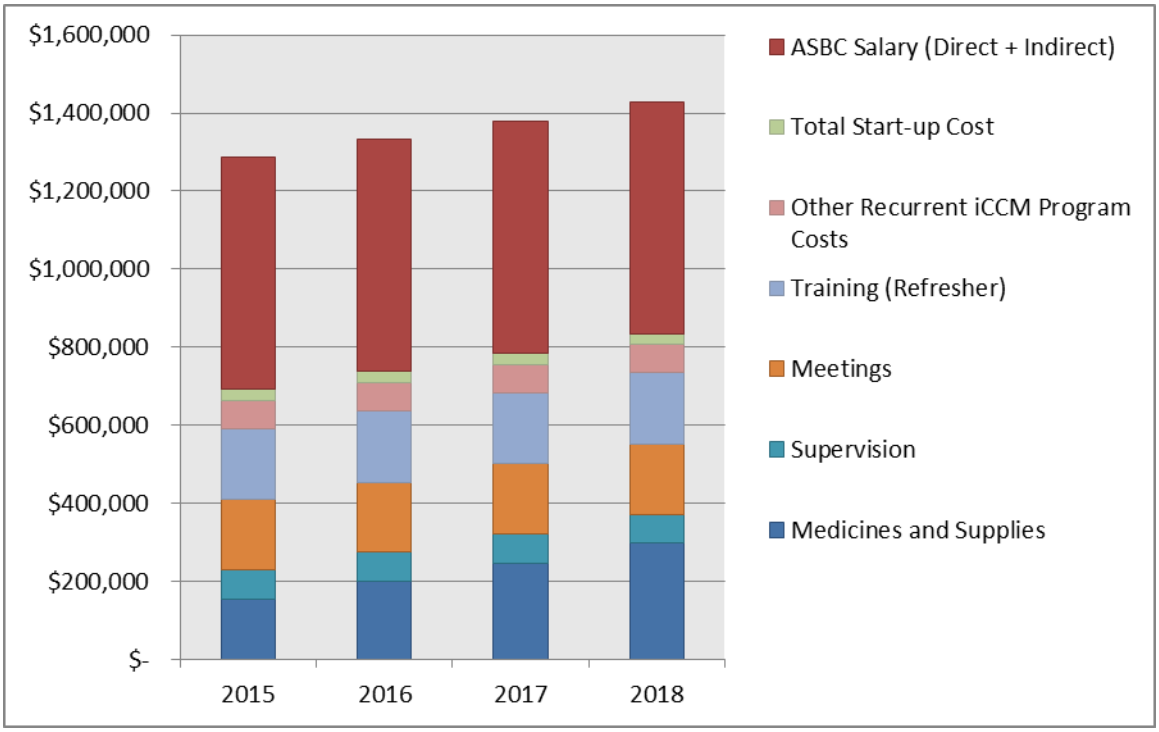
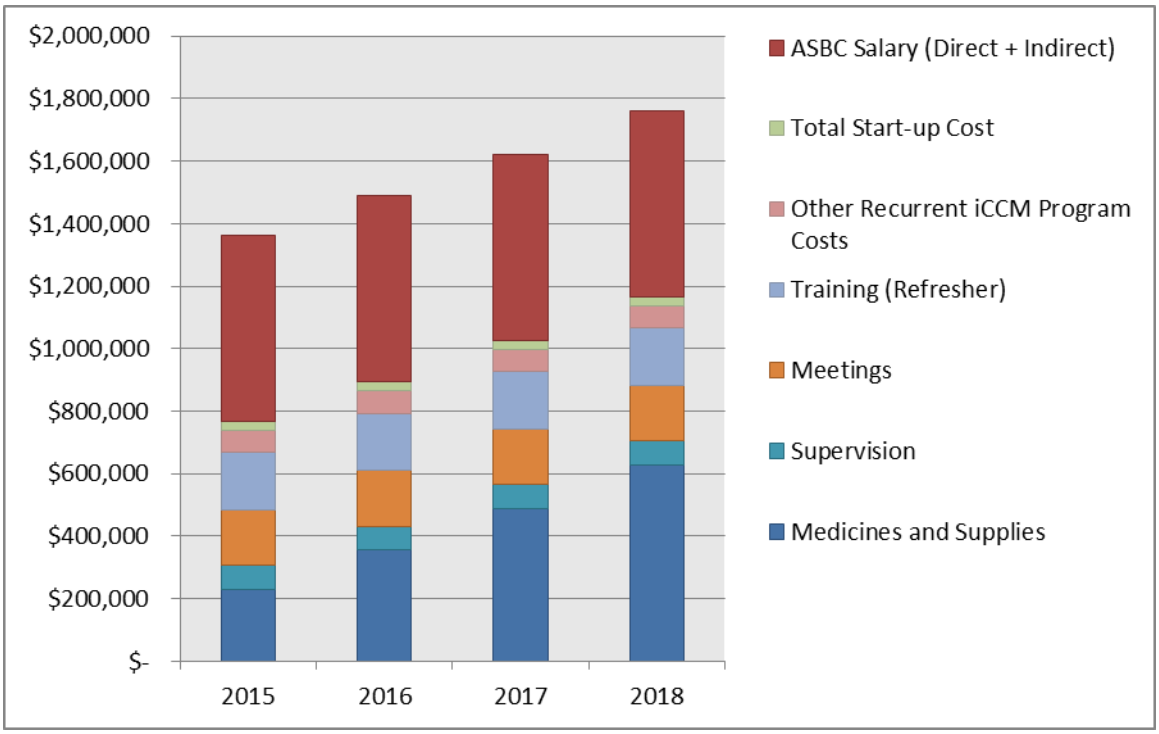


Figure 12. iCCM costs by resource type, Boucle du Mouhoun Region, high coverage scenario, USD



Impact

The potential impact of the iCCM program in the three regions was assessed using the Lives Saved Tool (LiST)[21], an evidence-based tool used to estimate the impact of different maternal, child, and neonatal health interventions based upon changes to intervention coverage levels. LiST was used to conduct the impact assessment of the Burkina Faso iCCM Costing and Financing models, demonstrating the potential health impact of each of the three coverage schemes (low, medium, and high) and the corresponding costs and budget allocations in the three regions through 2018.

We explored the use of LiST as a tool for planning and prioritizing the scale-up scenarios for the three regions in Burkina Faso for a few different reasons: 1) LiST uses *coverage* as an input parameter, determining the level of health service coverage increases over the study period to model the mortality impact of scaling up various services. In iCCM programming, coverage (or the percentage of the target population under 5 in hard-to-reach areas utilizing the services) is an important health service outcome indicator in evaluation of iCCM programming.[21] 2) LiST models the effects of changes in individual-level interventions such as exclusive breastfeeding of a newborn or ORS treatment of a child with diarrhea. This is broadly applicable to the characteristics and benefits of iCCM with its capacity in connecting and linking health services for individuals. 3) LiST modeling can be used as a way to investigate not only single interventions, but also a set of specific interventions, which may be combined into packages, as per an iCCM package of services. In particular, we used LiST to conduct the impact assessment of the

[21] N. Walker, Y. Tam, IK Friberg. "Overview of the Lives Saved Tool (LiST)." BMC Public Health 2013 13 Suppl 3 S1.

Burkina Faso iCCM Costing and Financing models so as to couple the cost and budget allocations of iCCM programs in Nord, Centre Nord and Boucle du Mouhoun with the potential impact as observed through changes in health coverage as the programs are expanded.

LiST is situated within the Spectrum Policy Modelling Software and utilizes links to the AIDS Impact Module (AIM), the Family Planning Module (FamPlan), and the Demography Module (DemProj). The primary inputs are the coverage of interventions (representing the numbers of individuals who have access to the intervention when needed), while the outputs include changes in population levels of risk factors and cause-specific mortality. The major assumption is that mortality rates and cause of death structures will not change except in response to changes in coverage of interventions or other proximate determinants. Mortality rates in LiST are thus determined through changes in coverage and the effectiveness or efficacy of a particular intervention in terms of reduction in cause-specific mortality. The coverage data for the impact measurements describing the changes in mortality can be confounded by fluctuations within the health system, (including the key bottlenecks described earlier in this report), or they can describe population-wide mortality rates. As a result, these fluctuations in coverage of specific iCCM interventions will not necessarily be adequate to estimate the impact of the iCCM scale-up scenarios. However, modeling this relationship can play a role in helping to link iCCM programs and their impact.[22]

One of the key challenges with using LiST for sub-national modeling is that all the region-specific information needed to create the projection may not be available. We created state-specific subnational files for Nord, Centre-Nord, and Boucle du Mouhoun regions using data from the 2010 Demographic Health Survey. We used the coverage scenarios for iCCM treatments that were inserted into the state-specific costing models based on those described in the *Assumptions* section of this report. changes in the coverage of the iCCM intervention were modelled and therefore did not take into account the impact of other interventions (e.g. introduction and dissemination of insecticide-treated bed nets) despite their potential impact on reducing malaria, diarrhea, and pneumonia incidence. However, these interventions were taken into account in the estimation of caseloads during the period of analysis. Additional details on the methodology used for the impact analysis using List are available in Annex 6. In each of the three scenarios for the three regions, national and sub-national estimates were used for causes of death, demographic details, and coverage data for a wide variety of maternal and child health interventions. The mortality rates are shown beginning in 2013 to account for mortality prior to the continuation of the iCCM program in the Nord and Centre-Nord regions and the start-up of the iCCM program in the Boucle du Mohoun region.

Figure 13 shows the expected changes in the mortality rate in the Nord region from 2013 to 2018. Under-five child mortality would decline from 143.61 to 137.13 per 1,000 live births under the medium scenario and to 143.61 per to 124.98 per 1,000 live births under the high scenario. The mortality rate would not change under the low scenario as the numbers of cases treated are only increasing in conjunction with population growth and not as rapidly as for the other scenarios.

[22] GP Garnett, S. Cousens, TB. Hallett, R. Steketee, N. Walker. "Mathematical models in the evaluation of health programmes." Lancet 2011 378 515 25

Figure 13. Modeled child mortality rate, Nord Region, by scenario, 2013-2018

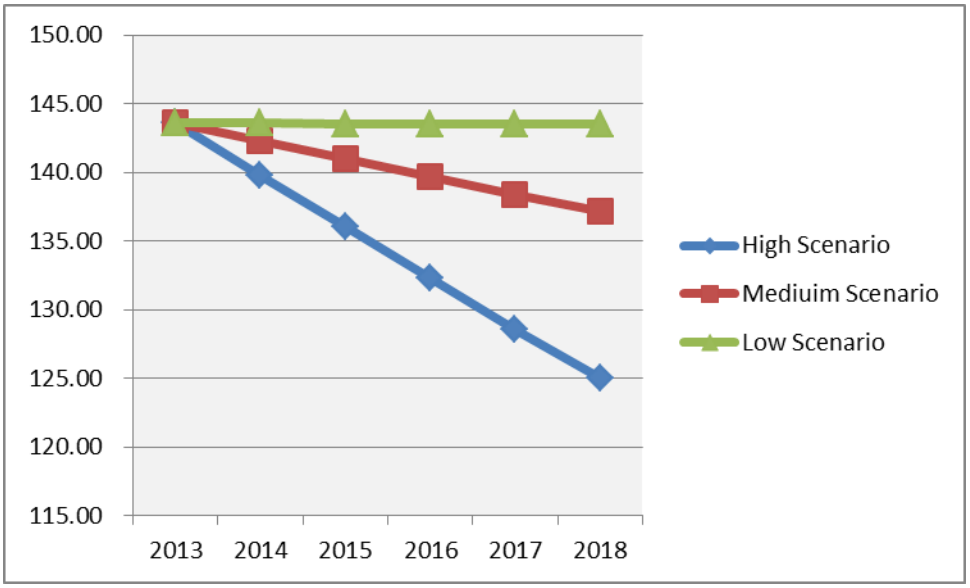


Figure 14 shows the expected changes in the mortality rate in the Centre-Nord region from 2013 to 2018. Under-five child mortality would decline from 112.72 to 107.40 per 1,000 live births under the medium scenario and from 112.72 to 97.37 per 1,000 live births under the high scenario. The mortality rate would not change under the low scenario as the numbers of cases treated are only increasing in conjunction with population growth and not as rapidly as for the other scenarios.

Figure 14. Modeled child mortality rate, Centre-Nord Region, by scenario, 2013-2018

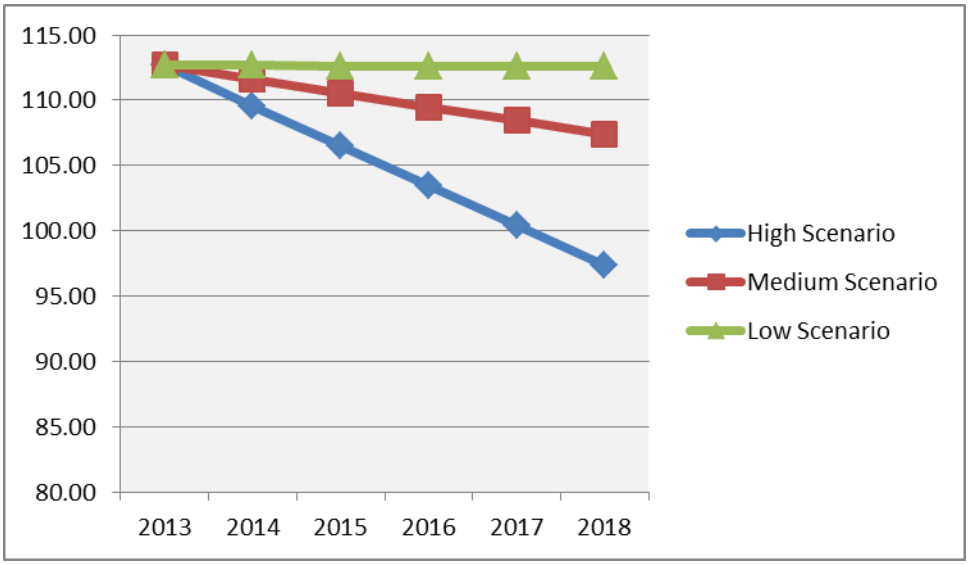
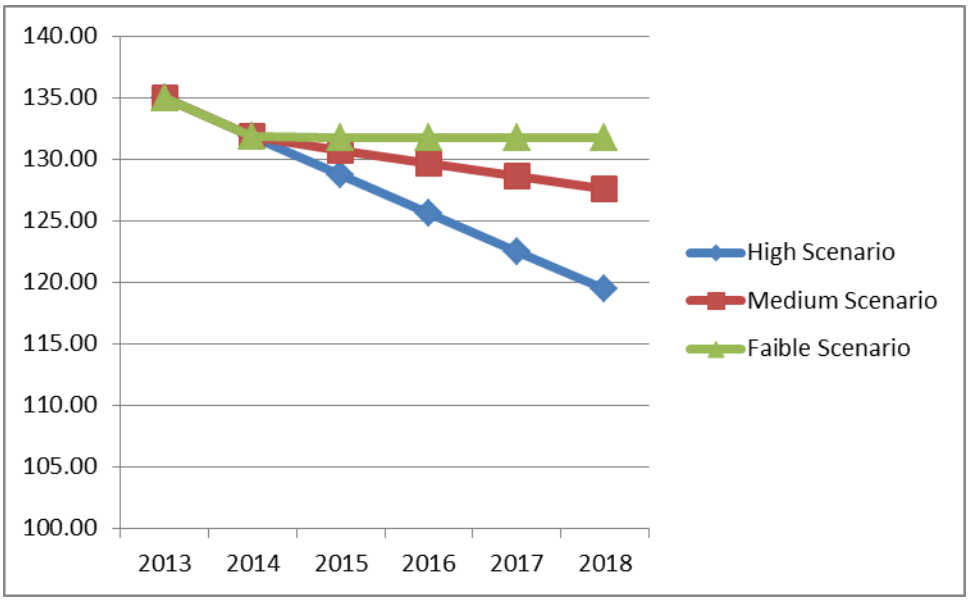


Figure 15 shows the expected changes in the mortality rate in the Boucle du Mouhoun from 2014 to 2018. Under-five child mortality would decline from 131.84 to 127.55 per 1,000 live births in 2018 under the medium scenario and from 131.84 to 119.48 per 1,000 live births under the high scenario. The mortality rate would not change under the low scenario between 2014 and 2018. However, for all

scenarios, the modeled mortality rate does significantly change between 2013 and the 2014 which is the first year of program implementation. The reason for this is due to the assumption that there is a five percent coverage rate for iCCM for all scenarios in 2014, as the parameters of LiST require an existing coverage rate in order to measure the impact of future scale-up.

Figure 15. Modeled child mortality rate, Boucle du Mouhoun Region, by scenario, 2013-2018



Since iCCM is not being delivered as a stand-alone intervention, the interpretation of mortality estimates using LiST should be treated with caution. There are several limitations in using LiST to assess the impact of the iCCM interventions. LiST does not systematically consider health systems constraints in achieving target coverage. In particular, there could be other health system interventions such as task-shifting or stock-outs at the health facility that drive patients to seek treatment at the community level and obtain iCCM services. For instance, subsidies for health services provided at the CSPS could influence patients to seek treatment at the CSPS as opposed to seeking treatment from an ASBC. Additionally, stockouts at the ASBC level could influence patients to seek services at the CSPS. Nevertheless, the purpose of showing the potential impact of the three coverage scenarios is to simulate the effects of different levels of utilization. These system-wide interventions, rather than the iCCM services, could in fact then be driving up measured mortality reductions described above. Further, the mortality estimates obtained through LiST do not necessarily take into account the technical or managerial feasibility of various strategies to achieve higher coverage levels; in other words, they do not explain how target coverage can be achieved. We have attempted to simulate this through the depiction of various scenarios, as agreed upon by the DSF. For simplicity, we assumed linear trends over time using LiST, but acknowledge that complex health systems and bottlenecks in expanding programs are likely to lead to a non-linear adoption in intervention coverage.

The impact assessment of iCCM services in Burkina Faso could be strengthened with programmatic data on treatment coverage (of both iCCM and non-iCCM interventions) and detailed utilization data. As discussed in the iCCM Evidence Review Symposium in Ghana in 2014, impact assessments should also take into account program exposure periods that would accumulate sufficient numbers of deaths in a study period and should give the targeted population time to get used to the new providers. Mortality assessments should typically be made once programs have been functioning for 2 years or more, as per recommendations from findings discussed at the Symposium. In our impact assessment above, we assumed that the iCCM programs in all regions in Burkina Faso under study would be delivered at an intensity sufficient to generate impact at the population level. In effect, we demonstrated that service utilization slowly changed over the years through epidemiological changes in incidence and target service delivery coverage increments, and that service quality was reliably adequate. Moreover, we assumed that iCCM providers were sufficiently deployed to increase the service delivery points. We also assumed that the standard treatment protocol was modified to fit the iCCM guidelines. This ensured that the iCCM program design was appropriate for the local context and would conceivably work to reduce mortality.

The aim of combining these mortality estimates, with those of the costs obtained for scaling up iCCM in both states, is to demonstrate the value of maximizing combinations of inputs for iCCM programs under expected estimates of utilization of these services. Such an assessment can help the SMoH and other stakeholders interested in scaling up iCCM programs to prioritize investments, choose appropriate delivery platforms to achieve health outcomes, and evaluate the impact of higher coverage levels of interventions with proven impact.

Conclusions and Recommendations

The purpose of this analysis was to forecast the costs of continuing the iCCM program in the Nord and Centre-Nord regions and introducing an iCCM program in the Boucle du Mouhoun region. It is intended to help the MOH to understand the cost and impact of iCCM and to provide an evidence base for it to advocate with the Ministry of Finance and donors, such as the GFATM, for funding to maintain and expand these services.

The analysis covered projections of cases and costs, identification of bottlenecks, and estimates of impact. The costs included in this analysis cover medicines and supplies, BCC/IEC and communications support, refresher training of ASBCs, training of replacement ASBCs, and supervision and meeting costs. MOH salaries are excluded as it is assumed they are already covered.

The figures in the following summary of the results are also shown in Table 12 for easy comparison.

Nord Region

The PMNCH in Nord region started in 2008 and ended in December 2013. For the purpose of this analysis, two changes in the iCCM package have been assumed for 2015 and onwards – the scale-up of pneumonia treatment to the whole region and the introduction of RDTs. The projected costs through 2018 are based on three scenarios. Under the Low Utilization scenario, it is assumed that the number of cases would only increase to keep up with population growth. The Medium and High Utilization scenarios assumed annual increases of 1.7 percent and 5 percent of the need, respectively.

Under the Low Utilization Scenario, by 2018 the number of cases would increase to 181,256, the additional recurrent cost would be USD 1,101,719 and the under-five child mortality rate would remain at 143.61 deaths per 1,000 live births.

Under the Medium Utilization Scenario, by 2018 the number of cases would increase to 420,245, the additional cost would be USD 1,278,146 and the under-five child mortality rate would fall from 143.61 to 137.13 per 1,000 live births.

Under the High Utilization Scenario, by 2018 the number of cases would increase to 974,416, the additional recurrent cost would be USD 1,695,487 and the under-five child mortality rate would fall from 143.61 to 124.98 per 1,000 live births.

Note that these figures assume that there is no interruption in the program and that start-up training and equipping of ASBCs does not have to be repeated.

Centre-Nord Region

The PMNCH in Centre-Nord region started in 2008 and ended in December 2013. We assumed two changes in the iCCM package for 2015 and onwards – scale up of pneumonia treatment to the whole region and the introduction of RDTs. We then projected the costs through 2018 based on three scenarios. Under the Low Utilization scenario we assumed that the number of cases would only expand to keep up with population growth. The Medium and High Utilization scenarios assumed annual increases of 1.7 percent and 5 percent of the need, respectively.

Under the Low Utilization Scenario, by 2018 the number of cases would increase to 68,786, the additional recurrent cost would be USD 1,064,428 and the under-five child mortality rate would remain at 112.72 deaths per 1,000 live births.

Under the Medium Utilization Scenario, by 2018 the number of cases would increase to 321,520, the additional recurrent cost would be USD 1,251,001 and the under-five child mortality rate would fall from 112.72 to 107.40 deaths per 1,000 live births.

Under the High Utilization Scenario, by 2018 the number of cases would increase to 812,122, the additional recurrent cost would be USD 1,613,172 and the under-five child mortality rate would fall from 112.72 to 97.37 per 1,000 live births.

Note that these figures assume that there is no interruption in the program after the end of 2013 and that start-up training and equipping of ASBCs does not have to be repeated.

Boucle du Mouhoun Region

In Boucle du Mouhoun community health services are provided through ASBCs and although they may provide some community-based services, they do not provide the full iCCM package. For the purposes of this analysis, it is assumed that ASBCs are not providing treatment for any of the iCCM components of diarrhea, pneumonia, and malaria. If, however, any of these services are fully-functional and well-utilized, those costs can be reduced.

It is assumed that the full package of services would start on January 1, 2014 and the costs are therefore projected through 2018 based on three scenarios. A five percent coverage rate for iCCM is evident for all scenarios in 2014; however, in the following years, the Medium Utilization Scenario would show an increase of 1.7 percent per year and a 5 percent increase under the High Utilization Scenario.

Under the Low Utilization Scenario, the number of cases would be 151,921 in 2014 increasing to 170,326. The additional recurrent cost would be USD 1,218,932 in 2015 plus USD 581,663 for start-up costs. The total recurrent cost by 2018 would be USD 1,229,266 in 2018. The under-five child mortality rate would be 131.84 deaths per 1,000 live births in 2014 and would remain the same in 2018.

Under the Medium Utilization Scenario, the number of cases would increase from 151,921 in 2014 to 401,969 in 2018. The additional recurrent cost would be USD 1,400,269 in 2018. The under-five child mortality rate would fall from 131.84 per 1,000 live births in 2014 to 127.55 in 2018.

Under the High Utilization Scenario, the number of cases would rise from 151,921 in 2014 and increasing to 851,629 in 2018. The additional recurrent cost would be USD 1,732,217 in 2018. The under-five child mortality rate would fall from 131.84 per 1,000 live births in 2014 to 119.48 in 2018.

Table 12. Summary of case, recurrent costs and impact projections

	2014	2015	2016	2017	2018
NORD					
Number of cases					
Low Utilization	161,670	166,359	171,183	176,147	181,256
Medium Utilization	204,303	254,098	306,608	361,950	420,245
High Utilization	367,561	507,248	654,728	810,335	974,416
Recurrent iCCM program costs (USD)					
Low Utilization	1,087,275	1,090,732	1,094,291	1,097,952	1,101,719
Medium Utilization	1,118,747	1,155,503	1,194,264	1,235,115	1,278,146
High Utilization	1,246,618	1,349,948	1,459,036	1,574,130	1,695,487
Mortality rates					
Low Utilization	143.57	143.54	143.54	143.52	143.51
Medium Utilization	142.29	140.98	139.69	138.41	137.13
High Utilization	139.81	136.03	132.28	128.54	124.98
CENTRE-NORD					
Number of cases					
Low Utilization	61,353	63,133	64,963	66,847	68,786
Medium Utilization	106,438	155,918	208,177	263,337	321,520
High Utilization	193,956	336,030	486,180	644,757	812,122
Recurrent iCCM program costs (USD)					
Low Utilization	1,057,496	1,059,155	1,060,863	1,062,620	1,064,428
Medium Utilization	1,090,779	1,127,651	1,166,586	1,207,672	1,251,001
High Utilization	1,155,386	1,260,613	1,371,813	1,489,243	1,613,172
Mortality rate					
Low Utilization	112.67	112.64	112.63	112.62	112.61
Medium Utilization	111.63	110.55	109.5	108.45	107.4
High Utilization	109.6	106.51	103.45	100.4	97.37
BOUCLE DU MOUHOUN					
Number of cases					
Low Utilization	151,921	156,327	160,861	165,526	170,326
Medium Utilization	151,921	209,478	270,246	334,362	401,969
High Utilization	151,921	312,654	482,582	662,102	851,629
Recurrent iCCM program costs (USD)					
Low Utilization	-	1,218,932	1,222,279	1,225,722	1,229,266

	2014	2015	2016	2017	2018
Medium Utilization	-	1,258,169	1,303,029	1,350,361	1,400,269
High Utilization	-	1,334,336	1,459,779	1,592,305	1,732,217
Mortality rate					
Low Utilization	131.84	131.79	131.76	131.75	131.74
Medium Utilization	131.84	130.74	129.67	128.61	127.55
High Utilization	131.84	128.71	125.61	122.54	119.48

The bottlenecks to iCCM and community health services in general, reported by a small sample of the ASBCs and CSPS staff through the interviews were the same in the three regions. The key bottlenecks at were identified as:

- Stock-outs of essential medicines – sometime for months – resulting in low utilization of iCCM services;
- Inability of some patients to pay for medicines, resulting in inability of ASBCs to replenish medicine stocks;
- Unwillingness of patients to pay for medicines resulting in preference to use the CSPSs (even if they are far away), which may result in delays in treatment;
- Low levels of supervision, untrained supervisors and lack of funding for fuel;
- ASBCs unavailable to provide services due to the need to prioritize gainful work;
- ASBCs discontinuing service due to lack of financial incentive compared with other projects, which also results in loss of expertise and high training costs;
- Insufficient numbers of ASBCs in many areas;

There are some limitations due to the small sample size of interviews. It is also important to note that we have not estimated the cost of removing the bottlenecks; for example, strengthening the supply chain. Therefore, the costs shown in the findings are only the costs of implementing iCCM – ASBC salaries, medicines, supplies, and equipment; ASBC training and deployment; and supervision and assume that the bottlenecks have been resolved. To some degree the provision of funding for the medicines and supplies included in this costing would remove the bottlenecks for drugs if the reason for the bottleneck was lack of drugs. If the bottleneck is more systemic – e.g., a lack of secure storage or transport from the state level then additional resources would be needed. And the proposed payment of salaries to the ASBCs should address the above need to prioritize gainful work. We also assumed that the government would cover the salary and support costs of iCCM managers and supervisors: if those resources are lacking then the costs of implementation will be higher.

Recommendations

This analysis provides insight into programmatic costs of iCCM services in Burkina Faso; however, it also highlights the need for a greater understanding of the related financial and economic aspects. In that respect, some additional research is recommended: [23]

- An analysis of the cost of removing the bottlenecks pertaining to iCCM.
- A more detailed analysis of cost-effectiveness of iCCM services is needed, taking into account both the provider and patient financial and economic costs.
- A study of the payment of ASBC incentives and the use of medicine mark-ups as incentives.
- A study of the ability of patients to pay for iCCM services and ways to reimburse ASBCs for losses of medicine mark-up revenue due to patients who cannot pay.
- Analysis of the reasons for iCCM medicine stock-outs and ways to prevent them from occurring.

[23] It is understood that an evaluation of the PMNCH is under way and this may provide answers on some issues.

Annexes

Annex 1. Area Served and Maximum Range (KM) of CSPS (2012)[24]

Région / Districts	Area (km²)	Number of CSPS*	Maximum Range of Distance to CSPS (not including private facilities)
Centre-Nord	**19,677**	**130**	**6.9**
Barsalogho	3,962	11	10.3
Boulsa	6,391	35	7.6
Kaya	5,584	53	5.8
Kongoussi	4,010	31	6.4
Nord	**16,414**	**193**	**5.2**
Gourcy	1,980	30	4.6
Ouahigouya	5,068	69	4.8
Séguénégua	1,703	20	5.2
Titao	3,685	22	7.3
Yako	3,978	52	4.9
Boucle du Mouhoun	**34,333**	**206**	**7.1**
Boromo	4,539	33	6.5
Dedougou	6,873	36	7.2
Nouna	7,424	42	7.5
Solenzo	5,802	33	7.5
Toma	3,718	27	6.6
Tougan	5,977	35	7.3
Burkina Faso	**272,960**	**1,734**	**7.1**

*CSPS+Dispensaires isolés+Maternités isolées+CM

[24] MOH. Annuaire Statistique 2012.

Annex 2: Percentage of the Population According to Distance (2012)[25]

Région / Districts	Total Population (2012)	Percentage of the population by distance (km) from CSPS		
		0-4 km	5-9 km	10 km and more
Centre-Nord	**1,416,895**	**43.3**	**27.8**	**28.9**
Barsalogho	171,336	30.2	26.4	43.4
Boulsa	388,091	29.2	38.4	32.4
Kaya	532,685	51.4	22.9	25.7
Kongoussi	324,783	53.9	23.9	22.2
Nord	**1,382,111**	**57.9**	**27.2**	**14.9**
Gourcy	196,686	60.3	27.6	12.1
Ouahigouya	454,876	66.9	20.4	12.7
Séguénégua	190,204	49.2	31.2	19.5
Titao	167,942	56.2	25.3	18.5
Yako	372,403	50.7	34.2	15.1
Boucle du Mouhoun	**1,677,018**	**55.5**	**23.1**	**21.3**
Boromo	250,194	62.9	25.9	11.2
Dedougou	348,154	50.3	26.2	23.6
Nouna	322,251	45.7	29.6	24.8
Solenzo	314,593	66.6	16.7	16.8
Toma	188,691	58.7	16.0	25.3
Tougan	253,135	53.7	29.6	24.8
Burkina Faso	**16,779,207**	**59.9**	**21.3**	**18.8**

[25] MOH. Annuaire Statistique 2012.

Annex 3. Number of Contacts per Person per Year by Age Group (2012)[26]

Région / Districts	Number of Contacts per Person per Year (2012)		
	0-11 months	0-59 months	Number of contacts per person per year
Centre-Nord	**2.50**	**1.72**	**0.68**
Barsalogho	1.55	1.04	0.56
Boulsa	1.55	0.99	0.48
Kaya	4.01	2.75	0.88
Kongoussi	1.76	1.33	0.66
Nord	**2.35**	**1.72**	**0.78**
Gourcy	1.66	1.25	0.61
Ouahigouya	2.46	1.75	0.88
Séguénégua	4.32	3.08	1.09
Titao	1.93	1.49	0.69
Yako	1.67	1.30	0.62
Boucle du Mouhoun	**2.29**	**1.49**	**0.69**
Boromo	1.86	1.20	0.65
Dedougou	1.93	1.29	0.66
Nouna	1.84	1.25	0.66
Solenzo	1.98	1.29	0.61
Toma	1.79	1.16	0.56
Tougan	4.52	2.84	0.94
Burkina Faso	**2.29**	**1.49**	**0.69**

[26] MOH. Annuaire Statistique 2012.

Annex 4. Regions, Districts, Health Centers, and ASBC Sites Sampled

Région	District Sanitaire	CSPS (Aire de Santé)	ASBCs Interviewed
Centre-Nord	Kaya	N/A	N/A
	Barsalogho	Basma CSPS	2
Nord	Ouahigouya	Sissamba CSPS	16
	Gourcy	Bougounam CSPS	3
Boucle du Mouhoun	Dédougou	Kari CSPS	7
	Tougan	Bounou CSPS	4

Annex 5: People Contacted

Name	Organization	Title	Email
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Annex 6: Impact analysis methodology using the Lives Saved Tool (LiST)

Description of LiST

The Lives Saved Tool (LiST) was originally created as a part of the work for the Child Survival Series that was published in The Lancet in 2003.[21] LiST estimates the impact of a selected group of maternal, neonatal and child health (MNCH) interventions on health outcomes a as way to quantify the potential effectiveness an intervention or package of interventions.[27] Since its initial development, LiST has served many functions for health policy makers, researchers and implementers, including to:

- Quantify the possible impact of scale-up of various intervention packages at a global level (e.g. scale-up scenarios to assess intervention coverage needs to meet the child health-related Millennium Development Goals)[28]
- Analyze and re-prioritize health policy packages at a national level (e.g. examine the potential impact of the roll-out of community health workers who will increase access to treatment for malaria, pneumonia and diarrhea)[21;]
- Evaluate the impact of health programs that have measured intervention coverage level changes.[21]

Overall, LiST provides policy makers, planners, researchers and implementers an evidenced-based approach for assessing the health impact of MNCH interventions as they make decisions on how to best improve the health of their populations.

How does LiST Work?

LiST has been described as a linear, mathematical model that is deterministic as it shows a fixed relationship between inputs and outputs; the outputs of each projection will remain the same each time the model is run with identical inputs.[21] LiST sits as module within a larger suite of software called the Spectrum. LiST is typically run with three other modules within Spectrum:

- DemProj: projects population by age and sex using populations demographic information,
- AIM: examines the impact of HIV/AIDS, and,
- FamPlan: analyzes the cost and impact of family planning programs.

The LiST module interacts with the information in the other three modules in order to produce the impact of MNCH interventions.

At a high level, LiST calculates the impact of scale-up scenarios using two key inputs: effectiveness of clinical interventions and the changes in coverage levels of those interventions. In order to estimate the impact of interventions on mortality, LiST uses the effectiveness or efficacy, which is described in terms of reductions in cause-specific mortality as opposed to overall mortality. [21]

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[27] J. Stover, R. McKinnon, and B. Winfrey. "Spectrum: A Model Platform for Linking Maternal and Child Survival Interventions with Aids, Family Planning and Demographic Projections." *International Journal of Epidemiology* 39.S1 (2010): i7 - i10.
[28] Jones, G, et al. "How Many Child Deaths Can We Prevent This Year?" *Lancet* 362 (2003): 65 - 71.

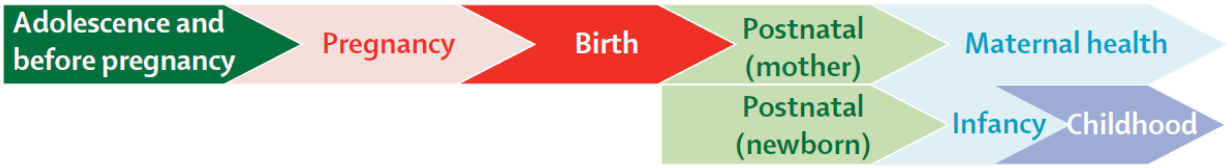
Efficacy is defined as in terms of the reductions of a cause of death or risk factor. Below illustrates the basic calculation that LiST makes to determine the impact of an intervention:

> For example, there may be 10,000 diarrhea deaths in children aged 1-59 months, and the proposed intervention is the introduction of a new vaccine that would be 50% effective in reducing diarrhea mortality. If coverage reaches 50%, diarrhea mortality among children would be reduced to 7,500 (=10,000 – (10,000 *0.5 *0.5)). If a second or a third intervention is added, the same approach is followed, although the impact of the additional diarrhea intervention(s) would be applied to the residual diarrhea deaths. Following the previous example, if the second new diarrhea intervention is also 50% effective and coverage reaches 50%, diarrhea mortality would fall to 5,625 (=7,500 – (7,500 *0.5 *0.5). By using cause-specific efficacy and applying each intervention to the residual deaths remaining after the previous intervention, LiST ensures that double counting is avoided and the potential impact of multiple interventions is not erroneously inflated.[21]

The primary inputs for LiST are coverage levels of maternal and child health interventions and the outputs are changes in population-level risk factors, such as wasting and stunting rates, or causes specify mortality. [21] Interventions can be linked to multiple interventions, and LiST prevents double-counting when examining the impact of changes in coverage of multiple interventions at the same time. Importantly, one of the key assumptions in LiST is that mortality rates and the cause of death structure will not change dynamically and that differences will be in response to differences in intervention coverage rates.[21]

LiST uses an age structure and set of interventions that mirror the continuum of care principle as shown below in Figure 1.[29]

Figure 1: Continuum of Care



LiST uses the following age periods: pregnancy among women aged 15-49 and 0-1, 1-5, 6-11, 12-23 and 24-59 months for children under the age of five. In LiST, impact in one age period is taken into account in the next age period. [21] As a result, "if interventions that have an impact on neonatal health are scaled up, more children would be expected to survive that period and will subsequently be exposed to the risk of death during the 1-59 month period. Therefore, the number of deaths in this age group will increase even though the rate of mortality will remain the same". [21]

[29] KJ Kerber et al. "Continuum of Care for Maternal, Newborn, and Child Health: From Slogan to Service Delivery." *The Lancet* 370.9595: 1358-69

Impact Assessment of iCCM Programs in Burkina Faso

LiST easily can be used to examine the impact of coverage changes at a global and national level as the program has preloaded datasets that are updated regularly. The pre-loaded data is usually compiled from large population-based surveys, such as the Demographic and Health Surveys (DHS) and/or Multiple Indicator Cluster Surveys (MICS). However, the iCCM Investment Case for Burkina Faso required regional- and state-level projection scenarios. As such we manually created subnational baseline files using regional-level data available from DHS for Burkina Faso. The detailed methodology is described below; a detailed list of coverage level indicators and their corresponding data sources is also embedded. Baseline projection files used for the analyses are available upon request from the authors.

***Demographic data adjustments**:*
We used the preloaded national baseline files available from the LiST software for Burkina Faso as a starting point. In DemProj, we then adjusted the total population, total fertility rates (TFR) and HIV prevalence rates (where applicable) by using the ratio of the subnational figure and dividing it by the national figure (example is below).

$$\text{Total Population Ratio} = \text{TotPop}_{SN}/\text{TotPop}_{N}$$

We then used each of the ratios as multipliers and applied them to the demographic trends for total population and total fertility rates in order to produce new trends for each subnational projection. In some cases, we had to use more than one round of multiplier to get closer approximations for the subnational population and TFRs. HIV prevalence adjustments were not made for the regional baselines in Burkina Faso. Regional data was not available from the 2010 DHS report, and the UNAIDS Sentinel Survey did not have prevalence broken down by region. We examined the regional HIV prevalence rates that were reported by the *Institut National de la Statistique et de la Démographie* ranged from 2.3%-0.8% with a national average of 1.8% in 2003.[30] Given that the HIV regional data was more than ten years old, we decided to use the national, pre-loaded data that was available in the AIM module. Table 1 details the data sources used to derive the ratios that were used to adjust the demographic data:

[30] http://www.insd.bf/n/contenu/Tableaux/T0608.htm

Table 1: Total Population, Total Fertility Rate, HIV Prevalence Figures

	Total Population	Total Fertility Rate	HIV Prevalence Rate
Burkina Faso	15,224,780 (year: 2009; source: BF Bureau of Statistics[31])	6 (year: 2010; source: DHS)	N/A
Boucle du Mouhoun	1,543,113 (year: 2009; source: BF Bureau of Statistics[32])	6.8 (year: 2010; source: DHS)	N/A
Nord	1,270,125 (year: 2009; source: BF Bureau of Statistics[33])	6.2 (year: 2010; source: DHS)	N/A
Centre-Nord	1,295,189 (year: 2009; source: BF Bureau of Statistics[34])	6.7 (year: 2010; source: DHS)	N/A

As a final step of the demographic data adjustments, we applied the same ratio that was used for the subnational total population adjustments ($TotPop_{SN}/TotPop_{N}$) and applied them to trends for international migration. As contraceptive prevalence rate was not an intervention that was not being scaled up in the iCCM investment case, we made no adjustments to the contraceptive prevalence rate. As such, we turned off the family planning (FamPlan) module for this analysis.

Coverage level adjustments:

After we made the demographic adjustments to reflect the figures for the subnational regions, we changed the coverage levels of the MNCH interventions in LiST from the default national level coverage figures to the subnational figures, where data was available. In general, we used subnational data available from DHS (Burkina Faso) for coverage levels of interventions that would impact the numbers of people in need of treatment and the cause of death structure. Where subnational data was not available, we used national level data. Where national level data was not available, we used sub-Saharan regional data. As a last source, we used global data and checked the data sources that were pre-loaded into LiST. A full list of indicators used for iCCM coverage is available in Tables 4-6. Baseline coverage levels for other interventions used at the subnational levels are available upon request.

Mortality rate adjustments:

After we adjusted the coverage levels of the LiST MNCH interventions, we changed the subnational mortality rates for each region by making direct entry changes in the "health status, mortality and economic status" tab of LiST. Subnational mortality rates were available and are listed in **Table 2.**

[31] BF Bureau of Statistics, http://www.insd.bf/n/contenu/Tableaux/T0317.htm
[32] BF Bureau of Statistics, http://www.insd.bf/n/contenu/Tableaux/T0317.htm
[33] BF Bureau of Statistics, http://www.insd.bf/n/contenu/Tableaux/T0317.htm
[34] BF Bureau of Statistics, http://www.insd.bf/n/contenu/Tableaux/T0317.htm

Table 2: Subnational Child Mortality Rates (per 1,000)

	Under-Five Mortality Rate (per 1,000)	Infant Mortality Rate	Neonatal Mortality Rate
Burkina Faso			
	Under-Five Mortality Rate (per 1,000)	**Infant Mortality Rate**	**Neonatal Mortality Rate**
Boucle du Mouhoun	135 (DHS 2010)	68 (DHS 2010)	33 (DHS 2010)
Nord	153 (DHS 2010)	71 (DHS 2010)	27 (DHS 2010)
Centre-Nord	116 (DHS 2010)	64 (DHS 2010)	23 (DHS 2010)

Baseline year for intervention:

As described in the report, the baseline year of coverage for Burkina Faso was considered as the year prior to when an iCCM program would conceivably be introduced in 2014 for Boucle du Mouhoun. Scale-up of coverage begins to occur in 2014 for the other regions.

Scale-up scenarios and projections:

LiST will allow one to model the scale-up of specific clinical interventions, such as the coverage of ORS for the treatment of childhood diarrhea and the coverage of insecticide treated nets to prevent childhood malaria. LiST uses the effectiveness of each intervention and the affected fraction of the population to calculate the impact of interventions. LiST does not allow one to model the scale-up of a health systems intervention. For example, it will not model the impact of the scale-up of iCCM as a whole. In order to estimate the impact of iCCM, we used the scale-up of the clinical interventions listed in Figure 2.

Figure 2: iCCM interventions modeled

Post-Neonatal Diarrhea	Post-Neonatal Malaria	Post-Neonatal Pneumonia
Oral rehydration salts (ORS), zinc	Artemisinin-based Combination Therapy (ACT)	Oral antibiotics for case management of pneumonia

We used LiST to model the impact of scaling up in three separate scenarios, as described in the section entitled, "Caseload and Service Delivery Targets" under *Assumptions* in this report. We inserted the following coverage rates into LiST from 2014-2019 to account for coverage changes based on these scenarios and to obtain the mortality reduction estimates presented in the section on, "Impact". The coverage rates in 2014 that were input into LiST for the various interventions described in Figure 2 were calculated by adding existing facility-based coverage rates already input into LiST (from MICS 2011) and the baseline iCCM coverage rates from the subnational iCCM costing and financing model (Table 3).

Table 3: Coverage rate for 2014 input into LiST

Nord			
	A*	**B****	**C+ = A+B**
ORS - Oral Rehydration Solution	7.0	12.5	19.5
Zinc - for treatment of diarrhea	7.0	0	7
Oral antibiotics - case management of pneumonia	29.0	46.8	75.8
Antimalarials - artemesinin compounds for malaria	5.0	5.9	10.9
Centre-Nord			
	A*	**B****	**C+ = A+B**
ORS - Oral Rehydration Solution	1.0	33.2	34.2
Zinc - for treatment of diarrhea	1.0	0	1
Oral antibiotics - case management of pneumonia	14.0	46.8	60.8
Antimalarials - artemesinin compounds for malaria	3.0	9.9	12.9
Boucle du Mouhoun			
	A*	**B****	**C+ = A+B**
ORS - Oral Rehydration Solution	5.0	14.1	19.1
Zinc - for treatment of diarrhea	5.0	0	5.0
Oral antibiotics - case management of pneumonia	5.0	46.8	51.8
Antimalarials - artemesinin compounds for malaria	5.0	3.0	8.0

* Target Service Delivery Coverage from iCCM Costing and Financing Model in 2014 (adapted from MICS 2011 specifically for community level data)

** Coverage from baseline subnational file in LiST for 2014 (MICS Zonal Level Data, 2011)

+ Coverage input into LiST incorporating facility and community-based intervention coverage

Table 4: Coverage (%) scenarios for Nord Region as input into LiST

Nord					
LOW COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	19.50	19.50	19.50	19.50	19.50
Zinc - for treatment of diarrhea	7.00	7.00	7.00	7.00	7.00
Oral antibiotics - case management of pneumonia	75.80	75.80	75.80	75.80	75.80
Antimalarials - artemesinin compounds for malaria	10.90	10.90	10.90	10.90	10.90
MEDIUM COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	21.20	22.90	24.60	26.30	28.00
Zinc - for treatment of diarrhea	8.70	10.40	12.10	13.80	15.50
Oral antibiotics - case management of pneumonia	77.50	79.20	80.90	82.60	84.30
Antimalarials - artemesinin compounds for malaria	12.60	14.30	16.00	17.70	19.40
HIGH COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	24.50	29.50	34.50	39.50	44.50
Zinc - for treatment of diarrhea	12.00	17.00	22.00	27.00	32.00
Oral antibiotics - case management of pneumonia	80.80	85.80	90.80	95.80	100.00
Antimalarials - artemesinin compounds for malaria	15.90	20.90	25.90	30.90	35.90

Table 5: Coverage (%) scenarios for Centre-Nord Region, as input into LiST

Centre-Nord					
LOW COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	34.20	34.20	34.20	34.20	34.20
Zinc - for treatment of diarrhea	1.00	1.00	1.00	1.00	1.00
Oral antibiotics - case management of pneumonia	60.80	60.80	60.80	60.80	60.80
Antimalarials - artemesinin compounds for malaria	12.90	12.90	12.90	12.90	12.90
MEDIUM COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	35.90	37.60	39.30	41.00	42.70
Zinc - for treatment of diarrhea	2.70	4.40	6.10	7.80	9.50
Oral antibiotics - case management of pneumonia	62.50	64.20	65.90	67.60	69.30
Antimalarials - artemesinin compounds for malaria	14.60	16.30	18.00	19.70	21.40
HIGH COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	39.20	44.20	49.20	54.20	59.20
Zinc - for treatment of diarrhea	6.00	11.00	16.00	21.00	26.00
Oral antibiotics - case management of pneumonia	65.80	70.80	75.80	80.80	85.80
Antimalarials - artemesinin compounds for malaria	17.90	22.90	27.90	32.90	37.90

Table 6: Coverage (%) scenarios for Boucle du Mouhoun Region, as input into LiST

Boucle du Mouhoun					
LOW COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	19.10	19.10	19.10	19.10	19.10
Zinc - for treatment of diarrhea	5.00	5.00	5.00	5.00	5.00
Oral antibiotics - case management of pneumonia	51.80	51.80	51.80	51.80	51.80
Antimalarials - artemesinin compounds for malaria	8.00	8.00	8.00	8.00	8.00
MEDIUM COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	20.80	22.5	24.2	25.9	27.6
Zinc - for treatment of diarrhea	6.7	8.4	10.1	11.8	13.5
Oral antibiotics - case management of pneumonia	53.5	55.2	56.9	58.6	60.3
Antimalarials - artemesinin compounds for malaria	9.7	11.4	13.1	14.8	16.5
HIGH COVERAGE					
iCCM Intervention	2014	2015	2016	2017	2018
ORS - Oral Rehydration Solution	24.1	29.1	34.1	39.1	44.1
Zinc - for treatment of diarrhea	10	15	20	25	30
Oral antibiotics - case management of pneumonia	56.8	61.8	66.8	71.8	76.8
Antimalarials - artemesinin compounds for malaria	13	18	23	28	33