

# Technical Appendix. Expansion on methods for the Lives Saved Tool (LiST) analysis

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## 1. Overview

This Appendix provides additional details on modelling scenarios and coverage values used in the Lives Saved Tool (LiST) analysis to assess the impact of the User Fee Elimination (UFE) intervention on maternal and child mortality.

The analysis classifies variables into two categories. Variables classified as Category 1 are viewed as unaffected by the UFE intervention. In contrast, variables classified as Category 2 should in principle capture UFE impact. For each Category 2 variable, we model changes in intervention coverage due to the UFE programme in its first year of implementation. We then use the LiST model to estimate the mortality impact of the difference in coverage between years 2008 and 2009 due to the effect of the UFE intervention. We project results for the Sahel, where the UFE intervention took place, and the national level in Burkina Faso. The Sahel constitutes the primary level of analysis.

## 2. Category 1 Variables

The UFE intervention was introduced in Burkina Faso in the year 2008, which constitutes the projection baseline for the analysis. LiST default values for all countries are currently standardised to the year 2008. We reviewed and updated default values for Burkina Faso and tailored the model to the sub-National level to represent the Sahel region in 2008. Data sources included household surveys(1-8), UN agency estimates,(9, 10) national administrative data,(11-15) and research reports.(16)

All values were extensively reviewed by the study team and colleagues in Burkina Faso and are available upon request.

### 2.1 Sensitivity Analyses

We conducted univariate sensitivity analyses to explore the effects of choices where values from other data sources differed importantly from the default values contained in LiST (rule of thumb: difference exceeds 10%). These included: child mortality, maternal mortality, prenatal care, assistance of births by skilled health personnel, delivery in a health facility, prevalence of breastfeeding and postnatal care. We also considered two different poverty measures (Multidimensional Poverty Index, Percentage of population living on less than \$ 1 per day).

While values for other variables had a relatively small impact on results, choices concerning mortality rates had an important effect on estimates of lives saved. We therefore developed mortality scenarios to evaluate the impact of uncertainty with respect to mortality rates.

### 2.2 Mortality Scenarios

For the national level, all planned analyses were performed using two mortality scenarios shown in Table 2.21. Results for the Sahel are modelled in a single mortality scenario shown in Table 2.22. We defined these scenarios for the following reasons:

Default child mortality estimates used in LiST cohere with values from international agencies. LiST child mortality values are based on the United Nations Inter-agency Group for Child Mortality Estimation (IGME) estimates. For under-5 mortality, IGME estimated 178 for Burkina Faso in 2010 and 146 (95% CI: 133, 183) for Burkina Faso in 2011.(17) These values are very close to IHME estimates for under-5

mortality (164.7 (95% CI: 140.4, 190.9) in 2008; 157.6 (95% CI: 126.9, 193.2) in 2009. (18) The central LiST (IGME) value for 2008 thus falls within IHME confidence intervals for the same year. In contrast, national data based on Burkina Faso's 2010 DHS & MICS household survey yield substantially lower mortality estimates.(3) As choices concerning mortality rates have an important impact on projections of lives saved, we decided that all analyses for the national level in Burkina Faso would be done using the two mortality scenarios in Table 2.21.

### *2.21 Baseline (2008) mortality scenarios used in analyses for the national level in Burkina Faso*

<b>Variable</b>	<b>Scenario 1: LiST values</b>	<b>Scenario 2: Alternative values (Source(3))</b>
<b>Neonatal mortality rate*</b>	34,96	28
<b>Infant mortality rate*</b>	92,09	65
<b>Under 5 mortality rate*</b>	168,7	129
<b>Maternal mortality ratio*</b>	700	307,3

Neonatal, infant and under- 5 mortality expressed per 1000 live births. Maternal mortality is per 100 000 births.

All analyses for childhood interventions in the Sahel were modelled in a mortality envelope based on results from the 2010 DHS-MICS survey.(3) The maternal mortality rate was updated using the most recent external source with data specific to the Sahel.(19) No data from international agencies (IHME, IGME) is available specifically for the Sahel, which is why only a single mortality scenario (shown in Table 2.22) was used in the analysis for the Sahel.

### *2.22 Baseline (2008) mortality scenario used in analyses for the Sahel*

<b>Variable</b>	<b>Sahel mortality scenario</b>	<b>Source</b>
<b>Neonatal mortality rate*</b>	42	(3)
<b>Infant mortality rate*</b>	119	(3)
<b>Under-5 mortality rate*</b>	235	(3)
<b>Maternal mortality ratio*</b>	840	(19)

Neonatal, infant and under-5 mortality rates expressed per 1000 live births. The maternal mortality ratio is per 100 000 births.

At the national level in Burkina Faso, estimates from national sources such as DHS-MICS surveys were substantially lower than international estimates for mortality from IGME and IHME. Use of DHS-MICS mortality estimates at the Sahel level should thus represent a lower estimate and lend a conservative bias to our results.

### 3. Category 2 Variables

A total of four Category 2 variables that enable us to partially capture the effect of the UFE intervention. One variable (facility delivery (delivery in a clinic (CSPS) or hospital) relates to pregnancy and childbirth, while three variables (ORS for diarrhoea, oral antibiotics for case management of pneumonia, and artemesinin for treatment of malaria) reflect curative services for children under 5 years of age.

#### 3.1 Sahel

##### Method for Establishing Coverage for the Sahel

For the four variables of interest for the analysis, we modelled coverage in 2009 as function of coverage in 2008. For each condition, the change in coverage from 2008 to 2009 reflects the difference in the proportion of individuals seeking medical care due to the UFE intervention. The following table summarises data sources; detailed explanations are presented below.

*Table 3.11 Data sources for coverage values used in the Sahel analysis*

Interventions	Coverage in 2008	UFE Intervention Effect ( $\Delta$ Proportion seeking care)	Coverage in 2009
<b>ORS for Diarrhoea</b>	DHS 2010	Statistical modelling of intervention effect using data from baseline and endline household surveys (UFE study)	Calculated
<b>Antibiotics for Pneumonia</b>	INSD 2012	Statistical modelling of intervention effect using data from baseline and endline household surveys (UFE study)	Calculated
<b>Artemesinin for Malaria</b>	DHS 2010	Statistical modelling of intervention effect using data from baseline and endline household surveys (UFE study)	Calculated
<b>Facility delivery (delivery in a hospital or clinic (CSPS))</b>	DHS 2010	Statistical modelling of intervention effect using administrative data from the national health information system <sup>1</sup>	Calculated

<sup>1</sup>Système National d'Information Sanitaire (SNIS)

Coverage data for 2008 for each variable was taken from external sources. We used representative, population-level data for the Sahel where available (ORS for diarrhoea, artemesinin for malaria, facility delivery in a hospital or health centre).<sup>(3)</sup> Otherwise, we used representative, population-level data from other health districts in Burkina Faso (antibiotics for pneumonia). All variable definitions correspond to the indicator descriptions required for use with LiST.<sup>(20)</sup> Table 1 of the main article presents indicator definitions and baseline coverage estimates used in the analysis. Table 5 of the main article presents statistical estimates of intervention effects used in LiST modelling.

To calculate coverage for 2009, we took 2008 coverage values and multiplied them by the intervention effect (relative risk of seeking medical care in 2009 versus 2008, by condition, and adjusted for multiple potential confounding factors). All analyses used intervention effects from Dori health district, which were uniformly lower than those from Sebba health district (see Tables 2 and 4 of the main article).

Due to uncertainty concerning levels of coverage for antibiotics for pneumonia in the Sahel in 2008, we explored three scenarios representing average, low and high estimates of coverage for this intervention.

We calculated lives saved estimates based on the midpoint, and the upper and lower 95% confidence intervals for UFE intervention effect. All results were projected in a single mortality scenario for the Sahel described in this Appendix, section 2.2 Table 2.22.

Table 3.12: Average coverage scenario<sup>1</sup>

	Coverage 2008	Intervention Effect <sup>2</sup>			Coverage 2009 <sup>3</sup>		
	μ	μ	RR lower CI	upper CI	μ	lower CI	upper CI
<b>ORS for Diarrhoea</b>	10%	1.65	1.08	1.98	17%	11%	20%
<b>Antibiotics for Pneumonia</b>	33%	1.59	0.67	2.15	52%	22%	71%
<b>Artemesinin for Malaria</b>	26%	1.75	1.17	2.12	46%	30%	55%
<b>Facility delivery (delivery in a hospital or clinic (CSPS))</b>	35%	1.80	1.46	2.20	63%	51%	77%

<sup>1</sup>These estimates are based on average 2008 coverage values.

<sup>2</sup>This is the effect of an intervention rendering care free at point of service on the likelihood of seeking medical care, after its first year of operation 2008-2009. For childhood interventions, this is the effect of the User Fee Elimination Intervention on the likelihood of seeking medical care, adjusted for confounders. For facility delivery, it is the combined effect of UFE and SONU interventions on monthly facility delivery, adjusted for confounders. See Table 5 of the main article.

<sup>3</sup>To model coverage increases, we use intervention effects expressed as risk ratios. Where the lower confidence intervals lie below the average coverage values for 2008, we modelled the intervention as having no effect (rather than as reducing coverage). For example, the coverage ranges used to model the impact of the intervention on coverage of antibiotics for pneumonia would be 33% in 2008, and 52% in 2009 (95% CI 33%, 71%).

Table 3.13: Low coverage scenario<sup>1</sup>

	Coverage 2008	Intervention Effect <sup>2</sup>			Coverage 2009 <sup>3</sup>		
	μ	μ	lower CI	upper CI	μ	lower CI	upper CI
<b>ORS for Diarrhoea</b>	10%	1.65	1.08	1.98	17%	11%	20%
<b>Antibiotics for Pneumonia</b>	10%	1.59	0.67	2.15	16%	7%	22%
<b>Artemesinin for Malaria</b>	26%	1.75	1.17	2.12	46%	30%	55%
<b>Facility delivery (delivery in a hospital or clinic (CSPS))</b>	35%	1.80	1.46	2.20	63%	51%	77%

<sup>1</sup>These estimates are based only on lowest 2008 coverage values for antibiotics for pneumonia.

<sup>2</sup>This is the effect of an intervention rendering care free at point of service on the likelihood of seeking medical care, after its first year of operation 2008-2009. For childhood interventions, this is the effect of the User Fee Elimination Intervention on the likelihood of seeking medical care, adjusted for confounders. For facility delivery, it is the combined effect of UFE and SONU interventions on monthly facility delivery, adjusted for confounders. See Table 5 of the main article.

<sup>3</sup>To model coverage increases, we use intervention effects expressed as risk ratios. Where the lower confidence intervals lie below the average coverage values for 2008, we modelled the intervention as having no effect (rather than as reducing coverage). For example, the coverage ranges used to model the impact of the intervention on coverage of antibiotics for pneumonia would be 10% in 2008, and 16% in 2009 (95% CI 10%, 22%).

Table 3.14: High coverage scenario1

	Coverage 2008	Intervention Effect <sup>2</sup> RR			Coverage 2009 <sup>3</sup>		
	μ	μ	lower CI	upper CI	μ	lower CI	upper CI
<b>ORS for Diarrhoea</b>	10%	1.65	1.08	1.98	17%	11%	20%
<b>Antibiotics for Pneumonia</b>	56%	1.59	0.67	2.15	89%	38%	120%
<b>Artemesinin for Malaria</b>	26%	1.75	1.17	2.12	46%	30%	55%
<b>Facility delivery (delivery in a hospital or clinic (CSPS))</b>	35%	1.80	1.46	2.20	63%	51%	77%

<sup>1</sup>These estimates are based only on *highest* 2008 coverage values for antibiotics for pneumonia.

<sup>2</sup>This is the effect of an intervention rendering care free at point of service on the likelihood of seeking medical care, after its first year of operation 2008-2009. For childhood interventions, this is the effect of the User Fee Elimination Intervention on the likelihood of seeking medical care, adjusted for confounders. For facility delivery, it is the combined effect of UFE and SONU interventions on monthly facility delivery, adjusted for confounders. See Table 5 of the main article.

<sup>3</sup>To model coverage increases, we use intervention effects expressed as risk ratios. Where the lower confidence intervals lie below the average coverage values for 2008, we modelled the intervention as having no effect (rather than as reducing coverage). Where the upper confidence interval exceeds 100% coverage, we modelled coverage at 100%. For example, the coverage ranges used to model the impact of the intervention on coverage of antibiotics for pneumonia would be 56% in 2008, and 89% in 2009 (95% CI 56%, 100%)

### 3.2 Burkina Faso National level

#### Method for Establishing Coverage for the National Level

The same general approach was taken to estimate coverage at the national level. For the four variables of interest for the analysis, we modelled coverage in 2009 as function of coverage in 2008. For a given condition of interest (diarrhoea, fever, childbirth) the change in coverage from 2008 to 2009 reflects the difference in the proportion of individuals seeking medical care due to the UFE Intervention.

Coverage estimates for 2008 at the national level generally reflect LiST default values. The intervention effect is taken directly from the UFE study and uses values identical to those for the Sahel analysis. Application to the national level requires the assumption that a similar intervention would have a similar effect at the national level. Our approach to statistical analysis should guarantee good internal validity; however, data to inform judgments of external validity are currently unavailable.

*Table 3.21 Data sources for coverage values used in the Burkina national analysis*

Interventions	Coverage in 2008	Change in proportion seeking medical care due to the UFE Intervention	Coverage in 2009
<b>ORS for Diarrhoea</b>	LiST default	Statistical modelling of intervention effect - Identical to Sahel analysis in Appendix §3.1	Calculated
<b>Antibiotics for Pneumonia</b>	LiST default	Statistical modelling of intervention effect - Identical to Sahel analysis in Appendix §3.1	Calculated
<b>Artemesinin for Malaria</b>	LiST default	Statistical modelling of intervention effect - Identical to Sahel analysis in Appendix §3.1	Calculated
<b>Facility delivery (delivery in a hospital or clinic (CSPS))</b>	LiST default, DHS 2010	Statistical modelling of intervention effect - Identical to Sahel analysis in Appendix §3.1	Calculated

## Coverage values used in the analysis for the national level in Burkina Faso

Only one coverage scenario was modelled at the national level, due to availability of representative, population level data from Burkina Faso's 2010 DHS MICS household survey.(3) We calculated lives saved estimates based on the midpoint, and the upper and lower 95% confidence intervals for intervention effect. All estimates were calculated for the two mortality scenarios described in Table 2.21 above.

*Table 3.22: Average coverage scenario<sup>1</sup>*

	Coverage 2008		Intervention Effect <sup>1</sup> RR		Coverage 2009 <sup>2</sup>		
	μ	μ	lower CI	upper CI	μ	lower CI	upper CI
<b>ORS for Diarrhoea</b>	21%	1.65	1.08	1.98	35%	23%	42%
<b>Antibiotics for Pneumonia</b>	31%	1.59	0.67	2.15	49%	21%	67%
<b>Artemesinin for Malaria</b>	41%	1.75	1.17	2.12	72%	48%	87%
<b>Facility delivery (delivery in a hospital or clinic (CSPS))</b>	39%	1.80	1.46	2.20	70%	57%	86%

<sup>1</sup> This is the effect of an intervention rendering care free at point of service on the likelihood of seeking medical care, after its first year of operation 2008-2009. For childhood interventions, this is the effect of the User Fee Elimination Intervention on the likelihood of seeking medical care, adjusted for confounders. For facility delivery, it is the combined effect of UFE and SONU interventions on monthly facility delivery, adjusted for confounders.

<sup>2</sup> To model coverage increases, we use intervention effects expressed as risk ratios. Where the lower confidence intervals lie below the average coverage values for 2008, we modelled the intervention as having no effect (rather than as reducing coverage). For example, the coverage ranges used to model the impact of the intervention on coverage of antibiotics for pneumonia would be 31% in 2008, and 49% in 2009 (95% CI 31%, 67%).



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