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Economic Evaluation

Economic Evaluation of User-Fee Exemption Policies for Maternal Healthcare in Burkina Faso: Evidence From a Cost-Effectiveness Analysis



Hoa Thi Nguyen, MSc,^{1,*} Aleksandra Torbica, PhD,² Stephan Brenner, Dr Med, MPH,¹ Joël Arthur Kiendrébéogo, MD, MSc,^{1,3,4} Ludovic Tapsoba, MSc,⁵ Valéry Ridde, PhD,⁶ Manuela De Allegri, PhD¹

¹Heidelberg Institute of Global Health, University Hospital, University of Heidelberg, Heidelberg, Germany; ²Centre for Research on Health and Social Care Management, Bocconi University, Milan, Italy; ³University Joseph Ki-Zerbo, Ouagadougou, Burkina Faso; ⁴Institute of Tropical Medicine, Antwerp, Belgium; ⁵National Institute of Public Health, Centre Muraz, Bobo-Dioulasso, Burkina Faso; ⁶Institute for Research on Sustainable Development, CEPED, Université de Paris, French National Institute of Health and Medical Research, Paris, France.

ABSTRACT

Objectives: The reduction and removal of user fees for essential care services have recently become a key instrument to advance universal health coverage in sub-Saharan Africa, but no evidence exists on its cost-effectiveness. We aimed to address this gap by estimating the cost-effectiveness of 2 user-fee exemption interventions in Burkina Faso between 2007 and 2015: the national 80% user-fee reduction policy for delivery care services and the user-fee removal pilot (ie, the complete [100%] user-fee removal for delivery care) in the Sahel region.

Methods: We built a single decision tree to evaluate the cost-effectiveness of the 2 study interventions and the baseline. The decision tree was populated with an own impact evaluation and the best available epidemiological evidence.

Results: Relative to the baseline, both the national 80% user-fee reduction policy and the user-fee removal pilot are highly cost-effective, with incremental cost-effectiveness ratios of \$210.22 and \$252.51 per disability-adjusted life-year averted, respectively. Relative to the national 80% user-fee reduction policy, the user-fee removal pilot entails an incremental cost-effectiveness ratio of \$309.74 per disability-adjusted life-year averted.

Conclusions: Our study suggests that it is worthwhile for Burkina Faso to move from an 80% reduction to the complete removal of user fees for delivery care. Local analyses should be done to identify whether it is worthwhile to implement user-fee exemptions in other sub-Saharan African countries.

Keywords: Burkina Faso, economic evaluation, facility-based delivery, maternal care, user-fee exemptions.

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Introduction

The reduction and removal of user fees for public healthcare services has become a key instrument to advance universal health coverage in sub-Saharan African (SSA) countries.¹ User fees collected at the point of use have been identified as a major barrier to seeking essential care, including skilled birth attendance at a health facility.^{2–4} Given the central role of skilled attendance at birth in relation to maternal and neonatal health, many user-fee reduction and removal policies have targeted obstetric care services.⁵

Although consistent and rigorous evidence exists on the positive effects of reducing or removing user fees on the use of facility-based delivery^{6–9} and cesarean delivery,^{10,11} little evidence is available on their impact on maternal and neonatal health outcomes. Two quasi-experimental studies reported

contradictory results on the impact of these policies on neonatal health outcomes: 1 found no impact in Burkina Faso⁷ and 1 found a reduction of 2.9 neonatal deaths per 1000 births in Kenya, Ghana, and Senegal.¹² One modeling-based study in Burkina Faso found no impact of user-fee removal on maternal mortality 1 year after the intervention launch.¹³ No study has so far examined the impact of user-fee reduction/removal policies on morbidities associated with obstetric complications, although they potentially represent a larger share of the maternal health loss than maternal mortality.^{14,15} This paucity of evidence is probably attributable to the inapplicability of experimental study designs to examine the health impact of facility-based delivery, an issue further complicated by the presence of substantial selection bias, because women at higher risk of developing severe complications are more likely than others to deliver in a facility.¹⁶

* Address correspondence to: Hoa Thi Nguyen, MSc, Heidelberg Institute of Global Health, the Faculty of Medicine, University Hospital, University of Heidelberg, Im Neuenheimer Feld 365, 69120 Heidelberg, Germany. Email: hoa.nguyen@uni-heidelberg.de

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This paucity of evidence on the health impacts of user-fee reduction or removal policies is reflected in the lack of evidence on their economic impacts. We have identified only 1 study assessing the cost-effectiveness of the free healthcare initiative in Sierra Leone. Relying on the use of the Lives Saved Tool model,¹⁷ the study reported that the free care initiative was highly cost-effective: a cost per life-year saved ranged from \$420 to \$444.¹⁸ No study has so far compared the cost-effectiveness of user-fee reduction with complete user-fee removal, although SSA countries, because of extremely limited resources, must often decide between these 2 policy alternatives.

We aimed to fill this gap by estimating the cost-effectiveness of both user-fee reduction and removal policies in Burkina Faso, where a national 80% reduction policy and a complete (100%) removal pilot of user fees for delivery care services coexisted between 2007 and 2015.

Methods and Data

Study Setting

Burkina Faso is a landlocked low-income country in western SSA with a population of 18 450 494,¹⁹ most of whom live in rural areas (77%).²⁰ More than 40% of its population lives on less than 420 FCFA (Franc de la Communauté Financière Africaine; <\$1) per day.²¹ In 2015, maternal mortality was estimated at 371 per 100 000 live births,²² and neonatal mortality at 26 per 1000 live births.²³ Maternal deaths account for 19% of all deaths among women aged 15 to 49 years.²⁰

Baseline Situation in 2006 and 2 Study Interventions

Until 2006, delivery care was provided against payment of a fee paid by women at the point of use. Fees applied also to emergency obstetric cases requiring referral to higher-level health facilities. These fees varied across facilities, levels of care, and districts. According to 2 national surveys in 2001 and 2004,²⁴ women had to pay on average 4055 FCFA (\$6.85) for a normal delivery, 5415 FCFA (\$9.15) for a complicated delivery, and 38 988 FCFA (\$65.86) for a cesarean delivery. Two studies examined out-of-pocket expenditures for normal delivery in 2006, reporting values from 3827 FCFA²⁵ to 4060 FCFA.²⁶ In 2006, the coverage of facility-based delivery stood at approximately 42.9%,²⁴ and the quality of essential healthcare service, including delivery care, was poor.²⁷

Aware that user fees constituted one of the major barriers to accessing care,²⁸ the government of Burkina Faso drastically reduced user fees for deliveries and emergency obstetric care by introducing a national 80% user-fee reduction policy in January 2007 (hereafter referred to as the national policy). Starting from September 2008, a complete (100%) user-fee removal pilot was implemented in the Sahel region (hereafter referred to as the pilot). *Table 1* provides the key content of both interventions.^{29,30}

Study Perspective and Design

Our study adopted a health system perspective, defined to include the Ministry of Health (MOH) and *Helpe zur Selbsthilfe* (HELP), a German nongovernmental organization, in their efforts to implement the national policy and the pilot, respectively. We opted for this perspective rather than a societal one because it provides the most relevant evidence for MOH when allocating its constrained budget among competing health programs. We assessed both costs and effects of the 2 interventions from their onset until December 2015 and selected 2015, the final year of both interventions, as the base year of our analysis.

We relied on a decision tree model given that childbirth events evolve over a relatively short time period.^{31,32} In line with the study interventions, facility-based delivery was defined as a birth attended by skilled birth attendants (trained midwives, trained nurses, or physicians) in a health facility with access to emergency obstetric care (including cesarean delivery), whereas home delivery was defined as a delivery outside a health facility with no access to any obstetric services aforementioned. We limited our estimation to the 4 most common and severe (ie, life threatening) obstetric complications: postpartum hemorrhage, obstructed labor, puerperal sepsis, and preeclampsia/eclampsia.^{33,34}

Decision Tree Structure

Our decision tree has 3 arms representing 3 options: (1) the baseline (status quo with user fees), (2) the 80% user-fee reduction (the national policy), and (3) the complete (100%) removal (the pilot). Within each arm, we reflect a pregnant woman's decision to deliver either in a facility or at home. The probabilities fed into the model for either decision taken are based on an own prior work.⁹ We defined a delivery as normal when it was not associated with any of the aforementioned obstetric complications and as complicated when it was associated with 1 of the aforementioned complications. In line with the global guidelines³⁵ and given that both study interventions specifically targeted delivery care, for each delivery event, our decision tree accounts for both maternal health outcomes (categorized as maternal mortality, acute morbidities, and long-term disabilities from the 28th week of pregnancy to 42 days after delivery) and perinatal outcomes (categorized as fresh stillbirths from the 22nd week of gestation and neonatal deaths within 7 days after a live birth, hereafter jointly referred to as perinatal deaths). For each complication, we reflected the probabilities leading to maternal death, full recovery, and recovery with long-term disabilities. The model also reflects the fact that mothers who experience normal deliveries may die from external nonobstetric causes. Our model also depicts the link between perinatal survival and maternal survival and thus considered fetal/neonatal outcomes according to the mother's status of being alive or dead.³⁶ *Appendix 1* (in the Supplemental Materials found at <https://doi.org/10.1016/j.jval.2019.10.007>) presents the schema of the decision tree built for our analysis.

Estimation of Health Effects

To capture health gains measured not only in terms of reduced mortality but also reduced morbidity, we used disability-adjusted life-years (DALYs) as a final outcome measure. The mortality component of DALYs included maternal deaths due to obstetric complications and perinatal deaths. Given that neonatal morbidities account for just about 5% of the disease burden caused by neonatal conditions³⁷ and the lack of relevant data on neonatal morbidities, the morbidity component of DALYs included only maternal morbidities. We assessed both short-term morbidities affecting mothers during childbirth and long-term morbidity owing to sequela/disabilities affecting mothers who survived childbirth. We considered only the 3 most harmful disabilities: severe anemia, fistula, and secondary infertility, which are caused by severe postpartum hemorrhage, obstructed labor, and puerperal sepsis, respectively.^{38–40}

We calculated DALYs using the standard formula,⁴¹ without age weighting.^{42,43} Years of life lost were calculated using the country-specific estimates of female life expectancy at age 25 to 29 years (44.02) for maternal deaths and life expectancies at birth for both sexes (59.75) for perinatal deaths.⁴⁴ We calculated years lived with disability using DALY weights estimated by the global

Table 1. Key content of 2 study interventions: the national 80% user-fee reduction policy for delivery, emergency obstetric, and newborn care and the complete (100%) user-fee removal pilot.

The national 80% user-fee reduction policy for delivery, emergency obstetric, and newborn care (the national policy)

- implemented nationwide by the Ministry of Health (MOH) from January 2007
- fully funded by the state budget
- subsidized user fees for delivery care services at 80%
- applied 3 flat rates, which were informed by the MOH cost estimates to pay health facilities
- women had to pay the remaining 20% of the cost, which was set at 900 FCFA (US \$1.52) for a normal delivery, 3600 FCFA (US \$6.08) for a complicated delivery, and 11 000 FCFA (US \$18.58) for a cesarean section

The complete (100%) user-fee removal pilot for pregnant women, children younger than 5 years, and the indigents (the pilot)

- implemented by *Hilfe zur Selbsthilfe* (HELP; a German nongovernmental organization) in collaboration with the health authorities in 2 districts (Dori and Sebba) in the Sahel region from September 2008
- fully funded by the European Commission
- applied the same 3 flat rates applied by the national policy
- covered the remaining 20% of the cost that the national policy left for women to pay (ie, women did not have to pay any user fees for delivering their babies at public health facilities)

burden of disease study for the 4 obstetric complications and their 3 long-term sequela aforementioned.⁴⁵

We hypothesized that both user-fee reduction and removal can affect health via 2 different pathways: by producing changes in service utilization or by producing changes in the quality of healthcare service.^{5,46} Given that both study interventions aimed to increase healthcare utilization, our decision tree models the intervention impact on health primarily through increases in the use of facility-based delivery. It is possible, however, that user-fee reduction and removal also affect the quality of healthcare service either positively or negatively. Existing evidence did not find a reduction in quality of care due to either the national policy⁴⁷ or the pilot.⁴⁸ Therefore, we assumed no change in quality in the deterministic analysis but examined the effects owing to quality changes in the sensitivity analysis.

We fed into the model estimates from an own impact evaluation, suggesting that the national policy produced a cumulative increase of 31.4% in utilization of facility-based delivery between 2007 and 2014 and that the pilot produced an additional increase of 23.2% from 2008 to 2014.⁹ In line with the findings suggesting that the effect of both interventions stabilized over time,⁹ we used impact estimates from 2014 to populate 2015 projections.

All epidemiological model inputs were derived from existing literature, with the preference being given to systematic reviews with meta-analysis, randomized controlled trials, and observational studies conducted in Burkina Faso and SSA. In cases in which no evidence exists, we used expert opinions reported in published studies and assumptions at last. We report estimates for key model parameters and their relevant sources in [Table 2](#). Details of other model estimates are provided in [Appendix 1](#) (in Supplemental Materials found at <https://doi.org/10.1016/j.jval.2019.10.007>).

Estimation of Costs

Because both study interventions implied both a user-fee exemption component for the actual service provision and program activities to support implementation, we estimated the full economic costs of the 2 interventions, including both health service costs and program costs. Health service costs include resources consumed during the direct provision of care service (medicines, health worker time, laboratory, imaging tests), and program costs include resources required to establish and maintain an intervention (administration, publicity, training, delivery of supplies).⁵²

We estimated health service costs based on findings from a prior MOH study, which estimated the average costs of a normal delivery, a complicated delivery, and a cesarean delivery to be 4500 FCFA (\$7.60), 18 000 FCFA (\$30.41), and 55 000 FCFA

(\$92.90), respectively. These estimates include clinical procedures and products (drugs, diagnostics, medical supplies) and emergency transportation to referral facilities for 10 000 FCFA (\$16.89) in the case of a complicated delivery and a cesarean delivery.⁵⁰ In line with our model structure, which differentiates by type of obstetric complication rather than by the specific medical intervention delivered, we estimated an average cost for all complicated deliveries, irrespective of whether they implied a cesarean delivery or not. The national health management information system data indicated that between 2007 and 2015, one-third of complicated deliveries were handled by a cesarean delivery. Hence, we set the average cost for a complicated delivery at 30 333 FCFA (\$51.24), taking the weighted mean cost of a cesarean delivery ($1/3 \times 55\ 000$) and of a complicated delivery ($2/3 \times 18\ 000$). We derived the uncertainty range of these cost estimates based on a recent study by Meda et al.⁴⁹

We applied 80% and 100% of these cost estimates to the national policy and pilot arms of the decision tree, respectively. For the baseline scenario, given evidence suggesting that user fees in 2006 (4055 FCFA) recovered on average 90% of the total cost for a normal delivery (4500 FCFA),²⁴ we estimated the cost for a normal delivery at the baseline to be at 10% of the total costs. Similarly, the cost for a complicated delivery with and without a cesarean delivery at the baseline was estimated at 18% of the total costs, using the aforementioned rate of 30 333 FCFA and a net of 10 000 FCFA included to cover transportation costs.

We estimated program costs for both the national policy and the pilot on the basis of the monetary expenses recorded in the accounting systems of the implementing agencies (MOH and HELP).⁵³ We categorized program costs into startup costs (initial costs required to establish the intervention) and running costs (annual costs required to maintain the intervention). Startup costs were annualized over the entire intervention period, whereas running costs were further categorized into capital costs and recurrent costs.⁵⁴ In line with the specific contents of the study interventions, we applied 2 different approaches to derive the unit program costs, distinguishing those for the national policy and those for the pilot. [Appendix 2](#) in the Supplemental Materials (found at <https://doi.org/10.1016/j.jval.2019.10.007>) provides the detailed estimation of program cost for both interventions.

Analytical Approach

We calculated the incremental cost-effectiveness ratios (ICERs) of the 2 interventions under 2 distinct scenarios.⁵⁵ In the first scenario, we computed the ICERs of both interventions compared with the baseline. In the second scenario, we calculated the ICER of the pilot compared with the national policy. To facilitate the comparison of results across settings, health effects were

Table 2. Estimates of the model key parameters, assumption/justification for use, and their relevant sources.

| Parameter | Estimate | | Assumptions/justifications | PSA distribution | Sources |
|--|----------------|--------------------|--|-------------------------|-------------|
| | Most likely | Uncertainty range* | | | |
| Health service costs (FCFA/USD) | | | | | |
| Cost of a normal delivery | 4500 (7.60) | ±40% | The mean cost of a normal delivery was averaged across 3 health facility levels (primary, secondary, and tertiary) | Gamma | 49,50 |
| Cost of a complicated delivery (with and without a cesarean section) | 30 333 (51.24) | ±43% | | | |
| Epidemiological estimates | | | | | |
| Proportion of severe obstetric complications (%) | 6.17 | 5.8-6.5 | Given the absence of more specific data, this estimate was equally applied to home and facility-based deliveries | Triangular [†] | 34 |
| Risk of complications, % | | | Given the lack of more specific data, the estimates on the risk of different complications were uniformly applied to home and facility-based deliveries | Dirichlet | 34 |
| Postpartum hemorrhage | 26.2 | | | | |
| Obstructed labor | 30.9 | | | | |
| Preeclampsia/eclampsia | 9.6 | | | | |
| Sepsis | 1.4 | | | | |
| Other (ante-/peripartum hemorrhage, rupture of the uterus, fetal distress) | 31.9 | | | | |
| Case fatality rate, % | | | | | |
| Postpartum hemorrhage | 2.8 | ±20% | None | Beta | 34 |
| Obstructed labor | 1.7 | | | | |
| Preeclampsia/eclampsia | 5.6 | | | | |
| Sepsis | 33.3 | | | | |
| Other | 2.5 | | | | |
| Risk of long-term sequelae | | | | | |
| Probability of severe anemia among mothers surviving postpartum hemorrhage | 0.12 | ±20% | Like the global burden of disease study, ⁴⁵ fistula was assumed to occur only among home deliveries | Beta | 38 39,40 |
| Probability of secondary infertility among mothers surviving sepsis | 0.075 | ±20% | | | |
| Probability of fistula among mothers surviving obstructed labor | n/a | 0.01-0.14 | | Uniform | |
| Risk of perinatal deaths | | | | | |
| Perinatal death if mother is dead | 0.4087 | ±20% | Because of shared risk factors between mothers and their fetus/newborn, perinatal deaths are considered based on the mother's status as being alive or dead ³⁶ ; further, perinatal death is assumed to be uniformly correlated with maternal death, regardless of the cause of death | Beta | 36 |
| Perinatal death if mother is alive | 0.0477 | | | | |
| Relative risk (RR) | | | | | |
| RR of perinatal death for home versus facility-based delivery | 1.21 | 1.02-1.46 | Facility-based delivery has the same impact on mortality regardless of the complication type, and therefore, RRs were applied consistently to all complications | Triangular [‡] | 16 |
| RR of maternal death for facility-based versus home delivery | 0.00015 | ±20% | | | |

PSA indicates probabilistic sensitivity analysis.

*Uncertainty range refers to standard deviations, 95% confidence interval, or minimum and maximum values reported from the sources; an arbitrary range of ±20% is used when no data exist.

[†]The ideal distribution would be Beta if relevant data existed.

[‡]The ideal distribution would be log-normal.

discounted at 3% in the deterministic analysis and at 0% to 5% in the sensitivity analysis.⁵⁶ Given that both study interventions consumed mostly local resources,⁵⁷ costs incurred in different years were adjusted for inflation using the country's average consumer price index (2.5%) for the 2007 to 2015 period⁵⁸ before

converting to US dollars (USD) using the average exchange rate in 2015 (592 FCFA/USD).⁵⁹

First, we assessed the deterministic cost-effectiveness of the national policy and the pilot under both scenarios for each intervention year. Further, to quantify the totality of economic and

Table 3. Deterministic cost-effectiveness results of the national policy and the user-fee removal pilot for 2015.

| Decision options | Mean | | Incremental | | |
|---|------------|----------------|-------------|----------------|-----------------|
| | Cost (USD) | Effect (DALYs) | Cost (USD) | Effect (DALYs) | ICER (USD/DALY) |
| Scenario 1: National policy and user-fee removal pilot compared with the baseline | | | | | |
| Baseline | 0.55 | 1.5295 | | | |
| National policy | 5.82 | 1.5044 | 5.27 | 0.0251 | 210.22 |
| Pilot | 11.56 | 1.4859 | 11.01 | 0.0436 | 252.51 |
| Scenario 2: User-fee removal pilot compared with the national policy | | | | | |
| National policy | 5.82 | 1.5044 | | | |
| Pilot | 11.56 | 1.4859 | 5.74 | 0.0185 | 309.74 |

DALY indicates disability-adjusted life-year; ICER, incremental cost-effectiveness ratio; USD, US dollar.

health implications of user-fee reduction and removal policies on the national scale, we estimated both the total costs incurred and total DALYs averted by the national policy, the incremental costs incurred, and DALYs averted had the pilot been implemented nationwide.

Second, we conducted 1-way sensitivity analysis to explore the uncertainty of each model parameter and reported the relevant results for the 10 most influential parameters using a Tornado diagram. Third, we assessed the joint uncertainty of all model parameters through probabilistic sensitivity analysis (PSA) using Monte Carlo simulation with 5000 iterations. In each iteration, model parameters were sampled from their corresponding PSA distributions within the range specified in Table 2. The results of the PSA are presented on a cost-effectiveness scatter plot graph and as cost-effectiveness acceptability curve that reports the probability of an intervention being cost-effective as a function of different willingness-to-pay (WTP) thresholds. We report the value of an ICER for which the chosen intervention has the 95% probability of being cost-effective.⁶⁰

Fourth, we conducted a sensitivity analysis on the model assumption that obstetric complications were equally distributed across home and facility-based delivery by setting the proportion of severe obstetric complications 2 times higher among facility-based compared with home delivery. For this sensitivity analysis, we used the estimate on severe obstetric complications for facility-based deliveries (7.3%) from the most representative survey to our knowledge⁶¹ and reduced this estimate by half for home deliveries.

Fifth, to determine the cost-effectiveness of the study interventions for national-level decision making, we first compared the ICERs with the country's specific WTP, defined as the national per capita gross domestic product (GDP) per DALY averted, using the World Health Organization (WHO) cost-effectiveness thresholds to classify the intervention into 3 broad categories (very cost-effective, cost-effective, and not cost-effective).^{56,62} To account for local health system budgetary constraints when assessing the cost-effectiveness of the interventions, we then referred to the country-level cost-effectiveness thresholds estimated for Burkina Faso (\$17-379 in 2013 or 1%-54% GDP per capita).⁶³ Last, to assess the affordability of the study interventions, we estimated the total cost of the interventions per capita in 2015 and compared it with the country's per capita total health spending of the same year.

Model Validation

We checked the face validity of the model by inspecting whether all parameters influenced the model according to the expectations. The model was built using TreeAge Pro 2018. Cost analyses were conducted using Microsoft Excel 2016.

Results

We first report the estimation of program costs, then proceed to the deterministic and sensitivity analysis, and lastly present the model validation results.

Program Cost of the National Policy and the Pilot

The total program cost of the national policy during its entire implementation period (2007-2015) amounted to 2 131 020 479 FCFA (\$3 599 697). Its annual program cost ranged from a minimum 214 225 000 FCFA (\$361 867) in 2015 to a maximum 285 106 278 FCFA (\$481 598) in 2008. Because the national policy covered 5 097 671 facility-based deliveries in total between 2007 and 2015, its unit program cost was estimated at 418 FCFA (\$0.7) per facility-based delivery.

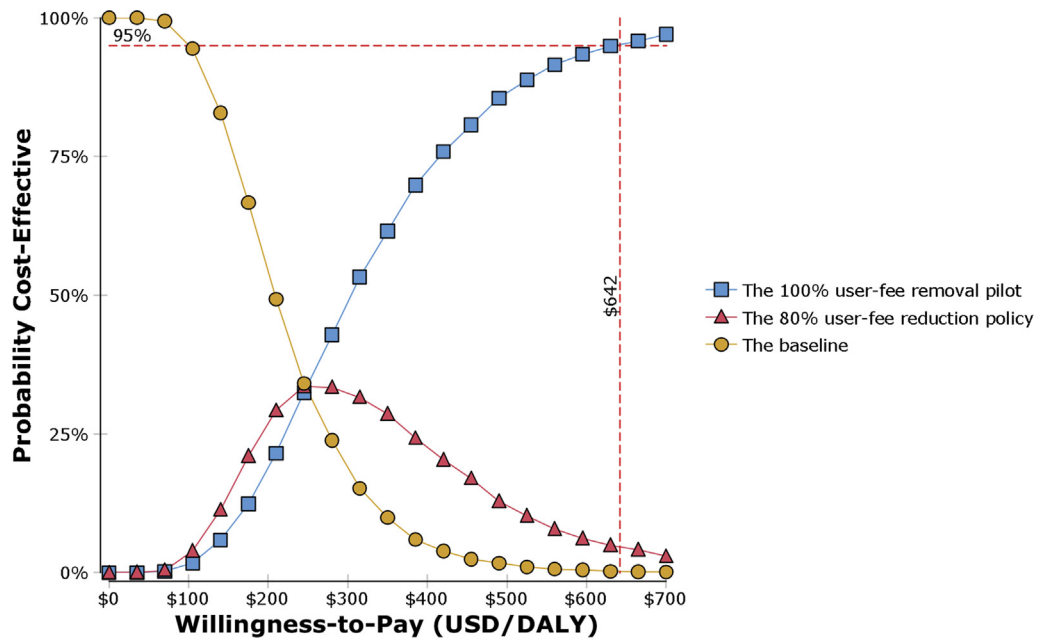
Between 2008 and 2015, the pilot incurred a total program cost of \$4 702 040, accounting for 43% of its health service costs. The annual proportion of its program costs to health service costs varied between 33% in 2012 and 69% in 2008. Appendix 2 in Supplemental Materials (found at <https://doi.org/10.1016/j.jval.2019.10.007>) presents a detailed calculation of the program costs for both interventions.

Deterministic Cost-Effectiveness Analysis

Table 3 presents the deterministic cost-effectiveness results for both the national policy and the pilot in both scenarios for 2015. In the first scenario, when both interventions are compared with the baseline, for each delivery, the national policy incurred an incremental cost of \$5.27 and averted 0.0251 DALY, and the pilot entailed an incremental cost of \$11.01 and averted 0.0436 DALY. Accordingly, the ICERs of the national policy and the pilot compared with the baseline were, respectively, \$210.22 and \$252.51 per DALY averted. In the second scenario, which compared the pilot with the national policy, the pilot incurred an incremental cost of \$5.74 and averted 0.0185 DALY per delivery, resulting in an ICER of \$309.74 per DALY.

The deterministic analysis results for all intervention years are reported in Table 3 of Appendix 2 (in Supplemental Materials found at <https://doi.org/10.1016/j.jval.2019.10.007>). Based on the deterministic estimates, for 2015 alone, the national policy incurred an estimated cost of \$5 025 349, equivalent to \$0.27 per capita, and averted 21 144 DALYs. The pilot could have entailed an incremental cost of \$0.26 per capita and averted an additional 15 584 DALYs had it been implemented nationwide in 2015. Between 2007 and 2015, the national policy incurred a total cost (program costs and health service costs) of \$41 481 428 and averted 144 377 DALYs. Had the pilot been implemented nationwide, it would have

Figure 1. Cost-effectiveness acceptability curves at different willingness-to-pay per DALY averted for the national policy, the pilot and the baseline for 2015.



DALY indicates disability-adjusted life-year; USD, US dollar.

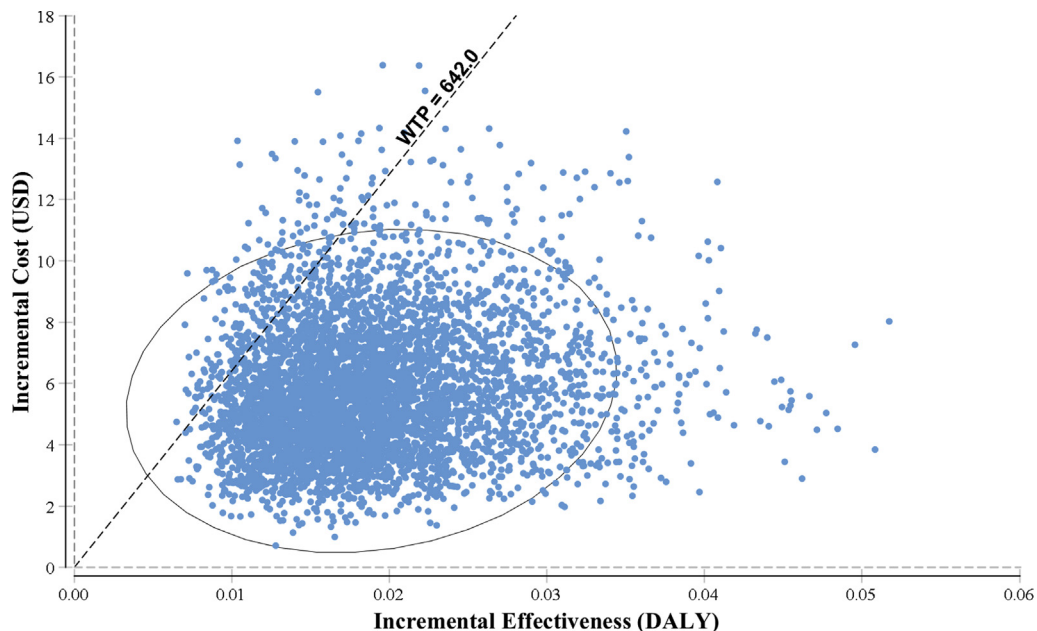
entailed an incremental cost of \$33 754 880 and averted an additional 102 008 DALYs between 2008 and 2015.

Sensitivity Analyses

We report the 1-way sensitivity analyses results for both scenarios in Appendix 2 (in Supplemental Materials found at <https://doi.org/10.1016/j.jval.2019.10.007>). The cost-effectiveness probabilities for all 3 policy options—the baseline, the national policy,

and the pilot—at different WTP levels are shown in Figure 1. The pilot is more likely to be the optimal choice above the WTP of \$252.51 per DALY averted, and at a threshold of \$642 per DALY averted, it has a 95% probability of being more cost-effective than the national policy. The incremental cost-effectiveness scatter plot (Fig. 2) visualizes 5000 ICER iterations of the pilot versus the national policy. All the dots lie in the northeast quadrant of the cost-effective plane, indicating that the pilot is always more

Figure 2. Incremental cost-effectiveness ratios scatter plot of the pilot versus the national policy for 2015.



effective than the national policy at a higher cost. Similarly, relative to the baseline, the national policy and the pilot have a 95% probability of being more cost-effective at WTPs of \$400 and \$472 per DALY averted, respectively (Appendix 2 in Supplemental Materials found at <https://doi.org/10.1016/j.jval.2019.10.007>).

When the incidence of severe obstetric complications for facility-based delivery is assumed to be twice as high as for home delivery, the deterministic ICERs of the national policy and the pilot versus the baseline become \$362.69 and \$437.61 per DALY averted, respectively. The ICER of the pilot compared with the national policy becomes \$539.00 per DALY averted.

Model Validation

All parameters influenced the model according to expectations, confirming its face validity.

Discussion

Our study makes a unique contribution to the literature on user-fee exemptions. First, in relation to the baseline, both the 80% reduction and the 100% removal for delivery care proved to be highly cost-effective in Burkina Faso. When assessing the interventions against the WHO cost-effectiveness thresholds,⁶⁴ ICER estimates of the 2 interventions in relation to the baseline for both deterministic and sensitivity analyses are substantially lower than the country's 2015 per capita GDP of \$575.⁶⁵ When assessing the interventions against country-level cost-effectiveness thresholds, the deterministic ICERs of both interventions, which were estimated at 37% GDP per capita for the national policy and 44% for the pilot, are also below the 54% GDP per capita threshold for Burkina Faso.⁶³ Having assessed the cost-effectiveness results also using the country-level thresholds, which were developed based on the health opportunity cost and thus explicitly considering the resource constraints faced by the national healthcare system in Burkina Faso,^{63,66} we are confident that our cost-effectiveness assessment is highly relevant in informing the ongoing development of user-fee exemptions in Burkina Faso.

Second, the 100% removal of user fees for delivery care is more cost-effective than the 80% reduction when implemented at the national scale. Relative to the national policy, the pilot entailed a deterministic ICER of \$309.74 per DALY averted, which is well below the WHO threshold for a highly cost-effective intervention and also below the 54% threshold for Burkina Faso. Further, our 1-way sensitivity analyses indicated that this ICER could be halved if the pilot incurred the same program costs as the national policy.

Third, our study suggested that the national policy was affordable in Burkina Faso. We estimated that the total cost of the national policy was about \$0.27 per capita in 2015, equivalent to 0.79% of the country's total health spending of the same year, which was \$34 per capita.⁶⁷ Further, our estimated total costs of the national policy was about 18% lower than the budget (30 billion FCFA) committed by the government for its implementation.²⁹ Similarly, our estimates support that Burkina Faso can afford to implement the 100% removal instead of 80% reduction of user fees for delivery care on a national scale using their domestic resources, given that such a shift would have entailed an incremental cost of about \$0.26 per capita, or 0.76% the country's total health spending in 2015. Our finding regarding the affordability of the 2 study interventions is consistent with the finding of a recent analysis that the government is capable of providing sustainable financing for use-fee exemption policies in Burkina Faso.⁶⁸

Fourth, our findings suggested that the national policy made a substantial contribution to reducing the country's disease burden due to maternal conditions by covering 5 097 671 out of 6 668 061

deliveries and averting 144 377 DALYs in total from 2007 to 2015. The pilot has great potential to improve maternal and perinatal health: it could have averted an additional 102 008 DALYs had it been implemented nationwide for the same period. In addition, it is important to note that our study adopted a health system perspective, considering only impacts on health. Nevertheless, we acknowledge that the actual gains from user-fee exemptions would likely be larger should one consider the intervention's wider societal impacts.^{25,47,69}

Appraising our findings with the only existing study assessing the cost-effectiveness of the user-fee removal policy,¹⁸ our estimated ICERs for both the national policy and the pilot are almost 2 times lower than those of the analysis of the free healthcare policy in Sierra Leone. This difference is possibly explained by the fact that this study did not account for morbidity benefits and that this policy entailed a higher cost and produced lower health benefits than what we observed for our 2 study interventions in Burkina Faso. This discrepancy questions the transferability of our findings, because it suggests that existing health system structures are important determinants of both costs and effects of an intervention. Hence, before we can conclude that user-fee reduction and removal policies are cost-effective in other settings, further evidence emerging from the local context, including health system factors and cost structures, is needed.

Appraising our findings in relation to existing literature, we note that our ICER estimates for both the national policy and the pilot are much higher than the ICER (\$46 per DALY) reported for the statewide maternal health insurance program in rural Nigeria.⁷⁰ Our ICER estimates are about 2 and 4 times lower, respectively, than the ICERs reported for the input-based financing (\$413 per quality-adjusted life-year) and the results-based financing (\$809 per quality-adjusted life-year) programs targeting maternal and child health services in rural Zambia.⁷¹

Our study makes several unique contributions to the literature on user-fee reduction and removal policies. First, it represents the first attempt to assess costs and effects of both partial and complete user-fee removal policies in a comparative manner. Second, having assessed the full economic costs as well as most of the relevant maternal and perinatal health impacts of both study interventions, we are confident that our work represents the most comprehensive assessment of the economic impacts of user-fee exemption policies for SSA. Third, our study is the first to rely on DALYs as a final outcome measure, accounting for health benefits measured in relation to both reduced mortality and reduced morbidity. With specific reference to maternal health, the need to expand the evaluation focus to include morbidity benefits is essential because scientific evidence indicates that maternal morbidities represent a major portion of the disease burden imposed by maternal conditions.^{14,15} Lastly, our work demonstrates that pooling information of high quality across different literature sources in a single model, robust estimation of the user-fee interventions' economic impacts is possible.

Our findings ought to be appraised in light of several methodological considerations. First, one must consider our estimates as the cost-effectiveness of user-fee removal and reduction combined with quality improvement. Because the national policy was implemented in a functioning health system with possibly concurrent activities targeting quality of care²⁹ and the pilot was implemented with accompanying quality improvement measures,³⁰ we had no way of disaggregating the impact of user-fee reduction and removal from quality improvements. Nevertheless, we have thoroughly assessed the impact of quality changes on our model results, and our core findings remained consistent. Second, given limited epidemiological and cost data availability, our model was based on several simplifying assumptions, which

could have potentially biased our estimates: (1) obstetric complications were treated as mutually exclusive events, ignoring the coexistence of multiple obstetric complications in reality³⁴; (2) we treated the impact of facility-based versus home delivery as constant across complications, and we treated the risk of perinatal death as constantly correlated to maternal death, irrespective of cause of death; (3) we averaged treatment costs across all complications, overlooking potential heterogeneity in the conditions leading to a complicated vaginal delivery versus a cesarean delivery; and (4) we used average yearly program costs, overlooking potential heterogeneity across years. Lastly, given that our impact study was conducted only in Sahel, where the use of facility-based delivery at baseline (17.6%) was 2 times lower than the country's average (42.9%), the impact we detected for both interventions might be more pronounced than it could be in other regions.⁷ We addressed this uncertainty by halving this impact estimate in the sensitivity analysis, and its results remained consistent with the main findings.

Conclusions

Our study suggests both 80% reduction and 100% removal of user fees for delivery care were cost-effective and affordable interventions in Burkina Faso. Our findings support that it is worthwhile for Burkina Faso to switch from 80% reduction to full removal of user fees for delivery care, the process already imitated by the country with the recently launched national free healthcare policy in 2016, which completely removes user fees for pregnant women, children younger than 5 years, and indigents.⁷² Future research needs to assess whether this nationwide policy has a cost-effectiveness similar to that of the pilot object in our study. Our work should be replicated locally to identify whether it is worthwhile to introduce user-fee exemptions in other SSA countries.

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Supplemental Material

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.jval.2019.10.007>.

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