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Complete List of Authors:	Torbica, Aleksandra; Bocconi University Grainger, Corinne; Options Consultancy Services Ltd Okada, Elena; Options Consultancy Services Ltd De Allegri, Manuela; Heidelberg University,
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What does it cost to combine supply-side and demand-side RBF approaches in a single intervention? Evidence from the Results Based Financing for Maternal and Newborn Health Initiative in Malawi

Aleksandra Torbica[1], Corinne Grainger[2], Elena Okada[3], Manuela De Allegri[4*]
[*] Corresponding author

[1] Centre for Research on Health and Social Care Management (CERGAS), Bocconi University
[2] Options Consultancy Services, United Kingdom
[3] Options Consultancy Services, United Kingdom
[4] Heidelberg Institute of Global Health, University Hospital and Medical Faculty, University of Heidelberg, Germany

* Corresponding author: Manuela De Allegri – manuela.deallegri@uni-heidelberg.de

Abstract

Objective: To estimate the economic cost associated with implementing the Results Based Financing for Maternal and Newborn Health (RBF4MNH) Initiative in Malawi. No specific hypotheses were formulated ex-ante.

***Setting*:** Primary and secondary delivery facilities in rural Malawi.

Participants: Not applicable. The study relied almost exclusively on secondary financial data.

Intervention: The RBF4MNH Initiative was an RBF intervention including both a demand and a supply-side component.

Primary and secondary outcome measures: cost per potential and for actual beneficiaries.

Results: The overall economic cost of the Initiative during 2011 – 2016 amounted to 12,786,924 Euro, equivalent to 24.17 Euro per pregnant woman residing in the intervention districts. The Supply Side Activity Cluster absorbed over 40% of all resources, half of which were spent on infrastructure upgrading and equipment supply, and 10% on incentives. Costs for the Demand Side Activity Cluster and for Verification were equivalent to 14% and 6% respectively of the Initiative overall cost.

Conclusion: Carefully tracing resource consumption across all activities, our study suggests that the full economic cost of implementing RBF interventions may be higher than what was previously reported in published cost-effectiveness studies. More research is urgently needed to carefully trace the costs of implementing RBF and similar health financing innovations, in order to inform decision-making in LMICs around scaling up RBF approaches.

Trial registration: Not applicable.

Strengths and limitations of this study

- We adopted a rigorous approach, rooted in Activity Based Costing, to trace all resources and related costs associated with designing and implementing a Results Based Financing intervention, combining demand- and supply-side incentives, and classified them by activity and by cost category.
- Tracing resource consumption across all activities, the economic cost of implementing RBF interventions appears to be greater than what has been indicated by prior cost-effectiveness studies.
- Due to the retrospective nature of our work, it is possible that we did not capture all costs or assigned them to the respective activities as accurately as it would have been possible had we collected data prospective.
- Further research is needed replicating the Activity Based Costing approach applied in this study to strengthen the evidence base on the economic costs of RBF interventions.

Introduction

Results-based financing (RBF) interventions are gaining increased attention as a means of improving access to care and enhancing quality of service provision across low- and middle-income countries (LMICs) [1]. With specific reference to health service delivery, results-based financing approaches include demand-side interventions, chiefly conditional cash transfers (CCT), and supply-side interventions, most notably performance-based financing (PBF). Conditional cash transfers are payments to healthcare users tied to compliance with a specific health behaviour, most frequently utilization of a given service, such as facility-based delivery or vaccinations [2]. Performance-based financing refers to the implementation of performance contracts, whereby healthcare providers and/or managers are paid upon the attainment of pre-defined quantity and quality indicators [3].

The widespread implementation of RBF has drawn attention to the need to assess the costs associated with these interventions. A recent publication by Chi and colleagues (2018) invites the research and policy community to be mindful of the identification, measurement and validation of the costs of RBF implementation as an integral element of research to inform investments in the health sector. To date, the scientific evidence base on the costs associated with RBF is extremely limited; it is mostly generated by studies that have focused exclusively on supply-side PBF interventions, and has largely neglected the estimation of costs associated with implementing demand-side programs, such as CCT [4]. This paucity of evidence is somewhat surprising considering that demand and supply-side RBF interventions are increasingly being combined in a single program design intended to address both sets of barriers to accessing health services [5].

Moreover, the available literature suffers from two limitations. First, existing costing studies on RBF struggle to accurately trace full costs across activities and cost categories, hence providing only limited information for policy makers as to which activities drive implementation costs [6]. Second, existing studies often aim to assess cost-effectiveness, relating the costs of implementing RBF approaches to their benefits, measured in terms of improved health service utilization and/or health gains [7–9]. While cost-effectiveness studies are instrumental in enabling policy makers to select interventions that generate the greater health benefits at lower costs, the evidence they generate does not provide guidance on the full cost structure of such programs, which is needed to inform further implementation and scale-up pilot interventions.

It is against this background that we aimed to fill the aforementioned gaps in knowledge by estimating the costs associated with implementing the Results Based Financing for Maternal and Newborn Health (RBF4MNH) Initiative in Malawi. This was an RBF intervention encompassing both a demand and a supply-side component to tackle maternal and newborn mortality by increasing access to better quality institutional delivery services. Our objective was to estimate the economic costs of the intervention, including both demand and supply-side components, clearly differentiating the costs across project phases, activities, and cost categories.

Methods

Study setting

With an estimated 2020 GDP per capita of 412 USD (current USD), Malawi is one of the poorest countries in sub-Saharan Africa. In 2010, prior to the launch of the RBF4MNH Initiative, maternal and neonatal mortality were estimated respectively at 639 deaths per 100,000 [10] and at 31 deaths per 1,000 live births [11]. Obstetric care services are provided through the country's essential health package offered free of charge at public and contracted not-for-profit faith-based health facilities. Facility-based delivery utilization rates have increased dramatically over the course of the last two decades, increasing from 55% in 2000 to 91% in 2016 [12].

In spite of the high rates of institutional delivery, in 2014, unmet need for emergency obstetric care (EmOC) among women with obstetric complications was estimated at 75%, given that the majority of health facilities still did not meet EmOC standards. The healthcare system was at the time, and continues to be, characterized by poor infrastructure, and severe shortages in human resources and medical supplies, largely linked to insufficient funding capacity [13]. In 2013, annual per capita total health expenditure amounted to 39 USD [14], with donor funding covering nearly 70% of this amount.

Intervention design

The RBF4MNH Initiative has been described extensively in the literature, since sustained research efforts have been channelled towards assessing its impact on providers' motivation [15], effective coverage [16], quality of service delivery [17,18], and maternal mortality at birth [19]. Hereafter, we synthetize the Initiative's main features to allow the reader to follow the rationale of the methodological decisions we made for the cost analysis and to contextualize the findings we present.

The RBF4MNH Initiative was implemented between 2013 and 2018 by the Reproductive Health Directory (RHD) of the Ministry of Health, with financing from Governments of Germany and Norway, and technical and management assistance by Options Consultancy Services. Initially implemented in 18 EmOC facilities, it was later expanded to a total of 33 facilities, including 28 Basic EmOC facilities and 5 Comprehensive EmOC facilities, distributed across four districts (Balaka, Dedza, Mchinji, Ntcheu). Not all health facilities in each district participated. The Initiative aimed at reducing maternal and neonatal deaths by targeting the quality of obstetric services, encouraging utilization of facility-based delivery and 48 hours in-facility post-partum stays. To achieve these objectives, the Initiative included a supply and a demand-side component, specifically: (a) performance contracts with health facilities and district health management teams (DHMTs) linked to defined obstetric and neonatal care quality and utilization targets; and (b) conditional cash transfers (CCT) to pregnant women arriving at a participating facility for delivery, intended as partial reimbursement for the costs associated with delivering at a health facility. An additional integral component of the RBF4MNH Initiative, setting it aside from other RBF interventions, was the investment made to support infrastructure works and supply of essential medical equipment to participating public health facilities (e.g., renovation of labor rooms, construction of maternity waiting homes).

The participating facilities and the respective DHMTs received performance payments on top of the usual budget and in-kind resources (i.e., staff salaries, drugs and medical supplies) allocated by central and district governments. Approximately two-thirds of performance payments could be redistributed among staff as personal incentives, while one third was to be re-invested by the staff to support quality improvements at the facility (i.e., using the funds to purchase drugs and basic supplies, hiring contract staff and paying for minor infrastructure works and repairs).

In a departure from the current system whereby health facilities are not designated as cost centres and districts are largely responsible for all expenditure related to health facility functioning, the RBF Initiative worked to enable participating health facilities to manage the additional funds acquired autonomously. Health workers were also directly in charge of disbursing the CCT to women at the facility (paid in instalments on arrival and before/after delivery), and to register women for eligibility during antenatal care.

Study design

Our retrospective cost analysis aimed at estimating the full economic cost of the RBF4MNH Initiative. Hence, we captured the full value of all resources used by any of the parties involved in the design and implementation of all activities related to the Initiative [20]. We adopted a health system perspective, accounting for costs incurred by the Ministry of Health (MoH) and their development and implementing partners. These included: the MoH Malawi as key implementing lead, Options Consultancy Services (providing programme management and technical assistance), the German Development Bank KfW (as co-funder), and Norwegian cooperation (represented by both Norad and the Norwegian Embassy in Lilongwe). Our analysis captures the costs incurred by the Initiative in the four concerned districts as well as costs incurred in any other relevant settings, including the capital Lilongwe, where both the MoH and the central RBF4MNH office were located, as well as London, Frankfurt and Oslo, where monitoring and oversight activities were undertaken.

Our work covers the period from 2011, the year when the initial Feasibility Study was commissioned marking the onset of the Initiative's design, to 2016. Hence, our analysis covers two years related to the Initiative design and start-up (2011-2012), and four years related to its implementation (2013-2016). While the Initiative was extended into 2018, our analysis concludes at 2016, since our research funding was aligned with the initial timeline of the Initiative and could not be prolonged to match its extension. Since the Initiative was also subject to some design modifications during implementation, we continued tracing design costs for the period 2013-2016. To the extent possible, we attempted to differentiate the cost of supply-side from demand-side activities. Given the retrospective nature of the study and the lack of relevant details in the financial data at our disposal, however, this was not always possible, so some activities, such as management, are not directly attributable to either the supply-side or the demand-side component.

Data sources and data collection strategies

To trace all costs pertaining to the design and implementation of the RBF4MNH Initiative, we adopted an Activity-Based Costing (ABC) approach. Accordingly, we started by retrospectively mapping all micro-level activities related to the design and

implementation of the Initiative and then traced all resources being consumed by these activities. We completed these first two steps by reviewing the complete documentation of the intervention and engaging in a series of repeated exchanges with key stakeholders, who had been involved in the implementation of the Initiative.

To attribute value to either single resources (where possible) or complete activities (when the former was not possible), we extracted relevant cost information from the financial data of the different implementing partners. These included: a. Options' financial data reporting central level costs related to implementation, including personnel costs; b. the RBF4MNH Initiative financial data, reporting costs for all activities related to field implementation, including incentive payments; c. financial data contributed by the development partners, including cost information on specific activities, such as the early Feasibility Study and the consultancies conducted during the course of the implementation.

To estimate resource consumption for activities that could not be traced in financial data, we conducted key informant interviews with MoH and development and implementing partners' staff. These interviews allowed us to quantify the extent to which these staff had contributed towards the Initiative, albeit the value of their engagement was not directly reflected in the financial data. To value the days of work contributed by MoH staff, we used official national-level cadre-specific salary information. To value the days of work contributed by development and implementing partner staff, we used level-specific average international and national consultancy rates. In addition, to value material contributions by development partners not included in the financial data, such as flights and other transport, we used average market price items. In line with the literature, we applied a 15% overhead rate to the costs incurred by MoH, Norwegian Embassy and Norad, as well as KfW, to account for overarching costs (such as overall management) not easily traceable when accounting only for crude salaries and/or consultancy rates.

The RBF4MNH Office provided us with the number of women who benefitted from the Initiative while the National Office of Statistics provided us with the number of expecting mothers estimated for the RBF4MNH district catchment areas over the 2013-2016 period. This information served as basis to compute the size of the actual and the potential beneficiary population respectively.

Data sharing statement

Given the sensitive nature of the data used for this analysis, the authors cannot share the data used for analysis with third parties. Any request for data needs to be directed to the Ministry of Health of Malawi and its partners.

Analytical approach: cost analysis

To complete the cost analysis, aggregating information across data sources, we proceeded in steps, exemplified in Figure 1. First, once we had identified all single micro-level activities, we aggregated them into Activity Clusters, i.e., a series of broader activity groups to facilitate policy appraisal of the intervention costs (see Appendix 1 for details). The Activity Clusters were identified in consultation with the RBF4MNH implementation team as follows: Design, Management, Promotion, Operations Research, Monitoring and Evaluation (M&E), Verification, Demand side and Supply side costs.

In order to estimate costs for each Activity Cluster identified above, we then adopted the following approach. We aggregated detailed cost information across specific micro-level activities into broader meaningful Cost Categories. Normally, cost categories refer to general cost items, such as transport, staff, office supplies, etc. In our case, however, due to the structure of the data available, we had to work with cost categories that were broader and more inclusive. Then, we further aggregated these Cost Categories into Analysis Cost Categories, to draw a link between Cost Categories and Activity Clusters. We attributed Analysis Cost Categories to the single Activity Clusters and then aggregated values within a given Activity Cluster. This process was designed to inform decision-making by indicating which broad activity area absorbed what portion of the overall costs of the Initiative.

Similarly to what was reported by De Allegri et al (2019), one challenge we faced was the attribution of staff costs to single activities. Staff costs were easily traceable to the individuals involved in implementation, but they were documented as salaries or consultancy fees and did not provide any indication of the breakdown of activities undertaken by staff who worked across more than one Activity Cluster. Hence, to attribute staff costs to single Activity Clusters, we interviewed key implementers to reconstruct their engagement in the project. We attributed all time contributed by MoH, Norway, and KfW partners to general management activities, since we could confirm that staff employed at this level were not involved directly in other activities.

Lastly, to allow the reader a better sense of the 'value' of the RBF4MNH Initiative, we computed the cost per beneficiary, accounting for both actual beneficiaries, i.e., the actual number of delivering women served each year, and potential beneficiaries, i.e., the expected annual total number of delivering women across the four districts, within and beyond the direct catchment areas of the intervention facilities (since mobility across catchment areas is allowed and we know that women moved to receive care at RBF4MNH facilities).

All costs were adjusted to the base year 2016. We used a GDP deflator for the Euro area to adjust for inflation from 2011 to 2016. The cost items expressed in local currency were converted to Euros using official yearly average conversion rates to account for the extreme fluctuations in exchange rates which occurred during the period of our analysis.

Ethical approval

Both the Ethics Committee at the Medical Faculty of Heidelberg University and the Ethics Committee in Malawi waived ethical approval since the study was based exclusively on secondary costing data.

Patients and public involvement

Given the nature of the work conducted, patients and the public were not involved in any phase of the project.

Funding

This research was made possible by funding from the Ministry of Health Malawi and the KfW, the German Development Bank. Grant number not available.

Results

Table 1 presents a synthesis of the Initiative costs, across all years and all Activity Clusters. Under Management, we purposely differentiate costs incurred by the RBF4MNH implementation unit, by the MoH, and by its development and implementing partners.

The overall economic cost of the Initiative for the period 2011 to 2016 amounted to 12,786,924 Euro. The MoH financial contribution when comparing to that of the RBF4MNH implementation unit which, while situated within the MoH, and financed by development partners was (0.04% vs. 20.5% of the total costs).

Table 1 here

Table 2 differentiates costs between the start-up (all costs incurred in 2011-2012 period) and the implementation phase (all costs incurred in 2013-2016 period), with start-up costs absorbing 1,521,454 Euro and implementation costs across the four years we followed absorbing a total of 11,265,470 Euro. Implementation costs rose in the initial years, but then stabilized and started to decrease by 2016. Reflecting the pattern observed for total costs, implementation costs per beneficiary increased in the early years, but stabilized and started to decrease in 2016.

Table 2 here

Combining start-up and implementation costs, Table 3 shows which Activity Cluster absorbed which portion of total costs and which Analysis Cost Category contributed towards each activity. The Supply Side Activity Cluster absorbed over 40% of all resources devoted to the project. Within this figure the incentives only represented approximately 10% of the total value of this activity whilst considerable infrastructural investment represented nearly half. In 2016, once the program reached full maturity, the value of the incentives relative to the total value of the Supply Side Activity Cluster increased substantially, reaching one third of the overall value of the activity.

The Demand Side Activity Cluster absorbed nearly 14% of the intervention value, with incentives in this case representing nearly one third of all activity-specific costs. Verification costs, referring exclusively to supply side verification (since demand-side verification was incorporated in demand-side supervision), only absorbed 6% of the overall value of the intervention. Overall management costs absorbed over one fifth of the intervention value. Design activities absorbed less than 5% of the total value of the initiative, with the cost being driven exclusively by the initial feasibility study and by personnel costs.

Table 3 here

Table 4 presents the same cost data in a different form, looking at the cost of the single Cost Categories and pooling across costs pertaining to both the start-up and the implementation phase across all activities included in Table 3. Personnel costs for contracted RBF4MNH staff represented the most substantial cost driver, absorbing nearly 23% of the intervention value. Structural investments absorbed nearly one fourth of the intervention cost. Here, supply side verification appears to have absorbed only

slightly above 3% of the intervention costs, while in Table 3, this is shown to be 6%. This difference can be explained by the fact that in Table 3, we look at the value of the entire Activity Cluster, including the value of personnel time devoted towards verification. In Table 4, instead, the term supply side verification is used as a Cost Category, reflecting only the payments directly made by the implementation unit (either to external verification agencies or to district teams) to execute the verification procedures. Supply side and demand side incentives accounted for approximately 15% of the value of the intervention, with supply side incentives accounting for 10% and demand side incentives accounting for 5%.

Table 4 here

Discussion

This study makes an important contribution to the literature, being the first to describe in detail start-up and implementation costs of an RBF intervention, including both a demand-side and a supply-side component. Not only have prior analyses of similar programs focused almost exclusively on costs related to supply-side incentive systems, but they have also been conducted primarily with the objective of assessing cost-effectiveness of such programs in relation to status quo service provision [7–9]. We aimed at informing policy decisions on further implementation of RBF programs by describing the cost of single activities and the comparative weight of the single cost categories in detail. As such, our work complements existing literature on the cost-effectiveness of RBF interventions.

The first important finding emerging from our study is the substantial cost of the intervention, estimated at a total of 12,786,924 euros, distributed across the six years of the evaluation period, including two start-up and four implementation years. It should be noted, however, that unlike other RBF programs, this value includes a sizeable investment in infrastructure up-grading and provision of equipment to all participating public health facilities. The fact that implementation costs (across all activities) increased between 2013 and 2015 is likely to be a reflection of the fact that the RBF4MNH Initiative grew in size from 18 facilities in 2013, to 28 in 2014, and to 33 in 2015. The decrease in implementation costs observed in 2016 is a potential indication that program management became more efficient as the intervention settled. This would not be surprising, given that the intensive efforts to enable RBF to function as expected, characterized the early implementation years. However, longer-term data would be necessary to confirm this hypothesis.

When considering the total number of women reached by the program, the cost of the RBF4MNH Initiative is equivalent to Euro 24.17 per potential beneficiary and 62.52 per actual beneficiary. Our estimates stand out as being somewhat higher than estimates produced by prior economic analyses of RBF programs, including the prior cost-effectiveness analysis of the RBF4MNH Initiative, which detected lower unit costs for delivery services [7]. This discrepancy may seem particularly surprising considering that our analysis did not include the cost of providing care so we would have expected our estimates to be lower than previous estimates. However, it may also indicate that our work captured costs associated with RBF implementation, such as those related to design and human resource inputs by development partners, which can easily go

unnoticed in studies focused on the cost-effectiveness of providing care under PBF. While this emerging hypothesis deserves further empirical verification, it would be aligned with the arguments postulated by Chi et al (2018) [6] in calling for the application of more rigorous cost tracing to determine the actual economic value of RBF.

The second finding of interest is the fact that domestic resources only accounted only for a very limited portion of the total costs of the intervention, while development and implementing partners contributed most resources. In line with literature on RBF programs [21,22] as well as other complex health interventions [23,24], this high reliance on donor funding has turned out to be a key challenge for the sustainability of the RBF4MNH Initiative. In spite of the positive effects reported by both the scientific literature [15–19] and by the implementation team [25], the Initiative was discontinued in 2018, once the relevant development cooperation agreement reached the end of its current funding cycle. Although the RBF4MNH Initiative was well-integrated within MoH structures and systems, the combination of human resource capacity constraints and very low operating budgets at the Reproductive Health Directorate (RHD) of the MoH, meant that only a very small portion of the human resources deployed towards managing the Initiative were contributed by staff already stationed at the RHD. Such reliance on external funding has been recognized before as a key challenge to the sustainability of RBF interventions [22,26–29].

Looking at findings in relation to the different activities which made up the RBF4MNH Initiative, we bring the reader's attention again to the fact that the Supply Side Activity Cluster absorbed over 40% of all resources devoted to the project, albeit the incentives only represented approximately 10% of the total value of this activity while the infrastructural investment represented nearly half of its value. The high proportion of costs absorbed by the Supply Side Activity likely reflects the strong focus on improving the quality rather than the quantity of care at participating facilities. The fact that the value of the incentives relative to the total value of the Supply Side Activity Cluster increased substantially over time suggests that as facilities become confident with working within the framework of a RBF intervention, their payoff increases, while the overall investments needed to operate the system (such as those in capacity building) decrease. While this pattern has been reported before in the literature [30], data from further implementation years would have been needed to confirm a trend towards increasing investments in incentives and decreasing investments in capacity building over time.

Nonetheless, the cost of the incentives compared to the overall cost of the intervention captured by our analysis is substantially lower than that observed in previous studies focused on supply-side RBF programs. In Zambia, for instance, incentives accounted for nearly half of all costs of the PBF program [8]. In a separate PBF program funded by USAID in Malawi, the SSDI-PBI program, incentives took up nearly one third of the overall cost of the intervention [30]. In Afghanistan, incentives were observed to absorb two-thirds of all economic costs [9]. Two factors may explain the differences observed between our findings and prior evidence. First, as discussed earlier, discrepancies may emerge as a consequence of different methodological approaches, specifically our focus on tracing and costing each and every activity making up the RBF program rather than solely estimating the costs of providing services under RBF. Second, the RBF4MNH Initiative included substantial capital investment in

infrastructure and purchase of large amounts of equipment for participating health facilities which the other programs it has been compared to may have not.

The Demand Side Activity Cluster absorbed nearly 14% of the intervention value, with incentives in this case representing nearly one third of all activity-specific costs. The fact that the value of the demand-side incentives decreased in 2016 compared to 2015 is attributable to the fact that the program switched from offering CCT to all women delivering in an intervention facility to offering cash transfers only to the women most in need. This measure was introduced at the request of the MoH in order to align better with the government's targeted social cash transfer program. Analyses conducted after the end of the official impact evaluation indicated that this shift did not affect utilization of delivery services, which remained high even once the universal cash transfers were discontinued.

Somewhat surprisingly, verification costs, referring exclusively to supply-side verification, only absorbed 6% of the overall value of the intervention. This value appears low considering that prior research has found verification costs to account for as much as 23% of overall costs of supply-side RBF programs [9] and that the costs associated with verification are often raised as an intrinsic challenge to the effective implementation of PBF programs [31–33]. The low verification cost observed in our study may be an indication that the verification processes within the framework of the RBF4MNH Initiative were managed efficiently. This was probably largely due to the fact that during the early stages of the intervention, the central management staff largely undertook the verification function (due to challenges in identifying and contracting a suitable verification strategy) while later the contract was awarded to a local agency, avoiding the high costs charged by international agencies in other settings.

Of additional interest is the fact that over the entire six-year period, design activities absorbed less than 5% of the total value of the initiative, with the cost being driven largely by the initial feasibility study (we had no beak down of the feasibility study in specific cost categories) and by personnel costs. Comparatively, design activities absorbed one third of the total costs of the parallel RBF intervention being rolled out in Malawi [30]. The fact that costs were incurred over time for design activities is indicative of the adaptive and dynamic nature of the intervention, which as observed in the impact evaluation final report, represents one of its key success features. Still, the reduction in design costs observed overtime suggests that by 2015, the Initiative had reached its full form and did not necessitate substantial further adjustments. This element ought to be considered in light of a possible scale up, since design decisions may need to be made to expand geographical scope, but assuming that the experience of the four pilot districts is representative of the country, the intervention may not necessitate extensive re-shaping, hence design costs could be kept to a minimum.

Methodological considerations

Beyond its value as the first cost analysis carefully tracing all activities of a complex RBF intervention including both a supply-side and a demand-side component, we ought to recognize some important methodological limitations to our study. First, the retrospective nature of data collection made it impossible for us to trace resource consumption across activities as accurately as we would have wished to. Nonetheless, we engaged closely with the implementation team to reconstruct to the extent possible

the roll-out of the intervention, complementing information from documents and financial data with information emerging from key informant interviews. This process was facilitated by the close relationship between the implementation and the research team, having worked together on the impact evaluation already. Second, given the paucity of similar studies focused specifically on the costs of RBF interventions, we recognize an inability to appraise our findings more comprehensively in relation to the experience of other settings. Third, since our study adopted a health system perspective, the resulting findings represent an underestimation of the total costs of the intervention, neglecting what costs might have been incurred at community level to enable its functioning (e.g., community leaders mobilization, identification of poor women, etc.). Fourth, we need to acknowledge that the computation of the cost per potential beneficiary is based on the estimated number of deliveries in the district. Hence, any imperfection in this population-based estimate is also reflected in our own cost estimate. Last, we need to acknowledge that due to the timing of our data collection, we could not include costs related to 2017 and 2018.

Conclusions

Our study represents the first comprehensive effort to assess the costs of setting up a RBF intervention, including both a demand and a supply-side component, examining all activity clusters and cost categories in detail. We have purposely not related these efforts to the benefits generated by the intervention, because, as documented by the literature, those have been very diverse and not easily reducible to a single matrix. Carefully tracing resource consumption across both start-up and design phases, our work suggests that the costs of bringing such an intervention into reality may be higher than what has been indicated by prior cost-effectiveness analyses. This observation calls for further research in the field, monitoring start-up and implementation costs of RBF programs as well as those of comparable health financing interventions, aimed at reforming purchasing structures. To overcome the challenges we have faced due to the retrospective nature of our work, we would argue in favour of integrating such research efforts in the infrastructure of the intervention evaluation from its very onset.

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Conflict of interest
Manuela De Allegri was the principal investigator of the impact evaluation of the RBF4MNH Initiative, but funding for the two parallel studies was acquired and managed independently of one another (different funding agencies). Corinne Grainger and Elena Okada worked for the agency that supported the implementation of the RBF4MNH Initiative, Options Consultancy Services (Options) during the data collection phase of the study. Subsequent contributions to this work have been purely voluntary and as such, the views expressed in this paper represent her own views and not those of Options.

Authors' contribution
MDA and AT were responsible for the initial study design, data collection strategy, and analytical approach. AT and MDA shared the responsibility for data acquisition, including both the retrieval of information from existing documents and the interviews with key informants. AT and MDA were in charge of analysis, with contributions by CG. MDA drafted the manuscript, with support from all authors. All authors read and approved of the final manuscript.

Data sharing statement
Given the sensitive nature of the data used for this analysis, the authors cannot share the data used for analysis with third parties. Any request for data needs to be directed to the Ministry of Health of Malawi and its partners.

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Table 1. Total costs by activity over time in 4 districts (real values in €, base year 2016)

Activity cluster	2011	2012	2013	2014	2015	2016	TOTAL
Design	261,684	228,319	52,619	26,289	9,627	0	578,537
Management							3,112,263
Contracted implementation unit (set within MOH)	69,095	355,224	347,065	477,790	537,819	830,828	*2,617,821*
MoH own resources	1,425	882	737	689	662	515	*4,909*
Development partners (KfW, Norad)	88,260	82,464	81,439	80,000	78,838	78,532	*489,533*
Promotion	2,246	3,703	40,300	58,478	238,202	278,128	621,058
Operations research	15,024	14,862	17,263	12,164	11,987	43,304	114,604
M&E	25,417	115,859	179,822	154,114	156,171	107,590	738,973
Verification	0	0	59,803	157,818	321,833	207,956	747,410
Demand side	8,103	45,752	269,044	290,987	574,657	507,354	1,695,897
Supply side	30,136	173,001	1,105,949	1,340,743	1,423,795	1,104,558	5,178,181
Totals by year	**501,390**	**1,020,064**	**2,154,041**	**2,599,073**	**3,353,592**	**3,158,765**	**12,786,924**

Table 2. Total start-up and implementation costs by year in 4 districts (real values €, base year 2016)

	2011	2012	2013	2014	2015	2016	TOTAL
Start-up costs	501,390	1,020,064					**1,521,454**
Implementation costs			2,154,041	2,599,073	3,353,592	3,158,765	**11,265,470**
N. of expected births (beneficiaries)			111,181	114,739	118,283	121,838	**466,041**
No. of women served per year			28042	41801	52399	57948	**180,190**
Implementation cost by potential beneficiary			19.37	22.65	28.35	25.93	**24.17**
Implementation cost by actual beneficiary			76.81	62.18	64.00	54.51	**62.52**

Table 3 Costs by activity cluster, cost category and by year (real values in €, base year 2016)

Activity cluster	Analysis Cost category	2011	2012	2013	2014	2015	2016	TOTAL	% of total cost
Design									
	Personnel	58,541	228,319	52,619	26,289	9,627	0	375,394	
	Feasibility study	203,143	0	0	0	0	0	203,143	
Total by year		***261,684***	***228,319***	***52,619***	***26,289***	***9,627***	***0***	***578,537***	***4.52%***
Management									
	Personnel	83,069	167,956	195,200	180,326	172,410	187,107	986,069	
	External Audit	0	0	0	0	0	3,760	3,760	
	Capacity building	0	0	20,704	84,902	153,830	394,662	654,099	
	Office /Equipment	18,584	97,812	41,899	46,385	49,342	103,218	357,241	
	General management	17,916	12,810	62,575	105,746	150,134	140,438	489,619	
	Transport/Accommodation	39,211	159,992	108,862	141,118	91,604	80,689	621,475	
Total by year		***158,780***	***438,570***	***429,240***	***558,479***	***617,319***	***909,875***	***3,112,263***	***24.34%***
Promotion									
	Personnel	2,246	3,703	35,600	40,685	47,884	54,400	184,519	
	Awareness campaign	0	0	4,700	17,793	190,318	223,728	436,540	
Total by year		***2,246***	***3,703***	***40,300***	***58,478***	***238,202***	***278,128***	***621,058***	***4.86%***
Operation									
	Personnel	15,024	14,862	14,677	12,164	11,987	11,804	80,518	
	Operation research	0	0	2,586	0	0	31,500	34,086	
Total by year		***15,024***	***14,862***	***17,263***	***12,164***	***11,987***	***43,304***	***114,604***	***0.90%***
M&E									
	Personnel	25,417	115,859	79,251	87,514	66,147	65,790	439,977	
	Baseline assessment	0	0	72,622	16,399	17,480	0	106,502	
	Capacity building	0	0	27,949	50,201	72,543	41,800	192,494	
Total by year		***25,417***	***115,859***	***179,822***	***154,114***	***156,171***	***107,590***	***738,973***	***5.78%***
Verification									
	Personnel	0	0	38,452	34,104	35,275	37,192	145,023	
	Agent	0	0	20,628	123,715	82,167	159,347	385,857	
	Internal Audit	0	0	722	0	204,391	11,417	216,531	
Total by year		***0***	***0***	***59,803***	***157,818***	***321,833***	***207,956***	***747,410***	***5.85%***
Demand side									
	Personnel	8,103	45,752	89,982	104,773	111,471	123,972	484,053	

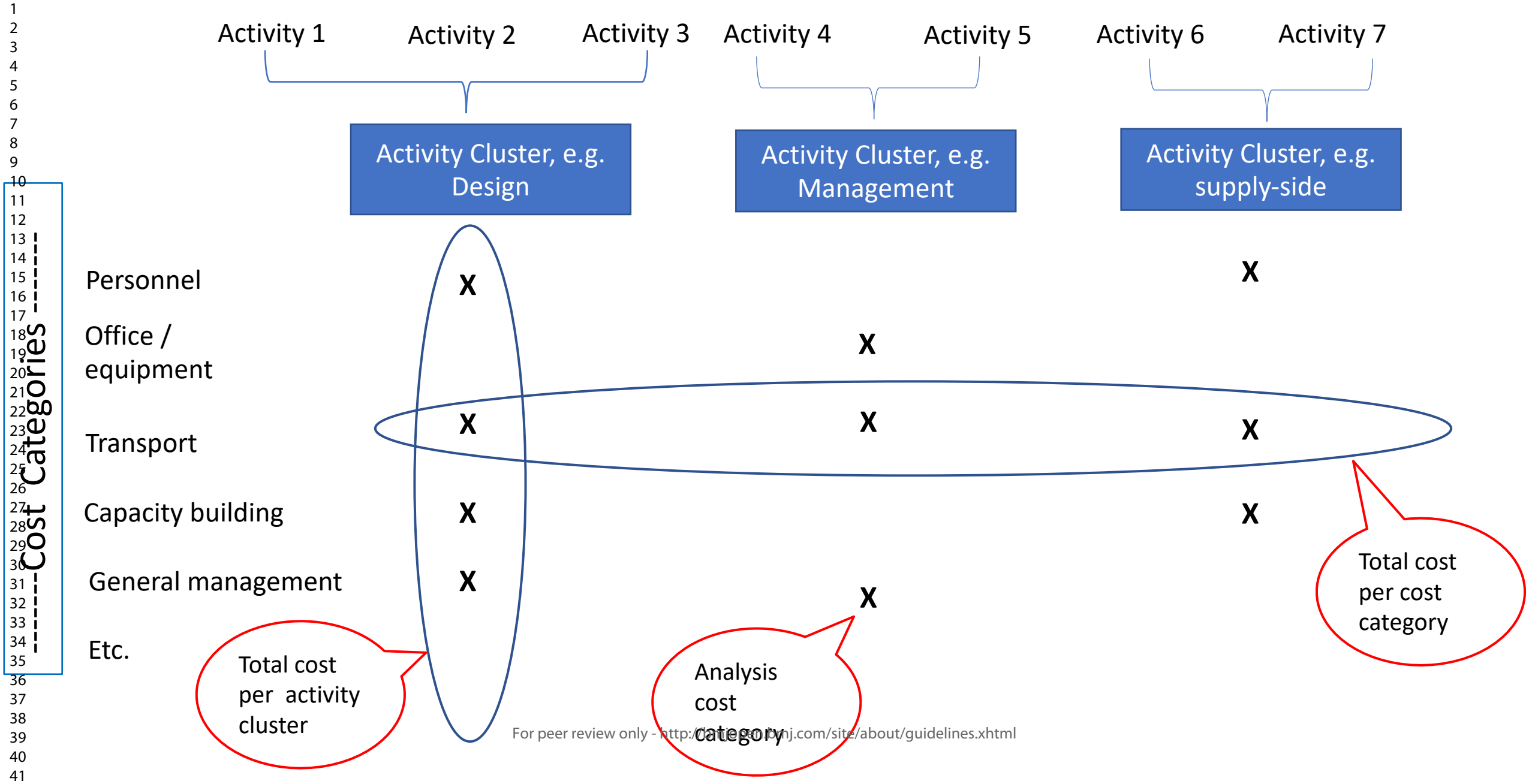
	Incentives	0	0	42,701	128,158	246,210	159,750	576,819	
	Capacity building	0	0	17,882	58,056	204,592	136,060	416,590	
	General management	0	0	118,479	0	12,385	87,571	218,435	
Total by year		***8,103***	***45,752***	***269,044***	***290,987***	***574,657***	***507,354***	***1,695,897***	***13.26%***
Supply side									
	Personnel	30,136	173,001	165,311	108,437	81,060	85,021	642,964	
	Infrastructure Investments	0	0	698,783	796,371	583,137	334,021	2,412,312	
	Equipment Investment	0	0	52,372	170,323	142,342	99,138	464,174	
	Incentives	0	0	0	11,805	66,709	427,057	505,571	
	Capacity building	0	0	189,484	253,807	550,548	159,322	1,153,161	
Total by year		***30,136***	***173,001***	***1,105,949***	***1,340,743***	***1,423,795***	***1,104,558***	***5,178,181***	***40.50%***
GRAND		**413,130**	**937,600**	**2,072,602**	**2,519,072**	**3,274,753**	**3,080,233**	**12,786,924**	

Table 4 Overall distribution of costs across cost categories (all years and all activities together; real values in €, base year 2016)

Cost Category	2011	2012	2013	2014	2015	2016	Total	
Personnel_RBF4MNH	145,009	673,219	595,924	522,482	465,107	489,735	**2,891,476**	22.61 %
Structural Investment - Infrastructure	0	0	698,783	796,371	583,137	334,021	**2,412,312**	18.87 %
Supply side incentives	0	0	103,551	171,450	516,356	479,811	**1,271,168**	9.94%
Capacity building - management	0	0	63,714	160,482	338,841	407,933	**970,969**	7.59%
Transport / accommodation	39,211	159,992	108,862	141,118	91,604	80,689	**621,475**	4.86%
Demand-side incentives	0	0	42,701	128,158	246,210	159,750	**576,819**	4.51%
General management	0	0	53,631	94,107	169,957	247,362	**565,056**	4.42%
Structural Investment - Equipment	0	0	52,372	170,323	142,342	99,138	**464,174**	3.63%
Communications	0	0	4,700	17,793	190,318	223,728	**436,540**	3.41%
Supply side verification	0	0	20,628	123,715	82,167	159,347	**385,857**	3.02%
Office and equipment	18,584	97,812	41,899	46,385	49,342	103,218	**357,241**	2.79%
Personnel (DP)	61,264	60,603	59,850	59,048	58,190	57,300	**356,254**	2.79%
Capacity building - supportive supervision	0	0	69,140	73,004	43,223	69,258	**254,625**	1.99%
Internal data audit	0	0	722	0	204,391	11,417	**216,531**	1.69%
Initial feasibility study	203,143	0	0	0	0	0	**203,143**	1.59%
Operations/Administration	0	0	118,479	0	12,385	0	**130,864**	1.02%
Governance	0	0	1,741	1,651	10,577	92,029	**105,998**	0.83%
Baseline assessment	0	0	72,622	16,399	17,480	0	**106,502**	0.83%
Fraud mitigation	0	0	0	36,831	43,070	13,757	**93,658**	0.73%
General management (DP)	17,730	12,695	12,537	12,021	11,847	12,566	**79,395**	0.62%
Consultancy (supportive)	15,024	14,862	14,677	12,164	11,987	17,804	**86,518**	0.68%
Investment - Human Resources	0	0	0	0	39,037	22,323	**61,360**	0.48%
Capacity building - Data collection & analysis	0	0	0	1,737	17,342	36,806	**55,885**	0.44%
Operations research	0	0	2,586	0	0	31,500	**34,086**	0.27%
Quality assurance	0	0	13,105	13,144	-47	0	**26,201**	0.20%

Capacity building - Financial Management	0	0	1,080	0	8,066	5,001	**14,147**	0.11%
Personnel (MoH)	1,239	767	641	599	575	448	**4,268**	0.03%
Audit	0	0	0	0	0	3,760	**3,760**	0.03%
Management (MoH)	186	115	96	90	86	67	**640**	0.01%

Activity-based Costing Approach



Appendix 1 Mapping from micro-level activities to Cost Categories to Main Activities

Main Activity	Analysis Cost Categories	Cost Categories	Original description of micro -level activities
Demand side	Personnel	Personnel	
Demand side	Demand side incentives	Demand-side incentives	Cash Transfers to districts and facilities
Demand side	Capacity building	Capacity building - management	Institutionalisation of the RBF Initiative
Demand side	Demand side incentives	Demand-side incentives	Demand side cash transfers
Demand side	Capacity building	Capacity building - management	Development of manual for operation, key guidelines
Demand side	General management	Operations/Administration	Operational Costs/Admin - Demands Side Related
Demand side	General management	General management	Print and distribute eligibility cards
Demand side	Capacity building	Capacity building - management	Capacity building (demand side structures and processes)
Demand side	Capacity building	Capacity building - management	Capacity building (demand side structures and processes)
Demand side	Capacity building	Capacity building - financial management	In conjunction with NLGFC train district accountants on RBF financial management and reconciliation
Design	Personnel	Personnel	
Design	Initial Feasibility Study	Initial feasibility study	Initial feasibility study
M&E	Personnel	Personnel RBF	
M&E	Capacity building	Capacity building - management	Improve quality of data
M&E	Baseline assessment	Baseline assessment	Baseline Assessment AND Facility Readiness Assessment
M&E	Capacity building	Capacity building - Data collection & analysis	Conduct regular data collection and analysis
M&E	Capacity building	Capacity building - Data collection & analysis	Train and orient district teams and facilities on the data collection tools and equipment provided
M&E	Capacity building	Capacity building - Data collection & analysis	Provide data collection tools and equipment to RBF health facilities

M&E	Capacity building	Capacity building - management	Support partnership and collaboration for M&E (capacity building)
M&E	Capacity building	Capacity building - management	Quality Assessment Contributions
M&E	Capacity building	Capacity building - Data collection & analysis	Modify the database
M&E	Baseline assessment	Baseline assessment	Conduct Baseline Reassessments SHOULD BE: Baseline Assessment and Facility Readiness Assessment
M&E	Baseline assessment	Baseline assessment	Printing of MoH key guidelines and tools (MNH Guidelines / Internal Supervision Tools)
M&E	Capacity building	Capacity building - management	Orient district M&E officers on collection tool for missing data
M&E	Baseline assessment	Baseline assessment	Collect baseline data from RBF health facilities
M&E	Baseline assessment	Baseline assessment	Collect missing baseline data for continuous monitoring
Management	Personnel	Personnel RBF	
Management	Capacity building	Capacity building - management	Orientation and re-orientation of facility and district staff
Management	General management	General management	RBF Coordination
Management	Transport & Accommodation	Transport/accommodation	International and local travel for foreign personnel
Management	Transport & Accommodation	Transport/accommodation	Local Transport
Management	Office & equipment	Office and equipment	Project Office
Management	Transport & Accommodation	Transport/accommodation	Allowance and accommodation costs for foreign personnel
Management	General management	General management	RBF COORDINATION
Management	Office & equipment	Office and equipment	Equipment
Management	Office & equipment	Office and equipment	Project Office
Management	Transport & Accommodation	Transport/accommodation	Local Transport
Management	Capacity building	Governance	Support the creation of a RBF steering committee on MoH level (D 2.2)
Management	General management	General management	Develop structure of the Initiative

Management	Transport & Accommodation	Transport/accommodation	Allowance and accommodation costs for foreign personnel
Management	General management	General management	RBF COORDINATION
Management	Office & equipment	Office and equipment	Office and Equipment
Management	Capacity building	Fraud mitigation	Set up monitoring system for fraud control
Management	Capacity building	Capacity building - management	Briefing District Councils and DHMTs on RBF4MNH Phase II Extension
Management	Capacity building	General management	District Coordination Support
Management	Capacity building	Capacity building - management	Conduct meetings to increase cooperation with other players like CHAM, Government ministries
Management	Capacity building	Capacity building - management	Consultations with key stakeholders (MoH, MoF, MoLGaRD, NLGFC, …)
Management	Transport & Accommodation	Transport/accommodation	International and local ravel for foreign personnel
Management	Capacity building	Governance	Develop steering processes of the initiative
Management	Capacity building	Capacity building - management	Coordinate with partners and stakeholders
Management	Capacity building	Fraud mitigation	Set up monitoring systems for fraud control (see S14) SHOULD BE - Set up monitoring system for data fraud control
Management	Capacity building	Fraud mitigation	Strengthen monitoring systems for fraud control
Management	Capacity building	Capacity building - management	Provide capacity building and promote innovation for partners of RBF4MNH
Management	General management	General management	Link RBF4MMH with other related initiatives
Management	Capacity building	Capacity building - management	Briefing of MoH officials and partners at National level
Management	Capacity building	Capacity building - financial management	Strengthen RBF disbursement and accounting procedures at health facility level
Management	Transport & Accommodation	Transport/accommodation	Allowance and accommodation costs for local personnel
Management	Capacity building	Capacity building - management	Develop the RBF4MNH Options Office to a centre of excellence
Management	Capacity building	Capacity building - management	Briefing MoH top officials (Directors) and CHAM officials

Management	Audit	Audit	RBF Audit & external Evaluation
Management	Capacity building	Capacity building - financial management	Establish RBF disbursement and accounting procedures at HF level
Management	Personnel	Personnel _MoH	Director RH unit
Management	Office & equipment	Office and equipment	Reports and Documents
Management	Personnel	Personnel _MoH	Senior officer RH unit
Management	Capacity building	Capacity building - financial management	Discuss and develop expenditure guidelines with HF staff
Management	Capacity building	Capacity building - financial management	Establish bank accounts at district and facility level SHOULD BE - Support the establishment and management of bank account at district and facility level
Management	Capacity building	Capacity building - financial management	Support the establish and management of bank account at district and facility level
Management	General management	General management	Bank Charges
Management	General management	Management	Overheads MoH
Management	General management	General management	Bank Charges
Management	Audit	Audit	-
Management	Capacity building	Capacity building - financial management	Strengthen district accounts oversight
Management	Capacity building	General management	Support MoH organize technical and steering committee meetings
Management	Capacity building	Governance	Support regular meetings of the RBF steering committee on MoH level (D 2.2)
Management	Capacity building	General management	Support regular meetings of the district RBF steering committee on district level (ME 8.1)
Management	General management	General management	Miscellaneous (local)
Operations research	Personnel	Consultancy (supportive)	Phase I consultancies
Operations research	Personnel	Consultancy (supportive)	Phase II consultancies
Operations research	Operation research	Operations research	Conduct workload analysis in RBF facilities in 2016/17

Operations research	Operation research	Operations research	Disseminate workload analysis results to stakeholders in the RBF participating districts
Operations research	Operation research	Operations research	Operational Research
Operations research	Operation research	Operations research	utilisation of payments; why women are not delivering at RBF participating HF
Promotion	Personnel		
Promotion	Awareness campaign	Communications	Do Awareness Campaign for communities SHOULD BE - Community Awareness Campaigns
Promotion	Awareness campaign	Communications	Develop promotional products
Promotion	Awareness campaign	Communications	Community Awareness Campaigns
Promotion	Awareness campaign	Communications	Develop leaflet (brochure) in English and Chichewa
Promotion	Awareness campaign	Communications	Make use of promotional products to market the initiative
Promotion	Awareness campaign	Communications	Use the launch of the initiative for promotion SHOULD BE: Launch of the initiative for promotion
Promotion	Awareness campaign	Communications	Make use of promotional products to market the initiative
Promotion	Awareness campaign	Communications	Develop communication strategy
Promotion	Personnel	Consultancy (supportive)	Consultancy for dissemination workshop
Promotion	Awareness campaign	Communications	Develop communication strategy
Promotion	Awareness campaign	Communications	Community Awareness Campaigns
Promotion	Awareness campaign	Communications	Give the initiative a nationally recognised name and logo
Promotion	Awareness campaign	Communications	Open days to market the initiative at community level (dramatization etc.)
Promotion	Awareness campaign	Communications	Create RBF newsletter

Promotion	Awareness campaign	Communications	Advertising
Promotion	Awareness campaign	Communications	Roll out the RBF4MNH Communication strategy
Supply side	Infrastructure Investment	structural investment - infrastructure	Provide Infrastructure Investment (IE)
Supply side	Capacity building	Supply side incentives	Supply Side Incentives
Supply side	Personnel		
Supply side	Supply side incentives	Supply side incentives	Supply Side Incentives
Supply side	Equipment investment	structural investment - equipment	Provide Procurement of equipment (IE)
Supply side	Capacity building	Capacity building - supportive supervision	Provide capacity building and training for staff SHOULD BE - Provide capacity building and training for health workers
Supply side	Infrastructure Investment	structural investment - infrastructure	Provide Infrastructure Investment (IE)
Supply side	Capacity building	Investment - Human Resources	Support DHMTs to ensure health facility staff are well staffed and new staff have orientation towards RBF
Supply side	Capacity building	Capacity building - supportive supervision	DHMT Bi-monthly supportive supervision
Supply side	Capacity building	Capacity building - supportive supervision	Provide Capacity building and training for Health workers
Supply side	Equipment investment	structural investment - equipment	Provide Procurement of equipment (IE)
Supply side	Capacity building	Capacity building - supportive supervision	Conduct RBF supportive supervision and MNH mentorship
Supply side	Capacity building	Capacity building - management	Support Facilities & DHMTs SHOULD BE - Support facilities and DHMT in complying to the RBF SOPs and requirements
Supply side	Capacity building	General management	Ensure sufficient staffing levels in facilities according to MoH guidelines as a precursor to signing Quality and Performance Contracts
Supply side	Capacity building	Quality assurance	Establish quality assurance and improvement system
Supply side	Capacity building	Quality assurance	Establish quality assurance and improvement system
Supply side	Capacity building	General management	Ensure sufficient staffing levels in facilities according to MoH guidelines as a precursor to signing Quality and Performance Contracts

Supply side	Capacity building	Capacity building - management	Support facilities and DHMT in complying to the RBF SOPs and requirements
Supply side	Capacity building	General management	Ensure sufficient staffing levels in facilities according to MoH guidelines as a precursor to signing Quality and Performance Contracts
Supply side	Capacity building	Capacity building - supportive supervision	Make protocols available for 7-9 signal functions
Supply side	Capacity building	Capacity building - management	Capacity assessment and re-assessment of new and old facilities
Supply side	Capacity building	Capacity building - supportive supervision	Quarterly Zone supervision
Verification	Verification agent	Supply side verification	Identify, contract Verification agent, and conduct verification
Verification	Verification audit	Internal data audit	Internal Data Verification by RBF Team and MoH Team
Verification	Verification agent	Supply side verification	Identify and contract verification agent
Verification	Personnel		
Verification	Verification audit	Internal data audit	Data verification (RBF and MoH team) SHOULD BE - Internal Data Verification by RBF Team and MoH Team
Verification	Verification agent	Supply side verification	Support to External Data Verification Teams by RBF Team and MoH Team

BMJ Open

How much does it cost to combine supply-side and demand-side RBF approaches in a single intervention? Full Cost Analysis of the Results Based Financing for Maternal and Newborn Health Initiative in Malawi

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How much does it cost to combine supply-side and demand-side RBF approaches in a single intervention? Full Cost Analysis of the Results Based Financing for Maternal and Newborn Health Initiative in Malawi

Aleksandra Torbica[1], Corinne Grainger[2], Elena Okada[3], Manuela De Allegri[4*]
[*] Corresponding author

[1] Centre for Research on Health and Social Care Management (CERGAS), Bocconi University
[2] Options Consultancy Services, United Kingdom
[3] Options Consultancy Services, United Kingdom
[4] Heidelberg Institute of Global Health, University Hospital and Medical Faculty, University of Heidelberg, Germany

* Corresponding author: Manuela De Allegri – manuela.deallegri@uni-heidelberg.de

Abstract

Objective: To estimate the economic cost associated with implementing the Results Based Financing for Maternal and Newborn Health (RBF4MNH) Initiative in Malawi. No specific hypotheses were formulated ex-ante.

***Setting*:** Primary and secondary delivery facilities in rural Malawi.

Participants: Not applicable. The study relied almost exclusively on secondary financial data.

Intervention: The RBF4MNH Initiative was an RBF intervention including both a demand and a supply-side component.

Primary and secondary outcome measures: cost per potential and for actual beneficiaries.

Results: The overall economic cost of the Initiative during 2011 – 2016 amounted to 12,786,924 Euro, equivalent to 24.17 Euro per pregnant woman residing in the intervention districts. The Supply Side Activity Cluster absorbed over 40% of all resources, half of which were spent on infrastructure upgrading and equipment supply, and 10% on incentives. Costs for the Demand Side Activity Cluster and for Verification were equivalent to 14% and 6% respectively of the Initiative overall cost.

Conclusion: Carefully tracing resource consumption across all activities, our study suggests that the full economic cost of implementing RBF interventions may be higher than what was previously reported in published cost-effectiveness studies. More research is urgently needed to carefully trace the costs of implementing RBF and similar health financing innovations, in order to inform decision-making in LMICs around scaling up RBF approaches.

Trial registration: Not applicable.

Strengths and limitations of this study

- We estimated full economic costs of Results Based Financing intervention combining both supply and demand side incentives
- We adopted Activity Based Costing methodology, to trace all resources and related costs associated with designing and implementing an intervention
- We identify and evaluate costs across activities and different cost categories to give a comprehensive cost assessment and overcome limitations of previous analyses
- Due to the retrospective nature of our work, it is possible that we did not capture all costs or assigned them to the respective activities as accurately as it would have been possible had we collected data prospective.

Introduction

Results-based financing (RBF) interventions are gaining increased attention as a means of improving access to care and enhancing quality of service provision across low- and middle-income countries (LMICs) [1]. With specific reference to health service delivery, results-based financing approaches include demand-side interventions, chiefly conditional cash transfers (CCT), and supply-side interventions, most notably performance-based financing (PBF). Conditional cash transfers are payments to healthcare users tied to compliance with a specific health behaviour, most frequently utilization of a given service, such as facility-based delivery or vaccinations [2]. Performance-based financing refers to the implementation of performance contracts, whereby healthcare providers and/or managers are paid upon the attainment of pre-defined quantity and quality indicators [3].

The widespread implementation of RBF has drawn attention to the need to assess the costs associated with these interventions. A recent publication by Chi and colleagues (2018) invites the research and policy community to be mindful of the identification, measurement and validation of the costs of RBF implementation as an integral element of research to inform investments in the health sector. To date, the scientific evidence base on the costs associated with RBF is extremely limited; it is mostly generated by studies that have focused exclusively on supply-side PBF interventions, and has largely neglected the estimation of costs associated with implementing demand-side programs, such as CCT [4]. This paucity of evidence is somewhat surprising considering that demand and supply-side RBF interventions are increasingly being combined in a single program design intended to address both sets of barriers to accessing health services [5].

Moreover, the available literature suffers from two limitations. First, existing costing studies on RBF struggle to accurately trace full costs across activities and cost categories, hence providing only limited information for policy makers as to which activities drive implementation costs [6]. Second, existing studies often aim to assess cost-effectiveness, relating the costs of implementing RBF approaches to their benefits, measured in terms of improved health service utilization and/or health gains [7–9]. While cost-effectiveness studies are instrumental in enabling policy makers to select interventions that generate the greater health benefits at lower costs, the evidence they generate does not provide guidance on the full cost structure of such programs, which is needed to inform further implementation and scale-up pilot interventions.

It is against this background that we aimed to fill the aforementioned gaps in knowledge by estimating the costs associated with implementing the Results Based Financing for Maternal and Newborn Health (RBF4MNH) Initiative in Malawi. This was an RBF intervention encompassing both a demand and a supply-side component to tackle maternal and newborn mortality by increasing access to better quality institutional delivery services. Our objective was to estimate the economic costs of the intervention, including both demand and supply-side components, clearly differentiating the costs across project phases, activities, and cost categories.

Methods

Study setting

With an estimated 2020 GDP per capita of 412 USD (current USD), Malawi is one of the poorest countries in sub-Saharan Africa. In 2010, prior to the launch of the RBF4MNH Initiative, maternal and neonatal mortality were estimated respectively at 639 deaths per 100,000 [10] and at 31 deaths per 1,000 live births [11]. Obstetric care services are provided through the country's essential health package offered free of charge at public and contracted not-for-profit faith-based health facilities. Facility-based delivery utilization rates have increased dramatically over the course of the last two decades, increasing from 55% in 2000 to 91% in 2016 [12].

In spite of the high rates of institutional delivery, in 2014, unmet need for emergency obstetric care (EmOC) among women with obstetric complications was estimated at 75%, given that the majority of health facilities still did not meet EmOC standards. The healthcare system was at the time, and continues to be, characterized by poor infrastructure, and severe shortages in human resources and medical supplies, largely linked to insufficient funding capacity [13]. In 2013, annual per capita total health expenditure amounted to 39 USD [14], with donor funding covering nearly 70% of this amount.

Intervention design

The RBF4MNH Initiative has been described extensively in the literature, since sustained research efforts have been channelled towards assessing its impact on providers' motivation [15], effective coverage [16], quality of service delivery [17,18], and maternal mortality at birth [19]. Hereafter, we synthetize the Initiative's main features to allow the reader to follow the rationale of the methodological decisions we made for the cost analysis and to contextualize the findings we present.

The RBF4MNH Initiative was implemented between 2013 and 2018 by the Reproductive Health Directory (RHD) of the Ministry of Health, with financing from Governments of Germany and Norway, and technical and management assistance by Options Consultancy Services. Initially implemented in 18 EmOC facilities, it was later expanded to a total of 33 facilities, including 28 Basic EmOC facilities and 5 Comprehensive EmOC facilities, distributed across four districts (Balaka, Dedza, Mchinji, Ntcheu). Not all health facilities in each district participated. The Initiative aimed at reducing maternal and neonatal deaths by targeting the quality of obstetric services, encouraging utilization of facility-based delivery and 48 hours in-facility post-partum stays. To achieve these objectives, the Initiative included a supply and a demand-side component, specifically: (a) performance contracts with health facilities and district health management teams (DHMTs) linked to defined obstetric and neonatal care quality and utilization targets; and (b) conditional cash transfers (CCT) to pregnant women arriving at a participating facility for delivery, intended as partial reimbursement for the costs associated with delivering at a health facility. An additional integral component of the RBF4MNH Initiative, setting it aside from other RBF interventions, was the investment made to support infrastructure works and supply of essential medical equipment to participating public health facilities (e.g., renovation of labor rooms, construction of maternity waiting homes).

The participating facilities and the respective DHMTs received performance payments on top of the usual budget and in-kind resources (i.e., staff salaries, drugs and medical supplies) allocated by central and district governments. Approximately two-thirds of performance payments could be redistributed among staff as personal incentives, while one third was to be re-invested by the staff to support quality improvements at the facility (i.e., using the funds to purchase drugs and basic supplies, hiring contract staff and paying for minor infrastructure works and repairs).

In a departure from the current system whereby health facilities are not designated as cost centres and districts are largely responsible for all expenditure related to health facility functioning, the RBF Initiative worked to enable participating health facilities to manage the additional funds acquired autonomously. Health workers were also directly in charge of disbursing the CCT to women at the facility (paid in instalments on arrival and before/after delivery), and to register women for eligibility during antenatal care.

Study design

Our retrospective cost analysis aimed at estimating the full economic cost of the RBF4MNH Initiative. Hence, we captured the full value of all resources used by any of the parties involved in the design and implementation of all activities related to the Initiative [20]. We adopted a health system perspective, accounting for costs incurred by the Ministry of Health (MoH) and their development and implementing partners. These included: the MoH Malawi as key implementing lead, Options Consultancy Services (providing programme management and technical assistance), the German Development Bank KfW (as co-funder), and Norwegian cooperation (represented by both Norad and the Norwegian Embassy in Lilongwe). Our analysis captures the costs incurred by the Initiative in the four concerned districts as well as costs incurred in any other relevant settings, including the capital Lilongwe, where both the MoH and the central RBF4MNH office were located, as well as London, Frankfurt and Oslo, where monitoring and oversight activities were undertaken.

Our work covers the period from 2011, the year when the initial Feasibility Study was commissioned marking the onset of the Initiative's design, to 2016. Hence, our analysis covers two years related to the Initiative design and start-up (2011-2012), and four years related to its implementation (2013-2016). While the Initiative was extended into 2018, our analysis concludes at 2016, since our research funding was aligned with the initial timeline of the Initiative and could not be prolonged to match its extension. Since the Initiative was also subject to some design modifications during implementation, we continued tracing design costs for the period 2013-2016. To the extent possible, we attempted to differentiate the cost of supply-side from demand-side activities. Given the retrospective nature of the study and the lack of relevant details in the financial data at our disposal, however, this was not always possible, so some activities, such as management, are not directly attributable to either the supply-side or the demand-side component.

Data sources and data collection strategies

To trace all costs pertaining to the design and implementation of the RBF4MNH Initiative, we adopted an Activity-Based Costing (ABC) approach. Accordingly, we started by retrospectively mapping all micro-level activities related to the design and

implementation of the Initiative and then traced all resources being consumed by these activities. We completed these first two steps by reviewing the complete documentation of the intervention and engaging in a series of repeated exchanges with key stakeholders, who had been involved in the implementation of the Initiative.

To attribute value to either single resources (where possible) or complete activities (when the former was not possible), we extracted relevant cost information from the financial data of the different implementing partners. These included: a. Options' financial data reporting central level costs related to implementation, including personnel costs; b. the RBF4MNH Initiative financial data, reporting costs for all activities related to field implementation, including incentive payments; c. financial data contributed by the development partners, including cost information on specific activities, such as the early Feasibility Study and the consultancies conducted during the course of the implementation.

To estimate resource consumption for activities that could not be traced in financial data, we conducted key informant interviews with MoH and development and implementing partners' staff. These interviews allowed us to quantify the extent to which these staff had contributed towards the Initiative, albeit the value of their engagement was not directly reflected in the financial data. To value the days of work contributed by MoH staff, we used official national-level cadre-specific salary information. To value the days of work contributed by development and implementing partner staff, we used level-specific average international and national consultancy rates. In addition, to value material contributions by development partners not included in the financial data, such as flights and other transport, we used average market price items. In line with the literature, we applied a 15% overhead rate to the costs incurred by MoH, Norwegian Embassy and Norad, as well as KfW, to account for overarching costs (such as overall management) not easily traceable when accounting only for crude salaries and/or consultancy rates.

The RBF4MNH Office provided us with the number of women who benefitted from the Initiative while the National Office of Statistics provided us with the number of expecting mothers estimated for the RBF4MNH district catchment areas over the 2013-2016 period. This information served as basis to compute the size of the actual and the potential beneficiary population respectively.

Data sharing statement

Given the sensitive nature of the data used for this analysis, the authors cannot share the data used for analysis with third parties. Any request for data needs to be directed to the Ministry of Health of Malawi and its partners.

Analytical approach: cost analysis

To complete the cost analysis, aggregating information across data sources, we proceeded in steps, exemplified in Figure 1. First, once we had identified all single micro-level activities, we aggregated them into Activity Clusters, i.e., a series of broader activity groups to facilitate policy appraisal of the intervention costs (see Appendix 1 for details). The Activity Clusters were identified in consultation with the RBF4MNH implementation team as follows: Design, Management, Promotion, Operations Research, Monitoring and Evaluation (M&E), Verification, Demand side and Supply side costs.

In order to estimate costs for each Activity Cluster identified above, we then adopted the following approach. We aggregated detailed cost information across specific micro-level activities into broader meaningful Cost Categories. Normally, cost categories refer to general cost items, such as transport, staff, office supplies, etc. In our case, however, due to the structure of the data available, we had to work with cost categories that were broader and more inclusive. Then, we further aggregated these Cost Categories into Analysis Cost Categories, to draw a link between Cost Categories and Activity Clusters. We attributed Analysis Cost Categories to the single Activity Clusters and then aggregated values within a given Activity Cluster. This process was designed to inform decision-making by indicating which broad activity area absorbed what portion of the overall costs of the Initiative.

Similarly to what was reported by De Allegri et al (2019), one challenge we faced was the attribution of staff costs to single activities. Staff costs were easily traceable to the individuals involved in implementation, but they were documented as salaries or consultancy fees and did not provide any indication of the breakdown of activities undertaken by staff who worked across more than one Activity Cluster. Hence, to attribute staff costs to single Activity Clusters, we interviewed key implementers to reconstruct their engagement in the project. We attributed all time contributed by MoH, Norway, and KfW partners to general management activities, since we could confirm that staff employed at this level were not involved directly in other activities.

Lastly, to allow the reader a better sense of the 'value' of the RBF4MNH Initiative, we computed the cost per beneficiary, accounting for both actual beneficiaries, i.e., the actual number of delivering women served each year, and potential beneficiaries, i.e., the expected annual total number of delivering women across the four districts, within and beyond the direct catchment areas of the intervention facilities (since mobility across catchment areas is allowed and we know that women moved to receive care at RBF4MNH facilities).

We purposely focused on costs related to the implementation of the RBF program, including those born directly by the Ministry of Health, but excluded the costs related to routine provision of MCH services, since those did not change as a function of the introduction of RBF. Our objective was not to cost MCH service provision with or without RBF, but to look more specifically at the costs related to implementing RBF per se. Our choice is motivated by lack of adequate evidence on the costs of RBF programs.

All costs were adjusted to the base year 2016. We used a GDP deflator for the Euro area to adjust for inflation from 2011 to 2016. The cost items expressed in local currency were converted to Euros using official yearly average conversion rates to account for the extreme fluctuations in exchange rates which occurred during the period of our analysis.

Ethical approval

Both the Ethics Committee at the Medical Faculty of Heidelberg University and the Ethics Committee in Malawi waived ethical approval since the study was based exclusively on secondary costing data.

Patients and public involvement

Given the nature of the work conducted, patients and the public were not involved in any phase of the project.

Funding

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Results

Table 1 presents a synthesis of the Initiative costs, across all years and all Activity Clusters. Under Management, we purposely differentiate costs incurred by the RBF4MNH implementation unit, by the MoH, and by its development and implementing partners.

The overall economic cost of the Initiative for the period 2011 to 2016 amounted to 12,786,924 Euro. The MoH financial contribution when comparing to that of the RBF4MNH implementation unit which, while situated within the MoH, and financed by development partners was (0.04% vs. 20.5% of the total costs).

Table 1 here

Table 2 differentiates costs between the start-up (all costs incurred in 2011-2012 period) and the implementation phase (all costs incurred in 2013-2016 period), with start-up costs absorbing 1,521,454 Euro and implementation costs across the four years we followed absorbing a total of 11,265,470 Euro. Implementation costs rose in the initial years, but then stabilized and started to decrease by 2016. Reflecting the pattern observed for total costs, implementation costs per beneficiary increased in the early years, but stabilized and started to decrease in 2016.

Table 2 here

Combining start-up and implementation costs, Table 3 shows which Activity Cluster absorbed which portion of total costs and which Analysis Cost Category contributed towards each activity. The Supply Side Activity Cluster absorbed over 40% of all resources devoted to the project. Within this figure the incentives only represented approximately 10% of the total value of this activity whilst considerable infrastructural investment represented nearly half. In 2016, once the program reached full maturity, the value of the incentives relative to the total value of the Supply Side Activity Cluster increased substantially, reaching one third of the overall value of the activity.

The Demand Side Activity Cluster absorbed nearly 14% of the intervention value, with incentives in this case representing nearly one third of all activity-specific costs. Verification costs, referring exclusively to supply side verification (since demand-side verification was incorporated in demand-side supervision), only absorbed 6% of the overall value of the intervention. Overall management costs absorbed over one fifth of the intervention value. Design activities absorbed less than 5% of the total value of the initiative, with the cost being driven exclusively by the initial feasibility study and by personnel costs.

Table 3 here

Table 4 presents the same cost data in a different form, looking at the cost of the single Cost Categories and pooling across costs pertaining to both the start-up and the implementation phase across all activities included in Table 3. Personnel costs for contracted RBF4MNH staff represented the most substantial cost driver, absorbing nearly 23% of the intervention value. Structural investments absorbed nearly one fourth of the intervention cost. Here, supply side verification appears to have absorbed only slightly above 3% of the intervention costs, while in Table 3, this is shown to be 6%. This difference can be explained by the fact that in Table 3, we look at the value of the entire Activity Cluster, including the value of personnel time devoted towards verification. In Table 4, instead, the term supply side verification is used as a Cost Category, reflecting only the payments directly made by the implementation unit (either to external verification agencies or to district teams) to execute the verification procedures. Supply side and demand side incentives accounted for approximately 15% of the value of the intervention, with supply side incentives accounting for 10% and demand side incentives accounting for 5%.

Table 4 here

Discussion

This study makes an important contribution to the literature, being the first to describe in detail start-up and implementation costs of an RBF intervention, including both a demand-side and a supply-side component. Not only have prior analyses of similar programs focused almost exclusively on costs related to supply-side incentive systems, but they were also rather limited and not comprehensive of all cost items, thus not fully reflecting the opportunity costs of implementing RBF programs. The available studies have been conducted primarily with the objective of assessing cost-effectiveness of such programs in relation to status quo service provision thus focusing more on the estimation of consequences, related to process or health outcomes, and costs related to provision of health services in the presence or absence of RBF [7–9]. With our analysis, we aimed to trace all costs associated with designing and implementing a RBF intervention, beyond the focus on service provision . This is valuable not only to inform full economic evaluations, i.e.,i cost-effectiveness analyses but also for informing policy decisions on further implementation of RBF programs by describing the cost of single activities and the comparative weight of the single cost categories in detail. As such, our work complements existing literature on the economic evaluation of RBF interventions.

The first important finding emerging from our study is the substantial cost of the intervention, estimated at a total of 12,786,924 euros, distributed across the six years of the evaluation period, including two start-up and four implementation years. It should be noted, however, that unlike other RBF programs, this value includes a sizeable investment in infrastructure up-grading and provision of equipment to all participating public health facilities. The fact that implementation costs (across all activities) increased between 2013 and 2015 is likely to be a reflection of the fact that the RBF4MNH Initiative grew in size from 18 facilities in 2013, to 28 in 2014, and to 33 in 2015. The decrease in implementation costs observed in 2016 is a potential indication

that program management became more efficient as the intervention settled. This would not be surprising, given that the intensive efforts to enable RBF to function as expected, characterized the early implementation years. However, longer-term data would be necessary to confirm this hypothesis.

When considering the total number of women reached by the program, the cost of the RBF4MNH Initiative is equivalent to Euro 24.17 per potential beneficiary and 62.52 per actual beneficiary. We ought to specify that, when looking at cost per potential beneficiary, we did not account only for women who delivered in a healthcare facility, but for all women who were expected to experience a birth during a given year. We adopted this approach since the RBF4MNH Initiative aimed at reaching all women and encourage each one of them to deliver in a safe environment, hence all expecting months are potential beneficiaries. Our estimates stand out as being somewhat higher than estimates produced by prior economic analyses of RBF programs, including the prior cost-effectiveness analysis of the RBF4MNH Initiative, which detected lower unit costs for delivery services [7]. This discrepancy may seem particularly surprising considering that our analysis did not include the cost of providing care so we would have expected our estimates to be lower than previous estimates. However, it may also indicate that our work captured costs associated with RBF implementation, such as those related to design and human resource inputs by development partners, which can easily go unnoticed in studies focused on the cost-effectiveness of providing care under PBF. While this emerging hypothesis deserves further empirical verification, it would be aligned with the arguments postulated by Chi et al (2018) [6] in calling for the application of more rigorous cost tracing to determine the actual economic value of RBF.

The second finding of interest is the fact that domestic resources only accounted only for a very limited portion of the total costs of the intervention, while development and implementing partners contributed most resources. In line with literature on RBF programs [21,22] as well as other complex health interventions [23,24], this high reliance on donor funding has turned out to be a key challenge for the sustainability of the RBF4MNH Initiative. In spite of the positive effects reported by both the scientific literature [15–19] and by the implementation team [25], the Initiative was discontinued in 2018, once the relevant development cooperation agreement reached the end of its current funding cycle. Although the RBF4MNH Initiative was well-integrated within MoH structures and systems, the combination of human resource capacity constraints and very low operating budgets at the Reproductive Health Directorate (RHD) of the MoH, meant that only a very small portion of the human resources deployed towards managing the Initiative were contributed by staff already stationed at the RHD. Such reliance on external funding has been recognized before as a key challenge to the sustainability of RBF interventions [22,26–29].

Looking at findings in relation to the different activities which made up the RBF4MNH Initiative, we bring the reader's attention again to the fact that the Supply Side Activity Cluster absorbed over 40% of all resources devoted to the project, albeit the incentives only represented approximately 10% of the total value of this activity while the infrastructural investment represented nearly half of its value. The high proportion of costs absorbed by the Supply Side Activity likely reflects the strong focus on improving the quality rather than the quantity of care at participating facilities. The fact that the value of the incentives relative to the total value of the Supply Side Activity Cluster

increased substantially over time suggests that as facilities become confident with working within the framework of a RBF intervention, their payoff increases, while the overall investments needed to operate the system (such as those in capacity building) decrease. While this pattern has been reported before in the literature [30], data from further implementation years would have been needed to confirm a trend towards increasing investments in incentives and decreasing investments in capacity building over time.

Nonetheless, the cost of the incentives compared to the overall cost of the intervention captured by our analysis is substantially lower than that observed in previous studies focused on supply-side RBF programs. In Zambia, for instance, incentives accounted for nearly half of all costs of the PBF program [8]. In a separate PBF program funded by USAID in Malawi, the SSDI-PBI program, incentives took up nearly one third of the overall cost of the intervention [30]. In Afghanistan, incentives were observed to absorb two-thirds of all economic costs [9]. Two factors may explain the differences observed between our findings and prior evidence. First, as discussed earlier, discrepancies may emerge as a consequence of different methodological approaches, specifically our focus on tracing and costing each and every activity making up the RBF program rather than solely estimating the costs of providing services under RBF. Second, the RBF4MNH Initiative included substantial capital investment in infrastructure and purchase of large amounts of equipment for participating health facilities which the other programs it has been compared to may have not.

The Demand Side Activity Cluster absorbed nearly 14% of the intervention value, with incentives in this case representing nearly one third of all activity-specific costs. The fact that the value of the demand-side incentives decreased in 2016 compared to 2015 is attributable to the fact that the program switched from offering CCT to all women delivering in an intervention facility to offering cash transfers only to the women most in need. This measure was introduced at the request of the MoH in order to align better with the government's targeted social cash transfer program. Analyses conducted after the end of the official impact evaluation indicated that this shift did not affect utilization of delivery services, which remained high even once the universal cash transfers were discontinued.

Somewhat surprisingly, verification costs, referring exclusively to supply-side verification, only absorbed 6% of the overall value of the intervention. This value appears low considering that prior research has found verification costs to account for as much as 23% of overall costs of supply-side RBF programs [9] and that the costs associated with verification are often raised as an intrinsic challenge to the effective implementation of PBF programs [31–33]. The low verification cost observed in our study may be an indication that the verification processes within the framework of the RBF4MNH Initiative were managed efficiently. This was probably largely due to the fact that during the early stages of the intervention, the central management staff largely undertook the verification function (due to challenges in identifying and contracting a suitable verification strategy) while later the contract was awarded to a local agency, avoiding the high costs charged by international agencies in other settings.

Of additional interest is the fact that over the entire six-year period, design activities absorbed less than 5% of the total value of the initiative, with the cost being driven largely by the initial feasibility study (we had no beak down of the feasibility study in

specific cost categories) and by personnel costs. Comparatively, design activities absorbed one third of the total costs of the parallel RBF intervention being rolled out in Malawi [30]. The fact that costs were incurred over time for design activities is indicative of the adaptive and dynamic nature of the intervention, which as observed in the impact evaluation final report, represents one of its key success features. Still, the reduction in design costs observed overtime suggests that by 2015, the Initiative had reached its full form and did not necessitate substantial further adjustments. This element ought to be considered in light of a possible scale up, since design decisions may need to be made to expand geographical scope, but assuming that the experience of the four pilot districts is representative of the country, the intervention may not necessitate extensive re-shaping, hence design costs could be kept to a minimum.

Methodological considerations

Beyond its value as the first cost analysis carefully tracing all activities of a complex RBF intervention including both a supply-side and a demand-side component, we ought to recognize some important methodological limitations to our study. First, the retrospective nature of data collection made it impossible for us to trace resource consumption across activities as accurately as we would have wished to. Nonetheless, we engaged closely with the implementation team to reconstruct to the extent possible the roll-out of the intervention, complementing information from documents and financial data with information emerging from key informant interviews. This process was facilitated by the close relationship between the implementation and the research team, having worked together on the impact evaluation already. Second, given the paucity of similar studies focused specifically on the costs of RBF interventions, we recognize an inability to appraise our findings more comprehensively in relation to the experience of other settings. Third, since our study adopted a health system perspective, the resulting findings represent an underestimation of the total costs of the intervention, neglecting what costs might have been incurred at community level to enable its functioning (e.g., community leaders mobilization, identification of poor women, etc.). Fourth, we need to acknowledge that the computation of the cost per potential beneficiary is based on the estimated number of deliveries in the district. Hence, any imperfection in this population-based estimate is also reflected in our own cost estimate. Last, we need to acknowledge that due to the timing of our data collection, we could not include costs related to 2017 and 2018. Our research funding was aligned with the original funding of the intervention and we had no means to continue data collection once the intervention was unexpectedly extended with additional funding.

Conclusions

Our study represents the first comprehensive effort to assess the costs of setting up a RBF intervention, including both a demand and a supply-side component, examining all activity clusters and cost categories in detail. We have purposely not related these efforts to the benefits generated by the intervention, because, as documented by the literature, those have been very diverse and not easily reducible to a single matrix. Carefully tracing resource consumption across both start-up and design phases, our work suggests that the costs of bringing such an intervention into reality may be higher than what has been indicated by prior cost-effectiveness analyses. This observation calls for further research in the field, monitoring start-up and implementation costs of RBF programs as well as those of comparable health financing interventions, aimed at reforming purchasing structures. Furthermore, this observation inevitably draws

attention to the sustainability of such programs, when one considers that even excluding the costs of service delivery, for every woman served, the RBF4MNH Initiative absorbed more than half the annual per capita health budget available at country level. Last, we note that to overcome the challenges we have faced due to the retrospective nature of our work, we would argue in favour of integrating such research efforts in the infrastructure of the intervention evaluation from its very onset.

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Conflict of interest
Manuela De Allegri was the principal investigator of the impact evaluation of the RBF4MNH Initiative, but funding for the two parallel studies was acquired and managed independently of one another (different funding agencies). Corinne Grainger and Elena Okada worked for the agency that supported the implementation of the RBF4MNH Initiative, Options Consultancy Services (Options) during the data collection phase of the study. Subsequent contributions to this work have been purely voluntary and as such, the views expressed in this paper represent her own views and not those of Options.

Authors' contribution
MDA and AT were responsible for the initial study design, data collection strategy, and analytical approach. AT, MDA, and EO shared the responsibility for data acquisition, including both the retrieval of information from existing documents and the interviews with key informants. AT and MDA were in charge of analysis, with contributions by CG and EO. MDA drafted the manuscript, with support from all authors. All authors read and approved of the final manuscript.

Data sharing statement
Given the sensitive nature of the data used for this analysis, the authors cannot share the data used for analysis with third parties. Any request for data needs to be directed to the Ministry of Health of Malawi and its partners.

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Table 1. Total costs by activity over time in 4 districts (real values in €, base year 2016)

Activity cluster	2011	2012	2013	2014	2015	2016	TOTAL
Design	261,684	228,319	52,619	26,289	9,627	0	578,537
Management							3,112,263
Contracted implementation unit (set within MOH)	69,095	355,224	347,065	477,790	537,819	830,828	*2,617,821*
MoH own resources	1,425	882	737	689	662	515	*4,909*
Development partners (KfW, Norad)	88,260	82,464	81,439	80,000	78,838	78,532	*489,533*
Promotion	2,246	3,703	40,300	58,478	238,202	278,128	621,058
Operations research	15,024	14,862	17,263	12,164	11,987	43,304	114,604
M&E	25,417	115,859	179,822	154,114	156,171	107,590	738,973
Verification	0	0	59,803	157,818	321,833	207,956	747,410
Demand side	8,103	45,752	269,044	290,987	574,657	507,354	1,695,897
Supply side	30,136	173,001	1,105,949	1,340,743	1,423,795	1,104,558	5,178,181
Totals by year	**501,390**	**1,020,064**	**2,154,041**	**2,599,073**	**3,353,592**	**3,158,765**	**12,786,924**

Table 2. Total start-up and implementation costs by year in 4 districts (real values €, base year 2016)

	2011	2012	2013	2014	2015	2016	TOTAL
Start-up costs	501,390	1,020,064					**1,521,454**
Implementation costs			2,154,041	2,599,073	3,353,592	3,158,765	**11,265,470**
N. of expected births (beneficiaries)			111,181	114,739	118,283	121,838	**466,041**
No. of women served per year			28042	41801	52399	57948	**180,190**
Implementation cost by potential beneficiary			19.37	22.65	28.35	25.93	**24.17**
Implementation cost by actual beneficiary			76.81	62.18	64.00	54.51	**62.52**

Table 3 Costs by activity cluster, cost category and by year (real values in €, base year 2016)

Activity cluster	Analysis Cost category	2011	2012	2013	2014	2015	2016	TOTAL	% of total cost
Design									
	Personnel	58,541	228,319	52,619	26,289	9,627	0	375,394	
	Feasibility study	203,143	0	0	0	0	0	203,143	
Total by year		***261,684***	***228,319***	***52,619***	***26,289***	***9,627***	***0***	***578,537***	***4.52%***
Management									
	Personnel	83,069	167,956	195,200	180,326	172,410	187,107	986,069	
	External Audit	0	0	0	0	0	3,760	3,760	
	Capacity building	0	0	20,704	84,902	153,830	394,662	654,099	
	Office /Equipment	18,584	97,812	41,899	46,385	49,342	103,218	357,241	
	General management	17,916	12,810	62,575	105,746	150,134	140,438	489,619	
	Transport/Accommodation	39,211	159,992	108,862	141,118	91,604	80,689	621,475	
Total by year		***158,780***	***438,570***	***429,240***	***558,479***	***617,319***	***909,875***	***3,112,263***	***24.34%***
Promotion									
	Personnel	2,246	3,703	35,600	40,685	47,884	54,400	184,519	
	Awareness campaign	0	0	4,700	17,793	190,318	223,728	436,540	
Total by year		***2,246***	***3,703***	***40,300***	***58,478***	***238,202***	***278,128***	***621,058***	***4.86%***
Operation									
	Personnel	15,024	14,862	14,677	12,164	11,987	11,804	80,518	
	Operation research	0	0	2,586	0	0	31,500	34,086	
Total by year		***15,024***	***14,862***	***17,263***	***12,164***	***11,987***	***43,304***	***114,604***	***0.90%***
M&E									
	Personnel	25,417	115,859	79,251	87,514	66,147	65,790	439,977	
	Baseline assessment	0	0	72,622	16,399	17,480	0	106,502	
	Capacity building	0	0	27,949	50,201	72,543	41,800	192,494	
Total by year		***25,417***	***115,859***	***179,822***	***154,114***	***156,171***	***107,590***	***738,973***	***5.78%***
Verification									
	Personnel	0	0	38,452	34,104	35,275	37,192	145,023	
	Agent	0	0	20,628	123,715	82,167	159,347	385,857	
	Internal Audit	0	0	722	0	204,391	11,417	216,531	
Total by year		***0***	***0***	***59,803***	***157,818***	***321,833***	***207,956***	***747,410***	***5.85%***
Demand side									
	Personnel	8,103	45,752	89,982	104,773	111,471	123,972	484,053	

	Incentives	0	0	42,701	128,158	246,210	159,750	576,819	
	Capacity building	0	0	17,882	58,056	204,592	136,060	416,590	
	General management	0	0	118,479	0	12,385	87,571	218,435	
Total by year		***8,103***	***45,752***	***269,044***	***290,987***	***574,657***	***507,354***	***1,695,897***	***13.26%***
Supply side									
	Personnel	30,136	173,001	165,311	108,437	81,060	85,021	642,964	
	Infrastructure Investments	0	0	698,783	796,371	583,137	334,021	2,412,312	
	Equipment Investment	0	0	52,372	170,323	142,342	99,138	464,174	
	Incentives	0	0	0	11,805	66,709	427,057	505,571	
	Capacity building	0	0	189,484	253,807	550,548	159,322	1,153,161	
Total by year		***30,136***	***173,001***	***1,105,949***	***1,340,743***	***1,423,795***	***1,104,558***	***5,178,181***	***40.50%***
GRAND		**413,130**	**937,600**	**2,072,602**	**2,519,072**	**3,274,753**	**3,080,233**	**12,786,924**	

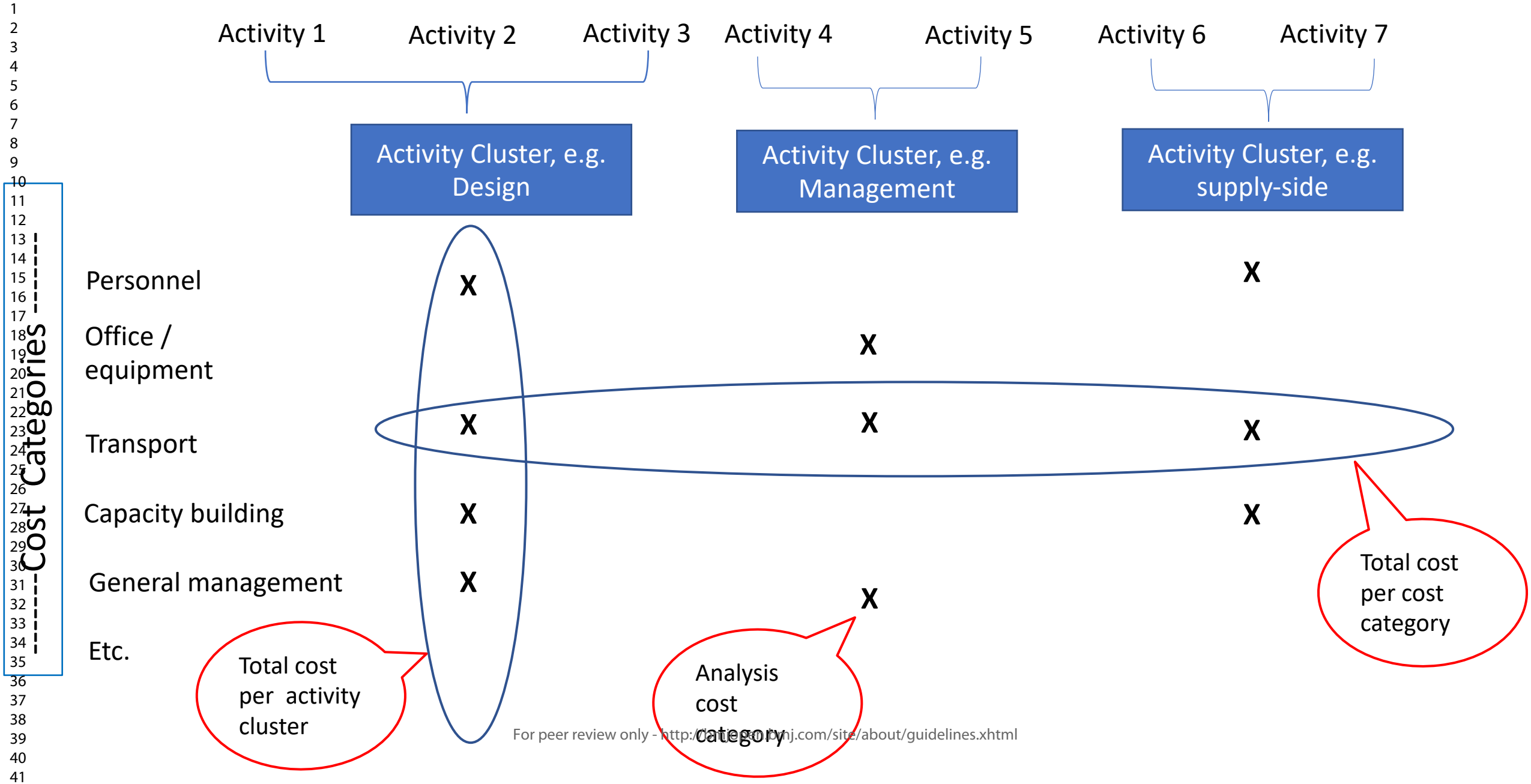
Table 4 Overall distribution of costs across cost categories (all years and all activities together; real values in €, base year 2016)

Cost Category	2011	2012	2013	2014	2015	2016	Total	
Personnel_RBF4MNH	145,009	673,219	595,924	522,482	465,107	489,735	**2,891,476**	22.61 %
Structural Investment - Infrastructure	0	0	698,783	796,371	583,137	334,021	**2,412,312**	18.87 %
Supply side incentives	0	0	103,551	171,450	516,356	479,811	**1,271,168**	9.94%
Capacity building - management	0	0	63,714	160,482	338,841	407,933	**970,969**	7.59%
Transport / accommodation	39,211	159,992	108,862	141,118	91,604	80,689	**621,475**	4.86%
Demand-side incentives	0	0	42,701	128,158	246,210	159,750	**576,819**	4.51%
General management	0	0	53,631	94,107	169,957	247,362	**565,056**	4.42%
Structural Investment - Equipment	0	0	52,372	170,323	142,342	99,138	**464,174**	3.63%
Communications	0	0	4,700	17,793	190,318	223,728	**436,540**	3.41%
Supply side verification	0	0	20,628	123,715	82,167	159,347	**385,857**	3.02%
Office and equipment	18,584	97,812	41,899	46,385	49,342	103,218	**357,241**	2.79%
Personnel (DP)	61,264	60,603	59,850	59,048	58,190	57,300	**356,254**	2.79%
Capacity building - supportive supervision	0	0	69,140	73,004	43,223	69,258	**254,625**	1.99%
Internal data audit	0	0	722	0	204,391	11,417	**216,531**	1.69%
Initial feasibility study	203,143	0	0	0	0	0	**203,143**	1.59%
Operations/Administration	0	0	118,479	0	12,385	0	**130,864**	1.02%
Governance	0	0	1,741	1,651	10,577	92,029	**105,998**	0.83%
Baseline assessment	0	0	72,622	16,399	17,480	0	**106,502**	0.83%
Fraud mitigation	0	0	0	36,831	43,070	13,757	**93,658**	0.73%
General management (DP)	17,730	12,695	12,537	12,021	11,847	12,566	**79,395**	0.62%
Consultancy (supportive)	15,024	14,862	14,677	12,164	11,987	17,804	**86,518**	0.68%
Investment - Human Resources	0	0	0	0	39,037	22,323	**61,360**	0.48%
Capacity building - Data collection & analysis	0	0	0	1,737	17,342	36,806	**55,885**	0.44%
Operations research	0	0	2,586	0	0	31,500	**34,086**	0.27%
Quality assurance	0	0	13,105	13,144	-47	0	**26,201**	0.20%

Capacity building - Financial Management	0	0	1,080	0	8,066	5,001	**14,147**	0.11%
Personnel (MoH)	1,239	767	641	599	575	448	**4,268**	0.03%
Audit	0	0	0	0	0	3,760	**3,760**	0.03%
Management (MoH)	186	115	96	90	86	67	**640**	0.01%

Figure 1 Caption: Activity-based Costing Approach

Activity-based Costing Approach



Appendix 1 Mapping from micro-level activities to Cost Categories to Main Activities

Main Activity	Analysis Cost Categories	Cost Categories	Original description of micro -level activities
Demand side	Personnel	Personnel	
Demand side	Demand side incentives	Demand-side incentives	Cash Transfers to districts and facilities
Demand side	Capacity building	Capacity building - management	Institutionalisation of the RBF Initiative
Demand side	Demand side incentives	Demand-side incentives	Demand side cash transfers
Demand side	Capacity building	Capacity building - management	Development of manual for operation, key guidelines
Demand side	General management	Operations/Administration	Operational Costs/Admin - Demands Side Related
Demand side	General management	General management	Print and distribute eligibility cards
Demand side	Capacity building	Capacity building - management	Capacity building (demand side structures and processes)
Demand side	Capacity building	Capacity building - management	Capacity building (demand side structures and processes)
Demand side	Capacity building	Capacity building - financial management	In conjunction with NLGFC train district accountants on RBF financial management and reconciliation
Design	Personnel	Personnel	
Design	Initial Feasibility Study	Initial feasibility study	Initial feasibility study
M&E	Personnel	Personnel RBF	
M&E	Capacity building	Capacity building - management	Improve quality of data
M&E	Baseline assessment	Baseline assessment	Baseline Assessment AND Facility Readiness Assessment
M&E	Capacity building	Capacity building - Data collection & analysis	Conduct regular data collection and analysis
M&E	Capacity building	Capacity building - Data collection & analysis	Train and orient district teams and facilities on the data collection tools and equipment provided
M&E	Capacity building	Capacity building - Data collection & analysis	Provide data collection tools and equipment to RBF health facilities

M&E	Capacity building	Capacity building - management	Support partnership and collaboration for M&E (capacity building)
M&E	Capacity building	Capacity building - management	Quality Assessment Contributions
M&E	Capacity building	Capacity building - Data collection & analysis	Modify the database
M&E	Baseline assessment	Baseline assessment	Conduct Baseline Reassessments SHOULD BE: Baseline Assessment and Facility Readiness Assessment
M&E	Baseline assessment	Baseline assessment	Printing of MoH key guidelines and tools (MNH Guidelines / Internal Supervision Tools)
M&E	Capacity building	Capacity building - management	Orient district M&E officers on collection tool for missing data
M&E	Baseline assessment	Baseline assessment	Collect baseline data from RBF health facilities
M&E	Baseline assessment	Baseline assessment	Collect missing baseline data for continuous monitoring
Management	Personnel	Personnel RBF	
Management	Capacity building	Capacity building - management	Orientation and re-orientation of facility and district staff
Management	General management	General management	RBF Coordination
Management	Transport & Accommodation	Transport/accommodation	International and local travel for foreign personnel
Management	Transport & Accommodation	Transport/accommodation	Local Transport
Management	Office & equipment	Office and equipment	Project Office
Management	Transport & Accommodation	Transport/accommodation	Allowance and accommodation costs for foreign personnel
Management	General management	General management	RBF COORDINATION
Management	Office & equipment	Office and equipment	Equipment
Management	Office & equipment	Office and equipment	Project Office
Management	Transport & Accommodation	Transport/accommodation	Local Transport
Management	Capacity building	Governance	Support the creation of a RBF steering committee on MoH level (D 2.2)
Management	General management	General management	Develop structure of the Initiative

Management	Transport & Accommodation	Transport/accommodation	Allowance and accommodation costs for foreign personnel
Management	General management	General management	RBF COORDINATION
Management	Office & equipment	Office and equipment	Office and Equipment
Management	Capacity building	Fraud mitigation	Set up monitoring system for fraud control
Management	Capacity building	Capacity building - management	Briefing District Councils and DHMTs on RBF4MNH Phase II Extension
Management	Capacity building	General management	District Coordination Support
Management	Capacity building	Capacity building - management	Conduct meetings to increase cooperation with other players like CHAM, Government ministries
Management	Capacity building	Capacity building - management	Consultations with key stakeholders (MoH, MoF, MoLGaRD, NLGFC, …)
Management	Transport & Accommodation	Transport/accommodation	International and local ravel for foreign personnel
Management	Capacity building	Governance	Develop steering processes of the initiative
Management	Capacity building	Capacity building - management	Coordinate with partners and stakeholders
Management	Capacity building	Fraud mitigation	Set up monitoring systems for fraud control (see S14) SHOULD BE - Set up monitoring system for data fraud control
Management	Capacity building	Fraud mitigation	Strengthen monitoring systems for fraud control
Management	Capacity building	Capacity building - management	Provide capacity building and promote innovation for partners of RBF4MNH
Management	General management	General management	Link RBF4MMH with other related initiatives
Management	Capacity building	Capacity building - management	Briefing of MoH officials and partners at National level
Management	Capacity building	Capacity building - financial management	Strengthen RBF disbursement and accounting procedures at health facility level
Management	Transport & Accommodation	Transport/accommodation	Allowance and accommodation costs for local personnel
Management	Capacity building	Capacity building - management	Develop the RBF4MNH Options Office to a centre of excellence
Management	Capacity building	Capacity building - management	Briefing MoH top officials (Directors) and CHAM officials

Management	Audit	Audit	RBF Audit & external Evaluation
Management	Capacity building	Capacity building - financial management	Establish RBF disbursement and accounting procedures at HF level
Management	Personnel	Personnel _MoH	Director RH unit
Management	Office & equipment	Office and equipment	Reports and Documents
Management	Personnel	Personnel _MoH	Senior officer RH unit
Management	Capacity building	Capacity building - financial management	Discuss and develop expenditure guidelines with HF staff
Management	Capacity building	Capacity building - financial management	Establish bank accounts at district and facility level SHOULD BE - Support the establishment and management of bank account at district and facility level
Management	Capacity building	Capacity building - financial management	Support the establish and management of bank account at district and facility level
Management	General management	General management	Bank Charges
Management	General management	Management	Overheads MoH
Management	General management	General management	Bank Charges
Management	Audit	Audit	-
Management	Capacity building	Capacity building - financial management	Strengthen district accounts oversight
Management	Capacity building	General management	Support MoH organize technical and steering committee meetings
Management	Capacity building	Governance	Support regular meetings of the RBF steering committee on MoH level (D 2.2)
Management	Capacity building	General management	Support regular meetings of the district RBF steering committee on district level (ME 8.1)
Management	General management	General management	Miscellaneous (local)
Operations research	Personnel	Consultancy (supportive)	Phase I consultancies
Operations research	Personnel	Consultancy (supportive)	Phase II consultancies
Operations research	Operation research	Operations research	Conduct workload analysis in RBF facilities in 2016/17

Operations research	Operation research	Operations research	Disseminate workload analysis results to stakeholders in the RBF participating districts
Operations research	Operation research	Operations research	Operational Research
Operations research	Operation research	Operations research	utilisation of payments; why women are not delivering at RBF participating HF
Promotion	Personnel		
Promotion	Awareness campaign	Communications	Do Awareness Campaign for communities SHOULD BE - Community Awareness Campaigns
Promotion	Awareness campaign	Communications	Develop promotional products
Promotion	Awareness campaign	Communications	Community Awareness Campaigns
Promotion	Awareness campaign	Communications	Develop leaflet (brochure) in English and Chichewa
Promotion	Awareness campaign	Communications	Make use of promotional products to market the initiative
Promotion	Awareness campaign	Communications	Use the launch of the initiative for promotion SHOULD BE: Launch of the initiative for promotion
Promotion	Awareness campaign	Communications	Make use of promotional products to market the initiative
Promotion	Awareness campaign	Communications	Develop communication strategy
Promotion	Personnel	Consultancy (supportive)	Consultancy for dissemination workshop
Promotion	Awareness campaign	Communications	Develop communication strategy
Promotion	Awareness campaign	Communications	Community Awareness Campaigns
Promotion	Awareness campaign	Communications	Give the initiative a nationally recognised name and logo
Promotion	Awareness campaign	Communications	Open days to market the initiative at community level (dramatization etc.)
Promotion	Awareness campaign	Communications	Create RBF newsletter

Promotion	Awareness campaign	Communications	Advertising
Promotion	Awareness campaign	Communications	Roll out the RBF4MNH Communication strategy
Supply side	Infrastructure Investment	structural investment - infrastructure	Provide Infrastructure Investment (IE)
Supply side	Capacity building	Supply side incentives	Supply Side Incentives
Supply side	Personnel		
Supply side	Supply side incentives	Supply side incentives	Supply Side Incentives
Supply side	Equipment investment	structural investment - equipment	Provide Procurement of equipment (IE)
Supply side	Capacity building	Capacity building - supportive supervision	Provide capacity building and training for staff SHOULD BE - Provide capacity building and training for health workers
Supply side	Infrastructure Investment	structural investment - infrastructure	Provide Infrastructure Investment (IE)
Supply side	Capacity building	Investment - Human Resources	Support DHMTs to ensure health facility staff are well staffed and new staff have orientation towards RBF
Supply side	Capacity building	Capacity building - supportive supervision	DHMT Bi-monthly supportive supervision
Supply side	Capacity building	Capacity building - supportive supervision	Provide Capacity building and training for Health workers
Supply side	Equipment investment	structural investment - equipment	Provide Procurement of equipment (IE)
Supply side	Capacity building	Capacity building - supportive supervision	Conduct RBF supportive supervision and MNH mentorship
Supply side	Capacity building	Capacity building - management	Support Facilities & DHMTs SHOULD BE - Support facilities and DHMT in complying to the RBF SOPs and requirements
Supply side	Capacity building	General management	Ensure sufficient staffing levels in facilities according to MoH guidelines as a precursor to signing Quality and Performance Contracts
Supply side	Capacity building	Quality assurance	Establish quality assurance and improvement system
Supply side	Capacity building	Quality assurance	Establish quality assurance and improvement system
Supply side	Capacity building	General management	Ensure sufficient staffing levels in facilities according to MoH guidelines as a precursor to signing Quality and Performance Contracts

Supply side	Capacity building	Capacity building - management	Support facilities and DHMT in complying to the RBF SOPs and requirements
Supply side	Capacity building	General management	Ensure sufficient staffing levels in facilities according to MoH guidelines as a precursor to signing Quality and Performance Contracts
Supply side	Capacity building	Capacity building - supportive supervision	Make protocols available for 7-9 signal functions
Supply side	Capacity building	Capacity building - management	Capacity assessment and re-assessment of new and old facilities
Supply side	Capacity building	Capacity building - supportive supervision	Quarterly Zone supervision
Verification	Verification agent	Supply side verification	Identify, contract Verification agent, and conduct verification
Verification	Verification audit	Internal data audit	Internal Data Verification by RBF Team and MoH Team
Verification	Verification agent	Supply side verification	Identify and contract verification agent
Verification	Personnel		
Verification	Verification audit	Internal data audit	Data verification (RBF and MoH team) SHOULD BE - Internal Data Verification by RBF Team and MoH Team
Verification	Verification agent	Supply side verification	Support to External Data Verification Teams by RBF Team and MoH Team