


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

Aleksandra Torbica,¹ Corinne Grainger,² Elena Okada,² Manuela De Allegri ³

To cite: Torbica A, Grainger C, Okada E, *et al*. 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. *BMJ Open* 2022;**12**:e050885. doi:10.1136/bmjopen-2021-050885

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-050885>).

Received 29 October 2021
Accepted 28 March 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Professor 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 a results-based financing (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 €12786924, equivalent to €24.17 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 low-income and middle-income countries around scaling up RBF approaches.

INTRODUCTION

Results-based financing (RBF) interventions are gaining increased attention as a means of improving access to care and enhancing the quality of service provision across low-income and middle-income countries.¹ With specific reference to health service delivery, RBF approaches include demand-side

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.

interventions, chiefly conditional cash transfers (CCT) and supply-side interventions, most notably performance-based financing (PBF). CCT are payments to healthcare users tied to compliance with a specific health behaviour, most frequently utilisation 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 on the attainment of predefined 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 *et al* and colleagues 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 programmes, 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 programme 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 utilisation 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 programmes, 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 US\$412 (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 000¹⁰ and at 27 deaths per 1000 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 utilisation 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, characterised 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 US\$39,¹⁴ 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 synthesize 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 contextualise the findings we present.

The RBF4MNH Initiative was implemented between 2013 and 2018 by the Reproductive Health Directory (RHD) of the Ministry of Health (MoH), with financing from the 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 utilisation of facility-based delivery and 48 hours in-facility postpartum 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 utilisation targets and (b) 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 (eg, renovation of labour 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 (ie, 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 (ie, 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 expenditures 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 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 2 years related to the Initiative design and start-up (2011–2012) and 4 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 approach. Accordingly, we started by retrospectively mapping all microlevel 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, although 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.

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 microlevel activities, we aggregated them into activity clusters, that is, a series of broader activity groups to facilitate policy appraisal of the intervention costs (see online supplemental appendix 1 for details). The activity clusters were identified in consultation with the RBF4MNH implementation team as follows: design, management, promotion,

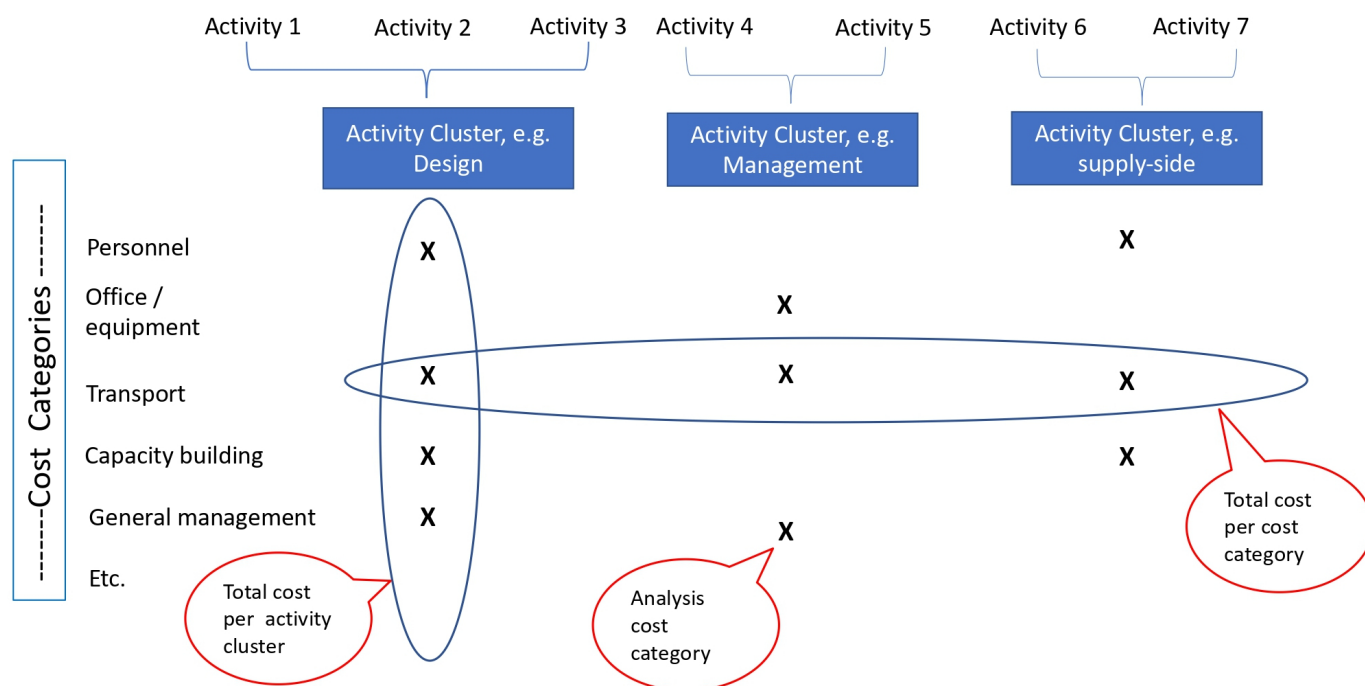


Figure 1 Activity-based costing approach.

operations research, monitoring and evaluation, 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 microlevel 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.

Similar to what was reported by De Allegri *et al*, 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.

Finally, 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, that

is, the actual number of delivering women served each year, and potential beneficiaries, that is, 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 programme, including those born directly by the MoH, but excluded the costs related to the routine provision of Maternal and Child Health (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 programmes.

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.

Patients and public involvement

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

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

Table 1 Total costs by activity over time in four 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
Total by year	501 390	1 020 064	2 154 041	2 599 073	3 353 592	3 158 765	12 786 924

M&E, monitoring and evaluation; MoH, Ministry of Health.

implementation unit, by the MoH and by its development and implementing partners. The overall economic cost of the Initiative for the period 2011–2016 amounted to €12 786 924. 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 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 and implementation costs across the 4 years we followed absorbing a total of €11 265 470. Implementation costs rose in the initial years, but then stabilised and started to decrease by 2016. Reflecting the pattern observed for total costs, implementation costs per beneficiary increased in the early years, but stabilised and started to decrease in 2016.

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 while

considerable infrastructural investment represented nearly half. In 2016, once the programme 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 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

Table 2 Total start-up and implementation costs by year in four 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
Expected births (beneficiaries) (n)			111 181	114 739	118 283	121 838	466 041
Women served per year (n)			28 042	41 801	52 399	57 948	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	
<i>Total by year</i>		<i>261 684</i>	<i>228 319</i>	<i>52 619</i>	<i>26 289</i>	<i>9 627</i>	<i>0</i>	<i>578 537</i>	<i>4.52</i>
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	
<i>Total by year</i>		<i>158 780</i>	<i>438 570</i>	<i>429 240</i>	<i>558 479</i>	<i>617 319</i>	<i>909 875</i>	<i>3 112 263</i>	<i>24.34</i>
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	
<i>Total by year</i>		<i>2 246</i>	<i>3 703</i>	<i>40 300</i>	<i>58 478</i>	<i>238 202</i>	<i>278 128</i>	<i>621 058</i>	<i>4.86</i>
Operation research	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	
<i>Total by year</i>		<i>15 024</i>	<i>14 862</i>	<i>17 263</i>	<i>12 164</i>	<i>11 987</i>	<i>43 304</i>	<i>114 604</i>	<i>0.90</i>
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	
<i>Total by year</i>		<i>25 417</i>	<i>115 859</i>	<i>179 822</i>	<i>154 114</i>	<i>156 171</i>	<i>107 590</i>	<i>738 973</i>	<i>5.78</i>
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	
<i>Total by year</i>		<i>0</i>	<i>0</i>	<i>59 803</i>	<i>157 818</i>	<i>321 833</i>	<i>207 956</i>	<i>747 410</i>	<i>5.85</i>
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	
<i>Total by year</i>		<i>8 103</i>	<i>45 752</i>	<i>269 044</i>	<i>290 987</i>	<i>574 657</i>	<i>507 354</i>	<i>1 695 897</i>	<i>13.26</i>
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	
<i>Total by year</i>		<i>30 136</i>	<i>173 001</i>	<i>1 105 949</i>	<i>1 340 743</i>	<i>1 423 795</i>	<i>1 104 558</i>	<i>5 178 181</i>	<i>40.50</i>
Grand total		413 130	937 600	2 072 602	2 519 072	3 274 753	3 080 233	12 786 924	

M&E, monitoring and evaluation.

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%.

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 programmes focused almost exclusively on costs related to supply-side incentive

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 (all years)	Percentage of total costs
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 and 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

MoH, Ministry of Health; RBF4MNH, Results Based Financing for Maternal and Newborn Health.

systems, but they were also rather limited and not comprehensive of all cost items, thus not fully reflecting the opportunity costs of implementing RBF programmes. The available studies have been conducted primarily with the objective of assessing cost-effectiveness of such programmes 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 an RBF intervention, beyond the focus on service provision. This is valuable not only to inform full economic evaluations, that is, cost-effectiveness analyses but also for informing policy decisions on further implementation of RBF programmes 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, distributed across the 6 years of the evaluation period, including two start-up and four implementation years. It should be noted, however, that unlike other RBF programmes, 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 programme 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, characterised 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 programme, the cost of the RBF4MNH Initiative is equivalent to €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 programmes, 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*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 programmes^{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 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 recognised 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, although 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 an 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 with the overall cost of the intervention captured by our analysis is substantially lower than that observed in previous studies focused on supply-side RBF programmes. In Zambia, for instance, incentives accounted for nearly half of all costs of the PBF programme.⁸ In a separate PBF programme funded by United States Agency for International Development in Malawi, the SSDI-PBI programme, 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 programme 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 programmes it has been compared with 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 with 2015 is attributable to the fact that the programme 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 programme. Analyses conducted after the end of the official impact evaluation indicated that this shift did not affect utilisation 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 programmes⁹ and that the costs associated with verification are often raised as an intrinsic challenge to the effective implementation of PBF programmes.^{30–33} 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 6-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 break 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 recognise 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 recognise 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 (eg, community leaders mobilisation, 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. Finally, 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 an 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 programmes 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 programmes, 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. Finally, 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.

Author affiliations

¹Department of Social and Political Sciences, Centre for Research for Health and Social Care Management, Bocconi University, Milano, Italy

²Options Consultancy Services Ltd, London, UK

³Heidelberg Institute of Global Health, Heidelberg University Hospital and Faculty of Medicine, Heidelberg University, Heidelberg, Germany

Acknowledgements This would have not been possible had the staff at the Ministry of Health Malawi, the RBF4MNH implementation unit, the consulting agency Options, and both German and Norwegian cooperation agencies not supported us, sharing all documentation with us and answering our frequent questions. The authors are indebted to Jobiba Chinkhumba for his support with logistics and with data collection during the early phases of the project and to

Bjarne Robberstad for his valuable comments on our study design and analytical approach.

Contributors 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 the final manuscript. MDA acts as guarantor for this manuscript.

Funding This research was made possible by funding from the Ministry of Health Malawi and the KfW, the German Development Bank.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics 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.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. The original data used for this study are not publicly available and would need to be obtained by the Ministry of Health Malawi and its development partners.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

Author note 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.

ORCID ID

Manuela De Allegri <http://orcid.org/0000-0002-8677-1337>

REFERENCES

- Gautier L, De Allegri M, Ridde V. How is the discourse of performance-based financing shaped at the global level? A poststructural analysis. *Global Health* 2019;15:6.
- Carrin G, Doetinchem O, Xu K. *Conditional cash transfers: what's in it for health? Technical Brief for Policy-Makers*. Geneva: World Health Organization, 2008.
- Fritsche GB, Soeters R, Meessen B. *Performance-Based financing toolkit*. World Bank Publications, 2014.
- Oxman AD, Fretheim A. NIPH Systematic Reviews. In: *An overview of research on the effects of Results-Based financing*. Oslo, Norway: Knowledge Centre for the Health Services at The Norwegian Institute of Public Health (NIPH), 2008.
- Bowser D, Gupta J, Nandakumar A. The effect of demand- and supply-side health financing on infant, child, and maternal mortality in low- and middle-income countries. *Health Syst Reform* 2016;2:147–59.
- Chi Y-L, Gad M, Bauhoff S, et al. Mind the costs, too: towards better cost-effectiveness analyses of PBF programmes. *BMJ Glob Health* 2018;3:e000994.
- Chinkhumba J, De Allegri M, Brenner S, et al. The cost-effectiveness of using results-based financing to reduce maternal and perinatal mortality in Malawi. *BMJ Glob Health* 2020;5:e002260.
- Zeng W, Shepard DS, Nguyen H, et al. Cost-effectiveness of results-based financing, Zambia: a cluster randomized trial. *Bull World Health Organ* 2018;96:760–71.
- Salehi AS, Borghi J, Blanchet K, et al. The cost-effectiveness of using performance-based financing to deliver the basic package of health services in Afghanistan. *BMJ Glob Health* 2020;5:e002381.
- WHO. *Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, world bank group and the United nations population division*. 104. Geneva: World Health Organization, 2019.
- Evelyn Z, Mary VK, Fannie K, et al. Newborn survival in Malawi: a decade of change and future implications for the Malawi Newborn Change and Future Analysis Group Author Notes Health Policy and Planning 2010;27:88–103.
- National Statistical Office Malawi; DHS Program. *Malawi demographic and health survey 2015-16 key indicators report*, 2016.
- Mueller DH, Lungu D, Acharya A, et al. Constraints to implementing the essential health package in Malawi. *PLoS One* 2011;6:e20741.
- Organization WH. *Global health expenditure database*, 2020.
- Lohmann J, Muula AS, Houfort N, et al. How does performance-based financing affect health workers' intrinsic motivation? A Self-Determination Theory-based mixed-methods study in Malawi. *Soc Sci Med* 2018;208:1–8.
- Brenner S, Mazalale J, Wilhelm D, et al. Impact of results-based financing on effective obstetric care coverage: evidence from a quasi-experimental study in Malawi. *BMC Health Serv Res* 2018;18:791.
- Kambala C, Lohmann J, Mazalale J, et al. How do Malawian women rate the quality of maternal and newborn care? experiences and perceptions of women in the central and southern regions. *BMC Pregnancy Childbirth* 2015;15:169.
- Brenner S, Wilhelm D, Lohmann J, et al. Implementation research to improve quality of maternal and newborn health care, Malawi. *Bull World Health Organ* 2017;95:491–502.
- De Allegri M, Chase RP, Lohmann J, et al. Effect of results-based financing on facility-based maternal mortality at birth: an interrupted time-series analysis with independent controls in Malawi. *BMJ Glob Health* 2019;4:e001184.
- Drummond MF, Drummond MFM, Sculpher MJ. *Methods for the economic evaluation of health care programmes*. Oxford University Press, 2005.
- Witter S, Bolton L. Towards sustainability of RBF in the health sector – learning from experience in high and middle income countries. In: *TASRI report for the world bank*, 2015.
- Sepey M, Ridde V, Touré L, et al. Donor-funded project's sustainability assessment: a qualitative case study of a results-based financing pilot in Koulikoro region, Mali. *Global Health* 2017;13:86.
- Muluh GN, Kimengsi JN, Azibo NK. Challenges and prospects of sustaining Donor-Funded projects in rural Cameroon. *Sustainability* 2019;11:6990.
- Bossert TJ. Can they get along without us? sustainability of donor-supported health projects in central America and Africa. *Soc Sci Med* 1990;30:1015–23.
- Development FM for EC. *How rewards improve health practice in Malawi*, 2017.
- Bertone MP, Wurie H, Samai M, et al. The bumpy trajectory of performance-based financing for healthcare in Sierra Leone: agency, structure and frames shaping the policy process. *Global Health* 2018;14:99.
- Ridde V, Yaogo M, Zongo S, et al. Twelve months of implementation of health care performance-based financing in Burkina Faso: a qualitative multiple case study. *Int J Health Plann Manage* 2018;33:e153–67.
- Bertone MP, Falisse J-B, Russo G, et al. Context matters (but how and why?) a hypothesis-led literature review of performance based financing in fragile and conflict-affected health systems. *PLoS One* 2018;13:e0195301.
- McMahon SA, Muula AS, De Allegri M. "I wanted a skeleton ... they brought a prince": A qualitative investigation of factors mediating the implementation of a Performance Based Incentive program in Malawi. *SSM Popul Health* 2018;5:64–72.
- De Allegri M, Makwero C, Torbica A. At what cost is performance-based financing implemented? novel evidence from Malawi. *Health Policy Plan* 2019;34:282–8.
- Gergen J, Josephson E, Vernon C, et al. Measuring and paying for quality of care in performance-based financing: experience from seven low and middle-income countries (Democratic Republic of Congo, Kyrgyzstan, Malawi, Mozambique, Nigeria, Senegal and Zambia). *J Glob Health* 2018;8:21003.

- 32 Antony M, Bertone MP, Barthes O. Exploring implementation practices in results-based financing: the case of the verification in Benin. *BMC Health Serv Res* 2017;17:204..
- 33 Grover D, Bauhoff S, Friedman J. Using supervised learning to select audit targets in performance-based financing in health: an example from Zambia. *PLoS One* 2019;14:e0211262.