Social Science & Medicine

Reengineering Pediatric Services with Results-Based Financing Evidence from Northern Uganda

--Manuscript Draft--

Manuscript Number:	
Article Type:	Research paper
Keywords:	Maternal and child healthcare; Low-and-middle-income countries (LMIC); Pay for performance (P4P); incentives; Sustainable Development Goals (SDGs)
Corresponding Author:	Roberto Moro Visconti, Prof. Dr. Università Cattolica del Sacro Cuore Milano, ITALY
First Author:	Roberto Moro Visconti, Prof. Dr.
Order of Authors:	Roberto Moro Visconti, Prof. Dr.
	Venice Omona
	Emmanuel Ochola
	Godfrey Smart
	Elisabetta D'Agostino
	Luigi Greco, professor
Manuscript Region of Origin:	ITALY
Abstract:	The application of Results-Based Financing (RBF) in pediatric services, especially in regions with scarce resources like Northern Uganda, provides an innovative approach to enhancing healthcare delivery. RBF aligns financial incentives with desired health outcomes. This model incentivizes healthcare providers to boost the quality, efficiency, and effectiveness of their services by tying compensation to the achievement of specific, measurable health targets, particularly for children. Lacor and Kalongo hospitals, before the introduction of RBF, faced numerous challenges in under-resourced settings, including limited resources, staffing shortages, and inconsistent quality of care. RBF adoption requires identifying and agreeing upon critical health outcomes to target, such as lowering child mortality rates, enhancing vaccination coverage, and increasing the frequency of timely prenatal care visits. The empirical application of RBF in pediatric services at Lacor and Kalongo Hospital from 2018 to 2024 sheds light on the practical implementation of RBF frameworks in real-world settings. RBF promotes significant improvements in healthcare quality and outcomes, especially in under-resourced regions confronted by additional challenges, including those brought about by the COVID-19 pandemic. Healthcare systems can identify ways to better implement RBF models, ensuring that financial incentives effectively contribute to the attainment of superior health outcomes.
Suggested Reviewers:	Paola Zagni, Dr. pediatric, Aziende Socio Sanitarie Territoriale Fatebenefratelli Sacco paola.zagni@gmail.com experienced medical doctor with long training experience in East Africa
	Chiara Ceccon, Medicine pediatric, ASST Spedali Civili di Brescia chiara.ceccon92@gmail.com on field expert in pediatrics
	Maresa Perenchio, Medicine Ospedale di Ivrea maresaperenchio@yahoo.it well trained specialist with children in Uganda
	Valeria Calbi, Medicine pediatric ematologist, San Raffaele Hospital calbi1.valeria@hsr.it

	well trained specialist in pediatric hematology
	Laura Alberghina, International relations Istituto Auxologico Italiano IRCCS laura.alberghina@gmail.com well trained physioterapist with long experiewnce in Uganda with children

Reengineering Pediatric Services with Results-Based Financing:
Evidence from Northern Uganda

Omona V., Ochola E., Smart G., Squillaci T., D'Agostino E., Arcidiaco C., Ambrosoli G.,
Moro-Visconti R*., Greco L.

* corresponding author. roberto.moro@unicatt.it, Università Cattolica del Sacro Cuore, Largo Gemelli 1, 20123, Milan, Italy

Abstract

The application of Results-Based Financing (RBF) in pediatric services, especially in regions with scarce resources like Northern Uganda, provides an innovative approach to enhancing healthcare delivery. RBF aligns financial incentives with desired health outcomes, boosting the quality, efficiency, and effectiveness of services by tying compensation to the achievement of specific, measurable health targets.

Lacor and Kalongo hospitals, before the introduction of RBF, faced numerous challenges, including limited resources, staffing shortages, and inconsistent quality of care. RBF adoption requires identifying and agreeing upon critical health outcomes to target, such as lowering child mortality rates, enhancing vaccination coverage, and increasing the frequency of timely prenatal care visits.

The empirical application of RBF in pediatric services at Lacor and Kalongo Hospital from 2018 to 2024 (before and after the COVID-19 pandemic) documents the promotion of significant improvements in healthcare quality and outcomes. Healthcare systems can identify ways to better implement RBF models, ensuring that financial incentives effectively contribute to the attainment of superior health outcomes.

Reengineering Pediatric Services with Results-Based Financing:
Evidence from Northern Uganda

Abstract

The application of Results-Based Financing (RBF) in pediatric services, especially in regions with scarce resources like Northern Uganda, provides an innovative approach to enhancing healthcare delivery. RBF aligns financial incentives with desired health outcomes, boosting the quality, efficiency, and effectiveness of services by tying compensation to the achievement of specific, measurable health targets.

Lacor and Kalongo hospitals, before the introduction of RBF, faced numerous challenges, including limited resources, staffing shortages, and inconsistent quality of care. RBF adoption requires identifying and agreeing upon critical health outcomes to target, such as lowering child mortality rates, enhancing vaccination coverage, and increasing the frequency of timely prenatal care visits.

The empirical application of RBF in pediatric services at Lacor and Kalongo Hospital from 2018 to 2024 (before and after the COVID-19 pandemic) documents the promotion of significant improvements in healthcare quality and outcomes. Healthcare systems can identify ways to better implement RBF models, ensuring that financial incentives effectively contribute to the attainment of superior health outcomes.

Highlights

- Results-Based Financing (RBF), especially in regions like Northern Uganda, provides an innovative approach to enhancing healthcare delivery
- RBF aligns financial incentives with desired health outcomes
- RBF boosts the quality, efficiency, and effectiveness of services

Reengineering Pediatric Services with Results-Based Financing:
Evidence from Northern Uganda

Abstract

The application of Results-Based Financing (RBF) in pediatric services, especially in regions with scarce resources like Northern Uganda, provides an innovative approach to enhancing healthcare delivery. RBF aligns financial incentives with desired health outcomes. This model incentivizes healthcare providers to boost the quality, efficiency, and effectiveness of their services by tying compensation to the achievement of specific, measurable health targets, particularly for children.

Lacor and Kalongo hospitals, before the introduction of RBF, faced numerous challenges in under-resourced settings, including limited resources, staffing shortages, and inconsistent quality of care. RBF adoption requires identifying and agreeing upon critical health outcomes to target, such as lowering child mortality rates, enhancing vaccination coverage, and increasing the frequency of timely prenatal care visits.

The empirical application of RBF in pediatric services at Lacor and Kalongo Hospital from 2018 to 2024 sheds light on the practical implementation of RBF frameworks in real-world settings. RBF promotes significant improvements in healthcare quality and outcomes, especially in under-resourced regions confronted by additional challenges, including those brought about by the COVID-19 pandemic. Healthcare systems can identify ways to better implement RBF models, ensuring that financial incentives effectively contribute to the attainment of superior health outcomes.

1. Introduction

Results-Based Financing (RBF) is a financing approach that ties funding to the achievement of predefined results or outcomes rather than the volume of services delivered. It is based on the principle of paying for performance, where healthcare providers are incentivized to deliver high-quality services and achieve specific health outcomes. RBF typically involves a contractual arrangement between a funder (such as a government, donor agency, or health insurer) and healthcare providers, wherein payments are made based on the results achieved.

This approach contrasts with traditional funding models that might focus more on inputs (such as the number of healthcare facilities built, or equipment purchased) rather than on outcomes (like reductions in disease prevalence or improvements in patient health).

RBF is a performance-based funding mechanism that aligns financial incentives with the achievement of specific health outcomes. It aims to improve the efficiency and effectiveness of healthcare delivery by shifting the focus from inputs to outputs and outcomes.

There are several potential benefits to RBF, including:

- Improved health outcomes: By focusing on outcomes, RBF can encourage providers to adopt more effective and efficient practices, leading to better health outcomes for patients.
- Increased efficiency: RBF can help eliminate waste and duplication of services, as providers are incentivized to focus on delivering the most effective care for the greatest number of patients.
- Greater transparency: RBF can increase transparency in healthcare delivery, as providers are required to report on their performance and demonstrate their ability to achieve the agreed-upon outcomes.

However, there are also some potential challenges associated with RBF, such as:

- Measuring outcomes: it can be difficult to measure some health outcomes, such as quality of life or patient satisfaction. This can make it challenging to design and implement effective RBF programs.
- Ensuring equity: RBF programs can sometimes exacerbate existing inequities in healthcare, as providers in disadvantaged areas may face greater challenges in achieving the agreed-upon outcomes.

1

- Managing risk: RBF programs can transfer risk from funders to providers, which can be a concern for providers in resource-poor settings.

Reengineering pediatric services with RBF involves restructuring healthcare delivery systems to improve efficiency, quality, and patient outcomes, particularly in under-resourced areas like Northern Uganda. RBF programs typically provide financial incentives to healthcare providers based on the achievement of predefined results or outcomes, such as improved health metrics among the pediatric population.

In Northern Uganda, as in many parts of Sub-Saharan Africa, healthcare systems face numerous challenges, including limited resources, understaffing, and high disease burdens. Pediatric services, essential for reducing child mortality and improving children's health outcomes, are particularly affected. Reengineering these services through RBF could address some of these challenges by incentivizing healthcare providers to improve service delivery and quality of care.

Evidence from implementing RBF in Northern Uganda and similar contexts suggests several benefits:

a) **Improved health outcomes**: RBF encourages providers to focus on achieving measurable health outcomes, leading to improvements in key indicators such as maternal and child mortality rates, infectious disease control, and overall population health.

b) **Efficient use of resources**: By linking payments to results rather than inputs, RBF encourages efficiency and accountability in resource allocation, ensuring that funds are directed toward interventions that deliver the greatest impact on health outcomes.

c) **Improved Quality of Care**: RBF schemes often lead to improvements in the quality of healthcare services. By linking financial incentives to specific health outcomes or service delivery benchmarks, healthcare providers are motivated to adhere to best practices and treatment guidelines.

d) **Increased Healthcare Utilization**: By incentivizing healthcare providers to improve their performance and reach specific health targets, RBF can help expand access to essential health services, especially in underserved areas. Financial incentives can encourage healthcare providers to engage more actively with the community, leading to increased utilization of pediatric services. This is crucial for preventive care services like vaccinations and regular health check-ups.

e) **Enhanced Accountability and Efficiency**: RBF programs typically include mechanisms for monitoring and evaluating healthcare providers' performance, which can enhance accountability and operational efficiency. This ensures that resources are used effectively to improve health outcomes.

f) **Strengthened Health Systems**: Beyond immediate improvements in pediatric care, RBF can contribute to broader health system strengthening. For example, the need for accurate data to support RBF payments can improve health information systems.

However, despite its potential benefits, healthcare providers in under-resourced settings face numerous challenges, including limited funding, inadequate infrastructure, shortages of trained staff, and logistical barriers. These challenges can impede the delivery of quality healthcare services and contribute to poor health outcomes. RBF has the potential to address these challenges by providing financial incentives for providers to overcome barriers to access, invest in infrastructure and equipment, recruit and retain skilled staff, and improve the quality of care delivery. By aligning incentives with health outcomes, RBF can drive positive change in healthcare delivery systems, particularly in resource-constrained environments like Northern Uganda.

The success of RBF programs depends on several factors, including the design of the incentive schemes, the context in which they are implemented, and the capacity of health facilities to respond to the incentives. Moreover, careful consideration must be given to ensure that RBF programs do not inadvertently create perverse incentives or widen health disparities.

Within this framework, the paper's research question is to examine the challenges faced by healthcare providers in under-resourced settings and the potential of RBF to address these issues, investigating the Long-Term Effects of RBF Intervention in Children's Wards in two main Northern Uganda hospitals (Lacor and Kalongo) in a pre- and post-Covid timeframe, from 2018 to 2024.

The study conforms to an IMRAD pattern and is structured as follows: after a short literature analysis, we present a model backed by empirical findings that precede a discussion and conclusion.

2. Literature analysis and gaps

There is a comprehensive literature analysis, mostly dating back to the last 15/20 years, documenting the practical applications of healthcare RBF (see Grittner et al., 2013; Moro-Visconti, 2024).

Anthony et al., 2017 found that the verification processes of RBF schemes in many African countries are complex, costly, and time-consuming. The design of RBF schemes should be adapted to the context and there should be room for iterative modifications during implementation.

RBF schemes in LMICs are for instance examined by Beane et al., 2013, Brenner et al., 2014, Brenner et al., 2018, Falisse et al., 2015, Friedman et al., 2016, James et al., 2020, Kuunibe et al., 2020, Manongi et al. 2014, Oxman & Fretheim, 2008, Soeters et al., 2011, Turcotte-Tremblay et al., 2016, Witter et al., 2019, Zeng et al., 2018.

Mathonnat & Pelissier, 2017, link RBF approaches in developing countries' efforts to achieve health-related Sustainable Development Goals (SDGs). Accessibility to First-Mile health services in Uganda is examined by Moro-Visconti et al., 2020.

Mushasha & El show that Bcheraoui (2023) show that results-based approaches have an overall positive impact on institutional delivery rates and numbers of healthcare facility visits, though this impact varies greatly by context, and it is essential to include rigorous monitoring and evaluation strategies when designing financing models.

A pre-Covid RBF test of pediatric services in the two target hospitals (Lacor and Kalongo) is illustrated in Fondazione Corti, Lacor Hospital, and Fondazione Ambrosoli (2021). This study represents an update of this test, with further theoretical and empirical considerations.

This paper fills some research gaps, showing an empirical comparison of these two major hospitals in a difficult environment, plagued by twenty years of civil war (1986-2006) (see Annan et al., 2011), and communicable diseases such as Ebola outbreaks (mainly in 2000), endemic malaria, TBC and AIDS. On-field evidence compares data from 2018 to 2024, passing through the Covid pandemic.

The research lacunae may also include Artificial Intelligence applications, sensitivity analyses in peculiar contexts, fine-tuned benchmarking with standard cost/quality comparable, etc. These can represent new research avenues.

3. The model

The RBF intervention in Uganda, implemented jointly by various NGOs and the Ugandan Government, aims to evaluate its efficacy both during its implementation period and in the medium to long term after the intervention ceases. Here's a breakdown of the key points and potential steps for the evaluation:

1. **Initial Evaluation (During Implementation)**:
   - Quarterly evaluations are conducted to measure the results achieved by beneficiaries.
   - These evaluations should cover various metrics agreed upon with the stakeholders, including staff from Children's wards and the management of hospitals like Lacor and Kalongo.
   - Data from these evaluations should be collected, analyzed, and compared against predetermined targets or benchmarks to assess the effectiveness of the RBF intervention during its active phase.

2. **Medium to Long-Term Evaluation (Four Years Post-Intervention)**:
   - This phase involves evaluating the sustained impact and effectiveness of the RBF intervention even after its conclusion.
   - Since long-term data are scarce, it is essential to design a strategy to gather relevant data over the four years following the end of the intervention.
   - Potential sources of data could include:
     - Follow-up surveys or interviews with beneficiaries to assess any lasting benefits or changes in behavior.
     - Health outcome data from the hospitals to determine if improvements observed during the intervention period have been maintained or if there have been any regressions.
     - Economic data to assess any ripple effects or economic benefits resulting from the intervention in the broader community.
     - Qualitative assessments to capture the perspectives and experiences of stakeholders involved in the intervention both during and after its implementation.

3. **Methodology and Analysis**:

3

- Develop a robust methodology for data collection, ensuring consistency with the initial evaluation methods where applicable.
- Employ appropriate statistical analysis techniques to compare data collected during the intervention period with data from the medium to long-term evaluation.
- Consider potential confounding variables or external factors that may influence outcomes during the post-intervention period and adjust the analysis accordingly.

4. **Reporting and Recommendations**:
- Compile the findings from both the short-term and medium to long-term evaluations into a comprehensive report.
- Highlight key insights regarding the effectiveness of the RBF intervention over time, including any sustained benefits or areas for improvement.
- Provide recommendations for future interventions or policy adjustments based on the findings, aiming to maximize impact and sustainability in similar contexts.

By conducting thorough evaluations both during and after the active phase of the RBF intervention, stakeholders can gain valuable insights into its effectiveness and inform future decision-making and resource allocation strategies.

RBF has been selected by various NGOs together with the Ugandan Government to evaluate the efficacy of financing based on the verified results reached at definite intervals by the beneficiaries. Several studies proved the efficacy of this intervention while it was in place, i.e. in the time of actual verification and rewarding. But the real efficacy of these interventions must be evaluated after they stop: long-term data are indeed scarcely, if ever, available.

The objective of this study is to evaluate the efficacy of an RBF intervention during the three years of action (quarterly evaluation) as well as in the medium-long term (four years after the stop).

The RBF targets were agreed upon with all the staff of the Children's wards and the Management of the two hospitals - Lacor and Kalongo.

3.1. The starting period

A target for quality improvements in the children's ward is reported in Annex 1. This contains:
1. a general checklist, and specific targets concerning:
2. hygiene and cleanliness
3. clinical and nursing processes
4. emergency readiness
5. training.

After a baseline evaluation at time 0, every three months a commission with internal and external reviewers assigned a quality score to each of 5 domains (structure and management, Hygiene, Clinical work, Emergency, and training,): staff received a financial reward according to the % of target score reached in that quarter. To evaluate the actual impact on the care of children in the two wards of Lacor and Kalongo, an independent evaluator team screened clinical charts 2 years before the RBF, (2016), at the end of RBF (2020), and 4 years after the end (2024).

The study design is the following:

- Prospective observational study.
- Process and health indicators in the years before the intervention.
- Process and health indicators at the end of the intervention.
- Progress of quality scores over time.
- Process and health indicators 4 years after the end of the intervention.

At Lacor and Kalongo Hospital, an external commission visited the Children's wards every quarter and scrupulously examined structures, management, and procedures within each of these domains to be evaluated and to which assign the relevant numeric scores.

The figures show the trend over time from Time 0 (2018) to quarter 12 (2020) and 4 years after the stop (2024). Linear regression or 2nd-degree polynomials were fitted to the raw data.

4

Analysis of variance was adopted to estimate the difference among average clinical scores across hospitals and years of assessment. Canonical Discriminant Analysis was used to select the variable of the clinical management that discriminated more the performance in the year 2018 (start of RBF) compared to the end (2020). Wilk's lambda estimates the capacity of each variable to discriminate between the two years in a multivariate fashion, after considering all other variables, where Wilks 1 = complete overlap between the two years and 0 complete distance.

3.2. The long-run extension

Annex 2, again in the Appendix, contains a checklist of qualitative items, collected retrospectively (year 2016) and prospectively (years 2020 and 2024). They concern the adherence to the protocols for the diseases subjected to revision.

A second section of the study contains a report on the quality assessment of the clinical management of sick children before, and after the RBF project and in the long run. The target is to compare the clinical management of children admitted for more than 48 hours in both hospitals' children's wards before RBF (the year 2016), after the three years of RBF (the year 2020), and 4 years after the stop of the Project (2024). A large series of clinical records of the three time periods from each hospital were scrutinized by an independent quality officer to compare two indicators from the RBF checklist regarding proper diagnosis & therapy. From each clinical record, we recorded the date of admission and discharge, the age of the child, and the final diagnosis. For each of the checklist items, a score was assigned according to the fulfillment of the single item (presence of information, complete and clear information, done according to WHO protocol).

0 = N.A. (missing or not applicable)
-1 = Absent, not done, not according to guidelines
1 = present, done, but unclear
3 = present, done, done according to guidelines

An overall 'Clinical management' score was obtained by summing the scores for History + Examination + Weight + Treatment + Antibiotics.

Since the items are correlated among themselves, we may offer an overenthusiastic view of the achieved results. For this reason, a multivariate analysis was required to find which variable more efficiently differentiated the management of patients between the year 2016 (before RBF) and the year 2020 (after). A stepwise Canonical Discriminant analysis model was fitted to the data, to select the best items that could discriminate between the two periods.

4. Results

To effectively analyze and interpret the results of implementing RBF in pediatric services at Lacor and Kalongo Hospitals, the findings are broken down into distinct sections:
- Lacor Hospital's ward
- Kalongo Hospital's ward
- Lacor Hospital's clinical management
- Kalongo Hospital's clinical management
- Quality Assessment Before and After the RBF Project in both hospitals

This structure facilitates a clear understanding of the impact of RBF on various aspects of healthcare delivery and allows for a comprehensive evaluation of its effectiveness in improving pediatric healthcare in these under-resourced settings.

By subdividing the results into these sections, stakeholders can gain a nuanced understanding of RBF's impact on pediatric healthcare delivery in Northern Uganda. Such a detailed analysis would not only highlight the strengths and weaknesses of the RBF model in these contexts but also offer valuable lessons and strategies for scaling up or adapting the model to similar settings globally.

4.1. Lacor Hospital's Ward

This section will focus on the pediatric ward of Lacor Hospital, examining changes in patient admission rates, length of stay, readmission rates, and mortality rates before and after the implementation of RBF. It could also look at specific health outcomes related to the most common pediatric illnesses treated in the ward, such as malaria, respiratory infections, and malnutrition, to assess improvements in treatment effectiveness and patient recovery.

Fig. 1 shows the percentage of the target score for the domain of Structure and Management of the ward plus the actions to preserve Hygiene and prevent infections at Lacor.

Figure 1 – Long-term hygiene targets at Lacor Hospital
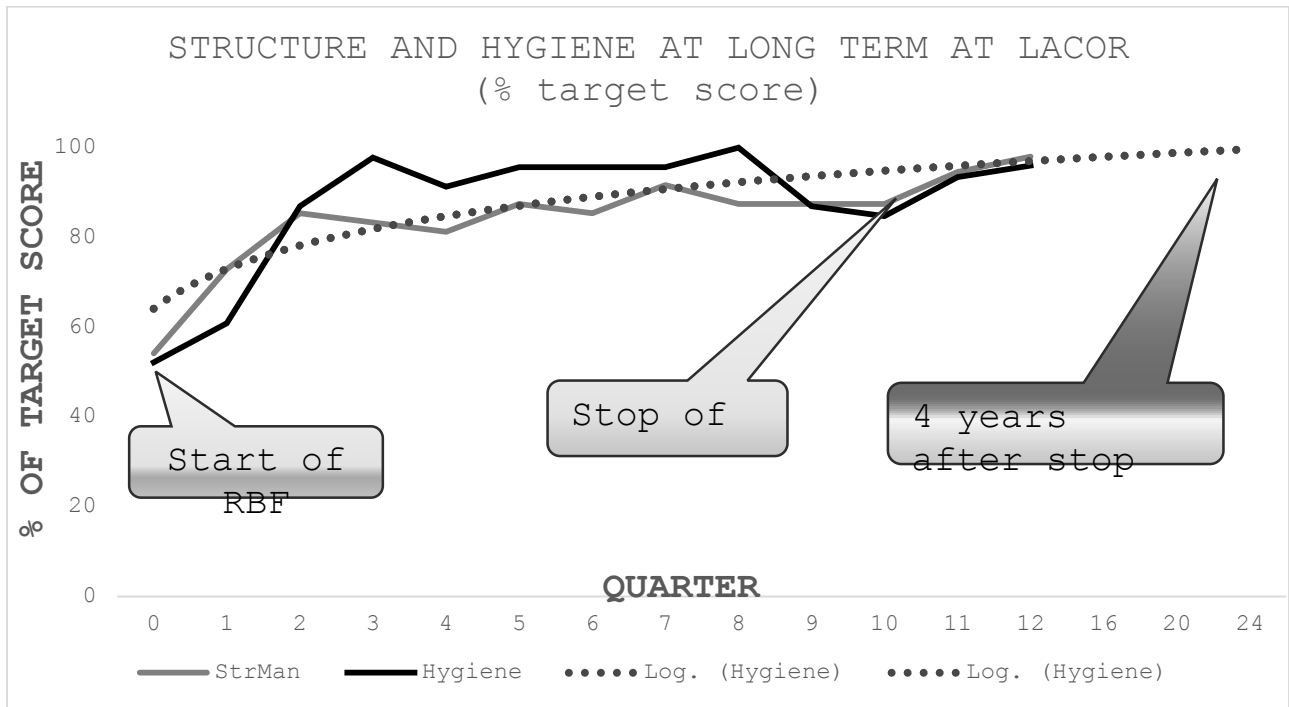
At Lacor the first year of the project was dedicated to covering the gaps in the respective domains, reaching, at the end of the first year (quarter 4) scores quite close to the set target. After the stop of the project (2020) there was no decay of the performance: at the point assessment of 2024, four years after the stop, the scores were very close to the target (see Table 1).

Fig. 2 shows the performance (as % of target score) in the domain of Clinical Management of patients, Emergency readiness, and training of students (nurses, medical doctors, and post-graduates) at Lacor.

Figure 2 – Long-term Clinical Emergency and Training at Lacor Hospital (% target score)
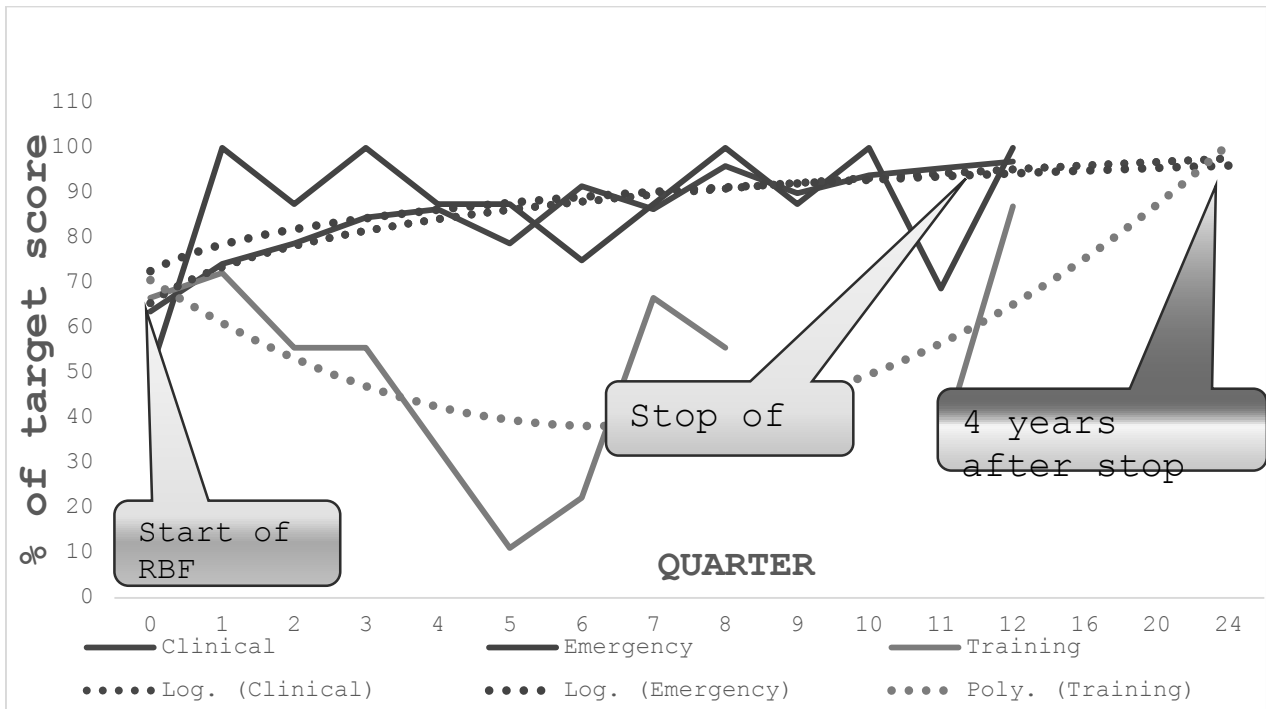
The pattern is like the one observed in Fig. 1: during the first year a significant performance improvement, which remained stable up to the end of the project (2020) and is still kept four years after the end. A special note should be dedicated to the domain of training: during the second and third years, the occasional absence of senior supervisors and the uncontrolled rotation of students (especially medical) made this activity unstable. By 2024 also training appeared to be stabilized at a high level of performance.

4.2. Kalongo Hospital's Ward

Similar to the section on Lacor Hospital, this part would analyze the same set of metrics and health outcomes for Kalongo Hospital's pediatric ward. Comparing the results between the two hospitals could identify patterns or differences in the impact of RBF, highlighting factors that might influence the success of the financing model, such as hospital size, staffing levels, or community engagement.
Fig. 3 shows the percentage of the target score for the domain of Structure of the ward and Management of the Ward plus the action to preserve Hygiene and prevent infections at Kalongo.

Figure 3 – Long-term structure hygiene targets at Kalongo Hospital

STRUCTURE AND HYGIENE AT LONG TERM AT KALONGO (% target score)
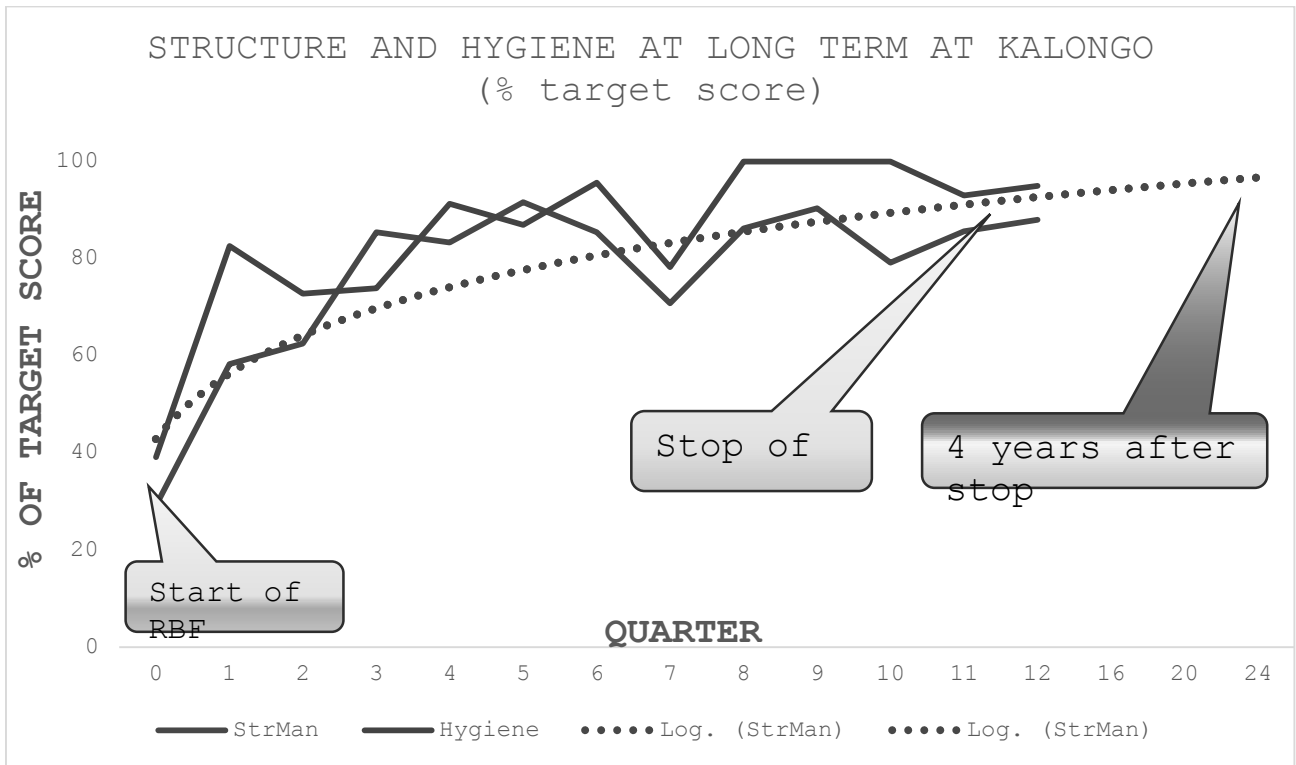
At Kalongo the first year of the project was dedicated to covering the gaps in the respective domains, investing the resources gained by the RBF project, in the amendment and maintenance of the basic structure of the children's ward. In the second year (quarters 5-8) the improvement toward the target became sensible, to reach in the third-year scores very close to the final objectives. After the stop of the project (2020) there was no decay of the performance: at the point assessment of 2024, four years after the stop, the scores were very close to the target (see Table 1).

Fig. 4 shows the performance (as % of target score) in the domain of Clinical Management of patients, Emergency readiness, and training of students (nurses, medical doctors, and post-graduates) at Kalongo.

Figure 4 – Long-term Clinical Emergency at Kalongo Hospital

CLINICAL EMERGENGY AND TRAINING AT LONG TERM AT KALONGO (% target score)
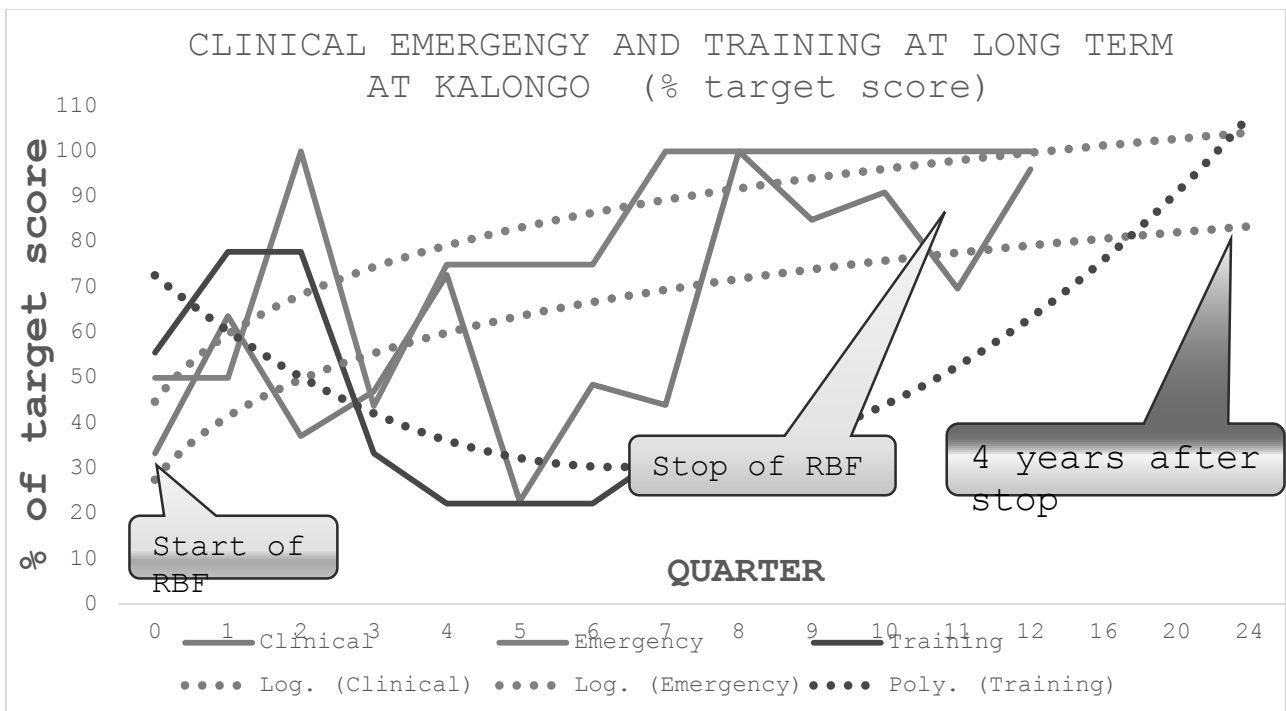
The inconstant presence of the pediatrician affected considerably the stability of the performance of clinical management and the training of students. Especially in the second year supervision and guidance appeared to be unstable, significantly affecting performance. By the third year, a significant improvement was observed, which was maintained as far as four years after the stop of the project.

4.3. Lacor Hospital's Clinical Management

This section will delve into how RBF has affected the clinical management practices within Lacor Hospital. It might include analyses of changes in clinical guidelines adherence, decision-making processes, the use of diagnostics, and treatment protocols. The focus would be on understanding how financial incentives have driven improvements in the efficiency and quality of clinical management in pediatric care.

Tables 1 and 2 show the distribution of scores for each of the quality items for Clinical Management. The number of clinical records scrutinized was 162 for the year before RBF (2016) 111 for the year after RBF 2020 and 100 4 years after the stop (2024). For each score, we report the numbers and the % of the maximum score attained (i.e. the value of '3') below. A Chi-Square is calculated to compare the differences between 2016 and 2020, with first-degree error (p) below. How many folds changed from 2016 to 2020 is in the last line.

Table 1 – *Distribution of Scores for Quality Items at Lacor (Clinical Management)*

Scores	Clinical History		Clinical examination		Managed Malaria		Weight checked		Diagnosed Anemia		specific Sepsis diagnosis	
	2016	2020	2016	2020	2016	2020	2016	2020	2016	2020	2016	2020
-1	32	0	29	0	7	0	72	11	2	0	39	10
	19,9	0,0	18,2	0,0	6,6	0,0	44,7	9,9	2,0	0,0	70,9	37,0
1	38	5	36	2	2	0			1	6	6	6
	23,6	4,5	22,6	1,8	1,9	0,0	0,0	0,0	1,0	6,4	10,9	22,2
3	91	106	94	109	97	85	89	100	99	88	10	11
% of Max Score	**56,5**	**95, 5**	**59,1**	**98,2**	**91,5**	**100**	**55,3**	**90,1**	**97,1**	**93,6**	**18,2**	**40,7**
TOTAL	161	111	159	111	106	85	161	111	102	94	55	27
χ2	51		53,6		7,57		37,6		5,36		8,66	
p	0,00001		0,00001		0,023		0,0001		5,36		0,013	
Fold Changes 2020/2016		1,69		1,66		1,09		1,63		0,96		2,24

Table 2 shows the distribution of scores for the required quality items (Treatment).

Table 2 – *Distribution of Scores for Treatment at Lacor - Treatment*

Scores	Treatment proper		Antibiotics required		URTI appropriate		LRTI appropriate	
	2016	2020	2016	2020	2016	2020	2016	2020
-1	35	5	52	10	1	0	0	2
	21,9	4,5	33,8	9,1	14,3	0,0	0,0	7,7
1	14	15	7	18	0	1	10	11
	8,8	13,5	4,5	16,4	0,0	20,0	50,0	42,3
3	111	91	95	82	6	4	10	13

% of Max Score	**69,4**	**82,0**	**61,7**	**74,5**	**85,7**	**80,0**	**50,0**	**50,0**
Total	160	111	154	110	7	5	20	26
$\chi 2$	16,18		27,6		2,12		1,68	
p	0,0001		0,0001		0,34		0,194	
Fold Changes 2020/2016		1,18		1,21		0,93		1,00

Figure 6 shows graphically the % maximum scores (=3) reached in the years 2016 (first bar), 2020 (second bar), and 2024 (third bar).

Figure 6 - *Clinical Management Scores in Lacor*
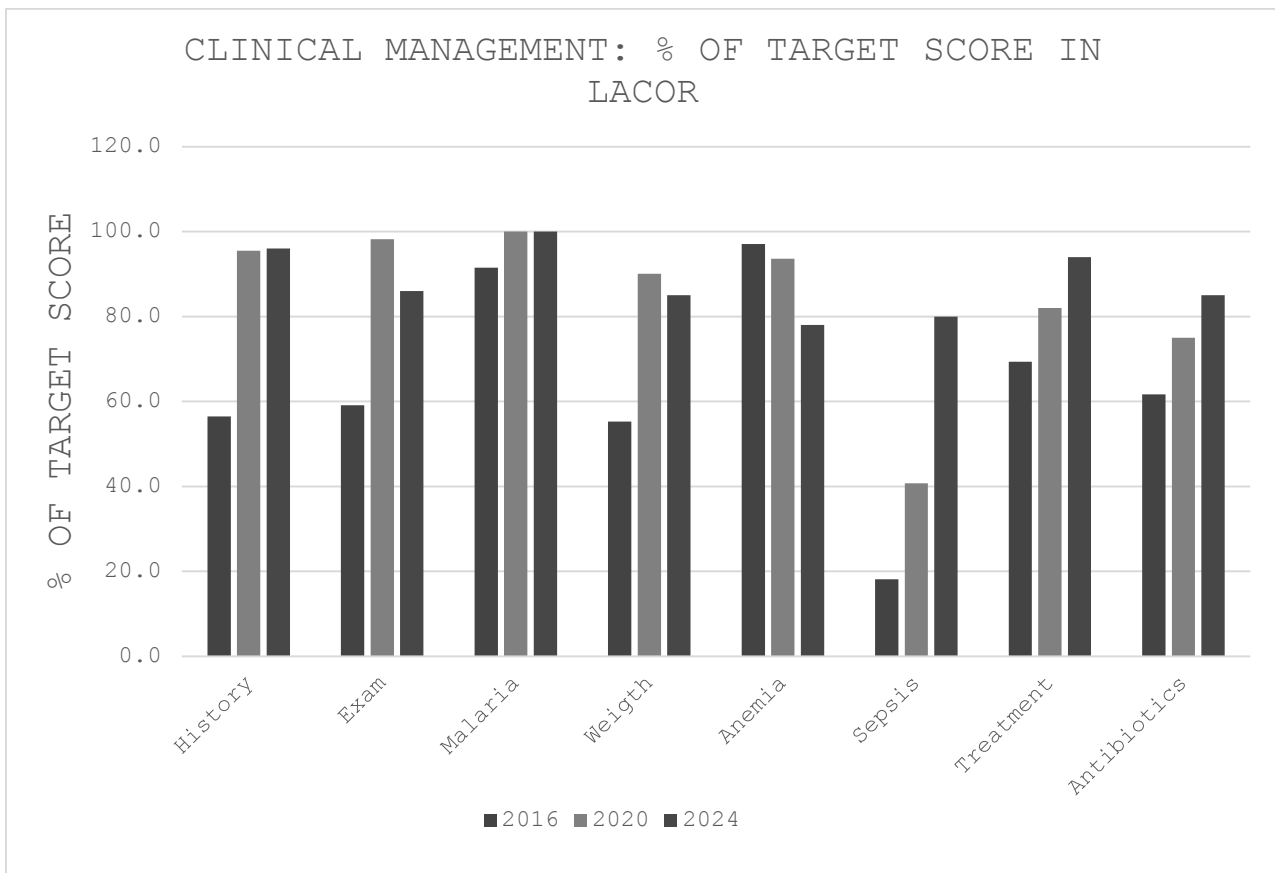
Since most of the observed analyses are correlated among themselves, a multivariate analysis was required to find which variable more efficiently differentiates the management of patients between the year 2016 and the year 2020. A stepwise Canonical Discriminant analysis model was fitted to the data, to select the best variables able to discriminate between the two years. Wilk's Lambda estimates the capacity of each variable to differentiate between the two years, where 1 = complete overlap and 0 = complete distance.

Table 3 - *Items selected to discriminate between year 2016 and year 2020 Lacor*

Step	Item	Wilks Lambda	F ANOVA	p
1	Symptom	,816	58,451	,000
2	Weigth	,731	47,521	,000
3	Exam	,711	34,865	,000

The symptoms based on clinical history, the measuring of weight, and the clinical examination are the best discriminators: no other variable contributes significantly to the model. The acceptable correct prediction of 75% of cases in the year they belong provides a sufficiently robust estimate of the adequacy of the model. The practical indication is that these three items should be reinforced to improve the quality of the service.

Unfortunately, the weight of the child is not reported in all cases, inasmuch there is no space on the forms to report the weight centile, which is essential to estimate the health of the child, this is more often recorded in the Outpatient form through which the majority of admitted children go through. Screening for malnutrition is very occasional and a specific query is not present on the clinical record. The main reason for this is that the assessment is done in the outpatient department but is not often reported in the clinical record.

Similarly, the immunization status of the child is erratic, since there is no specific query marked on the forms. The diagnosis of 'Sepsis' is applied extensively, without the appropriate search for a cause of the infection. A specific diagnosis would be much encouraged by the availability of a simple marker of infection, like the C C-reactive protein (CRP).

4.4. Kalongo Hospital's Clinical Management

By examining the same aspects of clinical management as in Lacor Hospital, this section would provide insights into the internal processes and practices at Kalongo Hospital. It would allow for a comparison of how RBF has influenced clinical management across different settings, identifying best practices and areas for improvement.

It is sufficient to see the fold changes from 2016 to 2020 (% max score achieved in 2020 / % max score achieved in 2016) to estimate the dramatic changes observed at Kalongo (Tables 5 and 6).

The reporting of a detailed clinical history and the accurate examination of the child improved more than 6 times (= 600%!). Similarly, good management of sepsis increased 9 times. The appropriateness of the treatment and use of antibiotics improved much less (1,6 - 1,7 times) because it was already often appropriate in 2016.

At Lacor the improvements from 2016 to 2020 appeared less impressive for a good reason: they were starting from a decent quality of care. However, the improvement was very significant indeed when considering clinical management and treatment of the sick child.

The number of clinical records scrutinized was 218 for the time before RBF (2016) 111 three years later (2020) and 50 after 4 years from the end of RBF (2024).

Table 5 shows the distribution of scores for the required quality items in 2016, 2020, and 2024: Clinical Management. For each score, we report the numbers and the % of the total below. Chi-Square is calculated to compare the differences between 2016 and 2020, with first-degree error (p) below. How many folds changed the score from 2016 to 2020 is shown in the last line.

Table 5 - *Distribution of the Quality Assessment Scores for Clinical Management*

Scores	Clinical History		Clinical examination		Malaria managed		Weight checked		Anemia diagnosed		Sepsis specific diagnosis	
	2016	2020	2016	2020	2016	2020	2016	2020	2016	2020	2016	2020
-1	159	3	149	2	29	1	25	15	9	0	56	3
%	*73*	*2,7*	*68,3*	*1,8*	*17,8*	*0,9*	*11.5*	*13,5*	*5,9*	*0*	*76,7*	*23,1*
1	36	17	36	8	18	1	0	0	26	0	14	5
%	*16,5*	*15,3*	*16,5*	*7,2*	*11*	*0,9*	*0*	*0*	*17*	*0*	*19,2*	*38,5*

11

3	23	91	33	101	116	104	193	96	118	107	3	5
% Max Score	**10,6**	**82,0**	**15,1**	**91,0**	**71,2**	**98,1**	**88,5**	**86,5**	**77,0**	**100,0**	**4,1**	**38,5**
TOTAL	218	111	218	111	163	106	218	111	153	107	73	13
χ^2	182		179		31,3		0,88		28		20,4	
p	0,00001		0,0001		0,00001		0,5		0,0001		0,0001	
Fold Changes 2020/2016		**7,77**		**6,01**		**1,38**		**0,98**		**1,3**		**9,36**

Table 6 shows the distribution of scores for the required quality items (Treatment).

Table 6 - *Distribution of the Quality Assessment Scores for Treatment*

Scores	proper Treatment		Antibiotics (only if required)		URTI appropriate		LRTI appropriate	
	2016	2020	2016	2020	2016	2020	2016	2020
-1	39	0	50	4	5	2	16	0
%	17,9	0	23,3	3,7	45,5	27,2	27,6	0
1	51	5	53	8	2	0	5	1
%	23,4	4,5	24,7	7,3	18,2	0	8,6	6,3
3	128	106	112	97	4	7	37	15
% Max Score	**58,1**	**95,5**	**52.1**	**89,0**	**36,4**	**77,8**	**63,8**	**93,8**
TOTAL	218	111	215	109	11	9	58	16
χ^2	49,2		43,4		3,94		6,1	
p	0,00001		0,00001		0,139		0,047	
Fold Changes 2020/2016		**1,62**		**1,70**		**2,14**		**1,47**

The Percentages of the maximum score achieved in 2016 (before), 2020 (at the end), and 2024 (four years after the end) are illustrated in Figure 7, which shows the % maximum scores (=3) reached in the year 2016 (first bar), year 2020 (second bar) and year 2024 (third bar).

Figure 7 – *Clinical Management Scores in Kalongo*

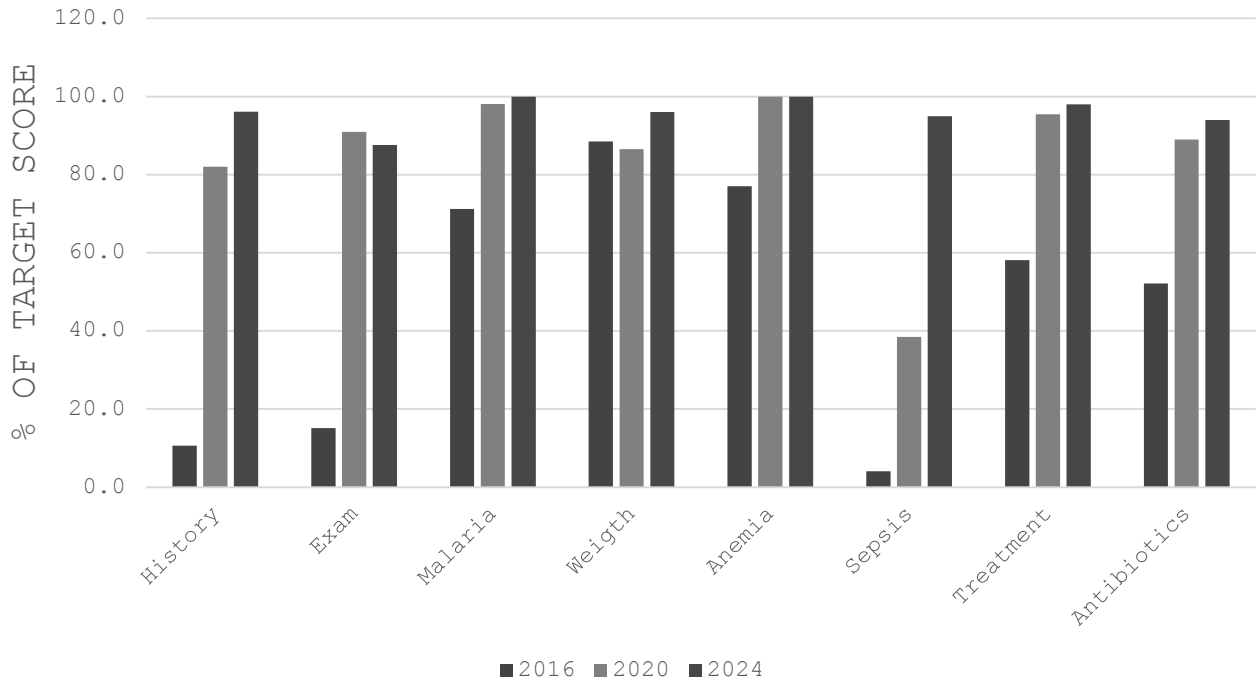CLINICAL MANAGEMENT: % OF TARGET SCORE IN KALONGO

Table 7 shows the items selected to discriminate between the year 2016 and year 2020 in Kalongo.

Since most of the observed items are correlated between themselves, we may offer an overenthusiastic view of the achieved results. For this reason, a multivariate analysis was required to find which variable more efficiently differentiates the management of patients between the year 2016 (before RBF) and the year 2020 (three years later).

Table 7 – Multivariate analysis of the patient's management in Kalongo

Step	Items	Wilk's lambda	Anova F	p
1	Symptom	,407	384,119	,000
2	Treatm	,382	212,335	,000
3	Exam	,369	149,217	,000

The symptoms based on clinical history, the appropriate treatment, and the clinical examination are the best discriminators: no other variable contributes significantly to the model. A stepwise Canonical Discriminant analysis model was fitted to the data, to select the best items able to discriminate between the two years. Wilk's Lambda estimates the capacity of each variable to differentiate the two years, where 1 = complete overlap and 0 = complete distance. If we apply the discriminant score obtained by this analysis we could blindly predict, for all the dates, each clinical record year. The Discriminant Model fits adequately the observed data and allows predict correctly to which year the record belongs in 90% of cases.

4.5. Quality Assessment Before and After the RBF Project

This section provides a comprehensive quality assessment of pediatric care in both hospitals, comparing the period before and after RBF implementation. This assessment could include patient satisfaction surveys, healthcare provider feedback, and adherence to national or international healthcare standards. Key performance indicators (KPIs) like healthcare-associated infections, vaccination rates, and the timeliness of care would be crucial metrics. This section could also explore the broader impact of RBF on hospital reputation, staff morale, and community trust.

Both hospitals, although with different starting points at time 0, showed a steep increase in the quality of services over the first and half year of intervention, reaching, by the 6th-8th quarter a score close to 85-90% of the target score. By the end of RBF, a remarkable change in the structure and management as well as in the procedures was observed. The expected fall of the performance after the stop of the program did not happen. The high level of average quality score was still present four years after the stop (2024). Not all domains reached the same results: training of nurses and medical students was frequently erratic.

The management of sick children in the wards also improved significantly comparing the charts of 2020 to those of 2016, before the project. Such a high level of quality in clinical activity persisted after the end of the project in 2024.

Scores for each domain over Time, where the following: 0 = starting time 2018, 12 = End of the project Dec. 2020, 24 = four years after the end of project 2024

The improvement of the score for each domain was obtained from the ratio between the observed score and the maximum score possible for the respective domain, expressed as a percentage of the target score (see scoring form in the Appendix). The distribution of final Diagnosis of children for the three years and the distribution of scores in the three times of observation for both hospitals are also shown in the Appendix.

Fig. 5 shows the improvement of quality scores as a percentage of the starting scores (at time 0 start of the project) either of the scores reached at the end of the project (2020) as well of the scores four years after the end of the project (2024) for Lacor and Kalongo Children's Wards. ('20' = Scores 2020-scores of 2018)*100/Scores of 2018) , ('24' = Scores 2024-scores of 2018)*100/Scores of 2018).

Figure 5 – Improvement of Quality Scores

% improvement from start (2018) to 2020 and to 2024

Legend: ■ LACOR20 ■ LACOR24 ■ KALONGO20 ■ KALONGO24
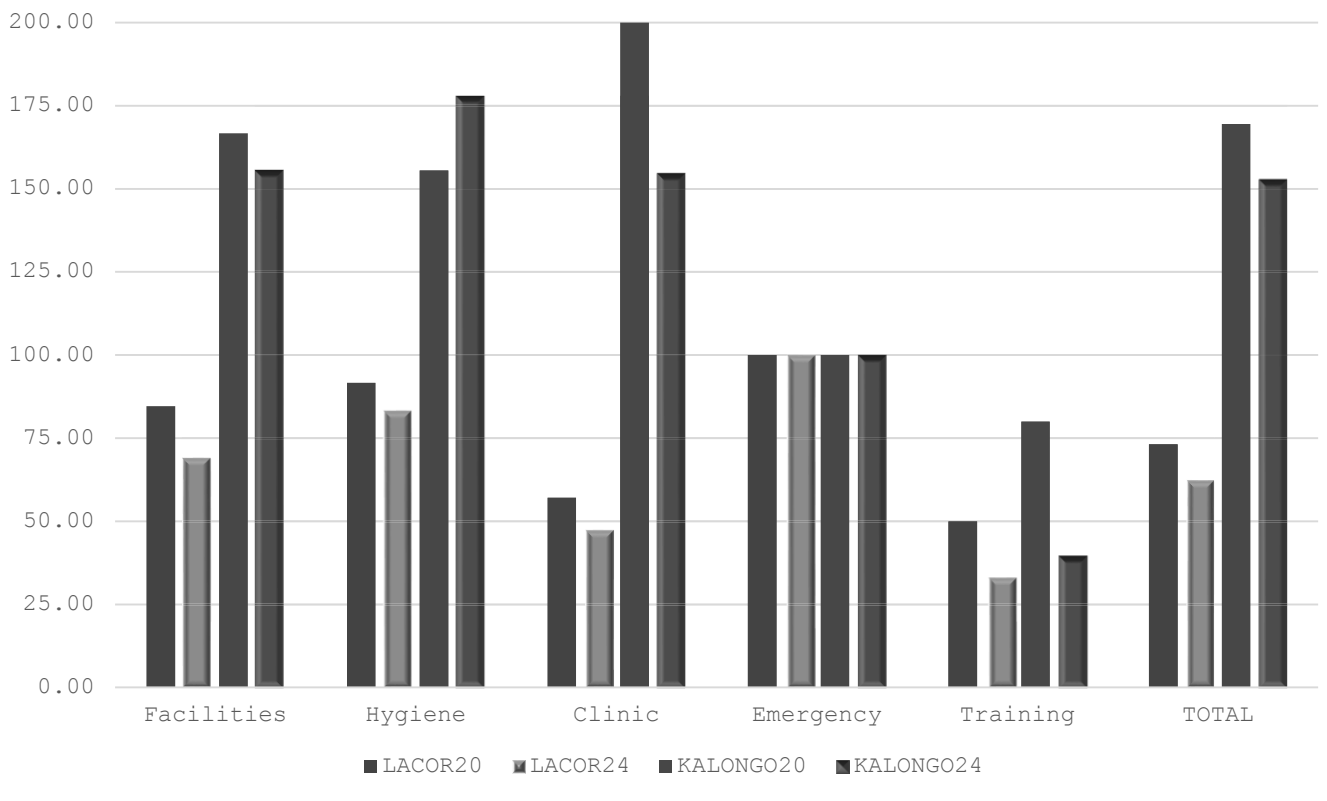
The % improvement in performance in all domains was greater in Kalongo than in Lacor since the starting point of this hospital was significantly lower compared to Lacor. However, it is intriguing to observe the relative stability of the improvement after four years by the end of the project. For example, in Kalong there was a + 150% of the scores from the start of 2018 to the end (2020) of the project for structure management and hygiene, but still a stable 150% improvement from 2018 to 2024 after the stop of the project. The domain of emergency was stabilized early and kept on for a long time, while the area of training could improve less in Kalongo than at Lacor, due to the inconstant presence of supervision.

Clinical management of sick children has been very significantly improved from 2016 (before RBF) to 2020 (after RBF) both in Lacor, where the average level of care was already at a good standard, but more evidently in Kalongo, where the gaps in human resources limited the quality of care in the years 2014-2016.

Fig. 8 shows the Mean and Interquartile Range of the sum of scores: History + Examination + Weight + Treatment + Antibiotics for both hospitals.

Figure 8 – Quality Score Assessment
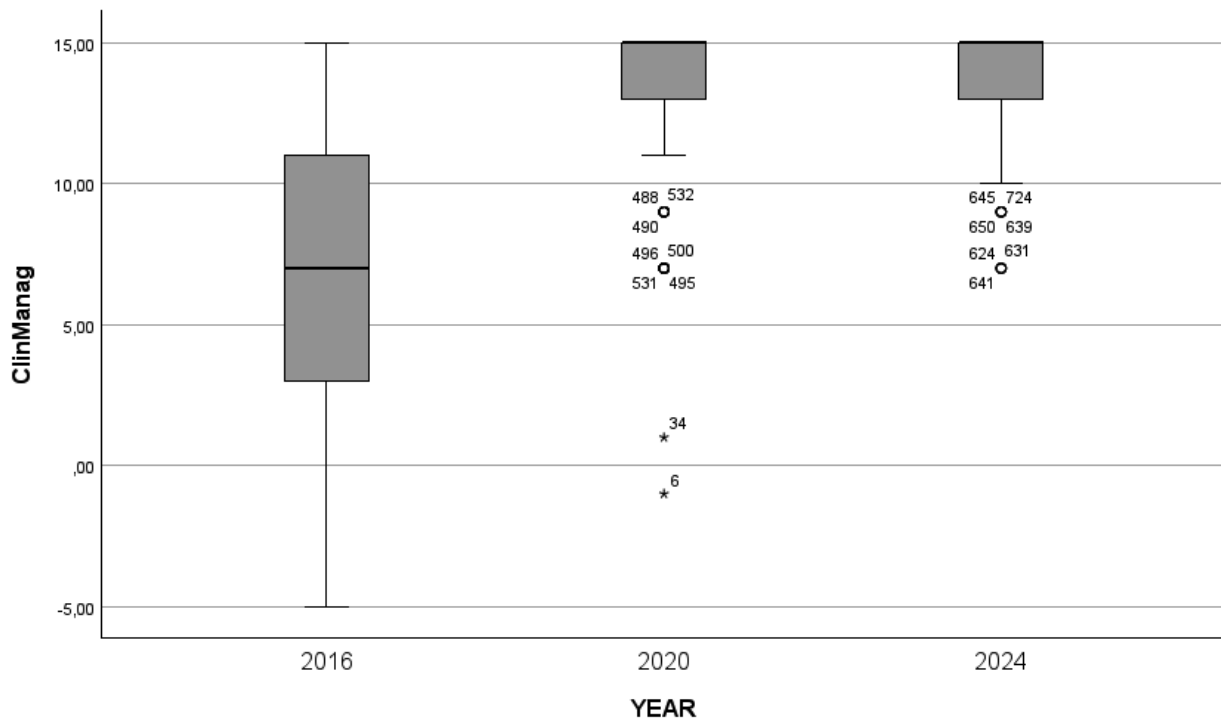
Clinical management of sick children improved significantly during the RBF project but also persisted 4 years after the stop of the project.

Analysis of Variance, considering the Average Clinical Score by Hospital and Year of Assessment, is reported in Table 8.

Table 8 – Average Clinical Score

		Factors	N
Hosp	1	LACOR	350
	2	KALONGO	375
YEAR	2016		366
	2020		219
	2024		140

Dependent: Clinical Management

Origin		Sum of Squares	df	Quadratic mean	F	p
Intercept	Hypothesis	77333,956	1	77333,956	21,972	,043
	Error	7044,404	2,001	3519,680a		
Hosp	Hypotesis	92,147	1	92,147	,544	,537
	Error	343,838	2,030	169,370b		
YEAR	Hypothesis	7656,407	2	3828,204	20,929	,046
	Error	365,822	2	182,911c		
Hosp * YEAR	Hypothesis	365,822	2	182,911	11,743	<,001
	Error	11198,900	719	15,576d		

a. ,919 MS(YEAR) + ,081 MS(Error)

b. ,919 MS(Hosp * YEAR) + ,081 MS(Error)

c. MS(Hosp * YEAR)

d. MS(Error)

Analysis of variance shows that Clinical Management was not significantly different between the two hospitals, but the difference across years of observation was marked and significant for both hospitals, as tested by the interaction Hosp x Year.

16

5. Discussion

This analysis has shown that RBF can be utilized to drive improvements in healthcare quality and outcomes, while also pointing out the complexities and challenges that need to be addressed to ensure the success and sustainability of these models. RBF has the potential to enhance healthcare delivery in challenging environments through financial incentives aligned with desired health outcomes. Lacor and Kalongo hospitals have navigated challenges before and after the implementation of RBF, showcasing improvements in healthcare efficiency, quality, and patient outcomes, especially in the context of the COVID-19 pandemic.

The longitudinal study from 2018 to 2024 offers a valuable perspective on the long-term effects of RBF in pediatric care, underlining the importance of continuous evaluation and adaptation of these models to local contexts and emerging health crises. The inclusion of detailed models and methodologies for evaluating the effectiveness of RBF interventions provides a solid framework for assessing their impact over time.

At Lacor, soon after the start of the project, the actions put in place to improve the structure, the management, and the procedures at the Children's ward, allowed a steep rise in the achieved percentage of the maximum score. The starting status was already quite acceptable in 2018, so dramatic changes could not be expected. After the first year (Time 3 = 3rd quarter) minimal changes were observed for most items. The exception was training, where the rotation of medical students and the occasional presence of expatriates did not allow for an estimate of adequate performance in the training domain.

The starting status at Kalongo suffered in 2018 from several gaps, so the scores of each domain gradually improved over the first 5 quarters. The children's ward was completely re-established in 2018-2019; this allowed a significant catch-up in the scores achieved. The erratic presence of a pediatric specialist was related to the several gaps observed in the Clinical Procedures. Similarly, to Lacor, even in Kalongo, the training domain suffered from the absence of supervision and the occasional presence of trainees.

The project indicators and verification assessment focused on qualitative and quantitative outputs of pediatric services, involving the children's ward and other hospital services necessary for diagnostic support to the children's ward, such as radiology and laboratory.

The first project verification obtained a score of 62% and highlighted several weaknesses, regarding a range of aspects such as infrastructure, ward organization, waste management, incomplete clinical forms, and fluid balance charts. During the first staff follow-up meeting to discuss the verification results, the quality team and children's ward staff engaged very proactively in the identification of a clear action plan, setting out individual responsibilities and deadlines for each point to be addressed. Some of the non-compliances highlighted in the first verification that regarded the purchase of equipment were addressed immediately by staff and management, such as setting up more hand-washing facilities and hypochlorite, the purchase of waste bins, and sterilization units. The non-compliances that regarded broader aspects such as management of clinical forms and other aspects related to clinical and nursing processes required a lengthier process for improvement, but at mid-project, such improvements have started to be visible in the quarterly verifications and the results show an improvement in all areas subject to verification, exception made for aspects that an RBF project cannot solve such as the difficulty in retaining specialists in rural and underserved health facilities.

Throughout the project implementation, staff has kept proactive in carrying out post-assessment follow-up meetings, with clear identification of responsibilities and deadlines. Documentation of follow-up meetings to record progress made in addressing non-compliances is however weak and should be a point of attention for future RBF projects.

The bonus produced because of the verification scores has been used by the hospital both for assigning incentives to staff involved in the project activities and for supporting general hospital costs, with priority for costs related to addressing any weaknesses identified during the verifications.

Through the RBF project in the Pediatric ward at Lacor Hospital, several quality impacts were improved:

- Implementation of measures to promote and enhance patient safety, reduce harm, and prevent errors within the ward and its surroundings.
- Utilization of evidence-based consistent practices through enhanced adherence to guidelines and protocols to standardize care.
- Regular assessment and monitoring of outcomes, processes, and infrastructures to identify areas for improvement.
- Provision of continuous medical and nursing education and training for the staff to keep them updated on best practices and advancements in healthcare.

The motivation to carry on beyond the project concerns the involvement of members from the department in the routine assessments, identification of gaps, and designing solutions/recommendations. This created a sense of local ownership of not just the processes but also the impacts. It has also been satisfying seeing this adapted in the other different departments within the hospital.

Both hospitals showed a steep increase in the scores for all domains in the first year (quarters 0-3).

In Lacor the levels achieved for most domains did not require greater improvement: the graphs show that high scores were kept throughout the project. Lacor hospital staff and management showed a remarkable capacity to keep a stable and sustainable high-quality profile over time, suggesting that the RBF project became mostly ordinary routine practice, rather than an occasional effort to improve the service to be rewarded.

In Kalongo Hospital the starting facilities suffered from several gaps: hence a longer time, the first 6 quarters, was required to establish a high level of quality of the services.

6. Conclusion

RBF has been shown to have a positive impact on healthcare services in low- and middle-income countries. It has been found to improve institutional delivery rates and the number of healthcare facility visits, although the impact varies depending on the context.

The application of RBF in pediatric services, particularly in under-resourced areas such as Northern Uganda, presents a promising avenue for enhancing healthcare delivery. RBF, by design, aligns financial incentives with desired health outcomes, creating a direct correlation between healthcare provider performance and compensation. This model encourages providers to improve service quality, efficiency, and effectiveness, with a particular focus on achieving specific, measurable health outcomes for children.

Applying the theoretical concepts of RBF to empirical cases involving Lacor and Kalongo hospitals provides valuable insights into the practical implications and challenges of implementing RBF in pediatric services.

Before the implementation of RBF, both hospitals, like many healthcare facilities in under-resourced areas, faced challenges such as limited resources, staffing shortages, and variable quality of care. With the introduction of RBF, these hospitals would have developed and agreed upon specific health outcomes to be achieved, such as reductions in child mortality rates, improved vaccination coverage, or increased rates of timely antenatal care visits.

The COVID-19 pandemic introduced unprecedented challenges to healthcare systems worldwide. In the context of RBF, these hospitals would have had to adapt their strategies and operations to continue meeting their healthcare delivery targets despite the pandemic. This might have involved shifting resources, adopting telehealth technologies, or implementing new protocols to manage COVID-19 cases while still providing pediatric care.

The period from 2018 to 2024 offers a significant timeframe to evaluate the impact of RBF on pediatric services. This would involve analyzing health outcome data before and after RBF implementation, as well as during and after the COVID-19 pandemic. Key factors for the evaluation would include changes in healthcare delivery efficiency, quality of care, patient satisfaction, and health outcomes among the pediatric population.

The experiences of Lacor and Kalongo Hospital would provide valuable lessons on the effectiveness of RBF in improving pediatric healthcare services, particularly in challenging and resource-limited settings. Identifying best practices, challenges, and strategies for overcoming obstacles would be crucial for refining RBF models and guiding future implementations.

In conclusion, the empirical application of RBF in pediatric services at Lacor and Kalongo Hospital offers a practical examination of how theoretical RBF models can be applied and adapted to real-world settings. It underscores the potential of RBF to drive improvements in healthcare quality and outcomes, particularly in under-resourced areas facing additional challenges such as those posed by the COVID-19 pandemic.

References

Annan, J., Blattman, C., Mazurana, D., & Carlson, K. (2011). Civil war, reintegration, and gender in Northern Uganda. *Journal of conflict resolution*, *55*(6), 877-908.

Antony, M., Bertone, M. P., & Barthes, O. (2017). Exploring implementation practices in results-based financing: the case of the verification in Benin. *BMC Health Services Research*, *17*(1), 1-12.

Beane, C. R., Hobbs, S. H., & Thirumurthy, H. (2013). Exploring the potential for using results-based financing to address non-communicable diseases in low-and middle-income countries. *BMC Public Health*, *13*, 1-9.

Brenner, S., Muula, A. S., Robyn, P. J., Bärnighausen, T., Sarker, M., Mathanga, D. P., ... & De Allegri, M. (2014). Design of an impact evaluation using a mixed methods model–an explanatory assessment of the effects of results-based financing mechanisms on maternal healthcare services in Malawi. *BMC Health Services Research*, *14*(1), 1-17.

Brenner, S., Mazalale, J., Wilhelm, D., Nesbitt, R. C., Lohela, T. J., Chinkhumba, J., ... & De Allegri, M. (2018). Impact of results-based financing on effective obstetric care coverage: evidence from a quasi-experimental study in Malawi. *BMC Health Services Research*, *18*(1), 1-10.

Center for Health, Human Rights and Development (CEHURD), (2021). Tracking The Progress And Implications Of The Global Financing Facility (In This Case Results-Based Financing) In The Healthcare Sector In Uganda, July, https://www.csogffhub.org/wp-content/uploads/2021/12/GFF-RBF-Study CEHURD UDN Wemos 2021.pdf

Falisse, J. B., Ndayishimiye, J., Kamenyero, V., & Bossuyt, M. (2015). Performance-based financing in the context of selective free health-care: an evaluation of its effects on the use of primary health-care services in Burundi using routine data. *Health policy and planning*, *30*(10), 1251-1260.

Fondazione Corti, Lacor Hospital, Fondazione Ambrosoli (2021). Results Based Financing an engine of change for Paediatric services. https://fondazionecorti.it/wp-content/uploads/2014/07/RBF-study-2021.pdf, September.

Friedman, J., Qamruddin, J., Chansa, C., & Das, A. K. (2016). *Impact evaluation of Zambia's health results-based financing pilot project.* Washington DC: World Bank Group.

Grittner, A. M. (2013). *Results-based Financing: Evidence from performance-based financing in the health sector* (No. 6/2013). Discussion Paper.

James, N., Lawson, K., & Acharya, Y. (2020). Evidence on result-based financing in maternal and child health in low and middle-income countries: a systematic review. *Global health research and policy*, *5*(1), 1-15.

Kuunibe, N., Lohmann, J., Hillebrecht, M., Nguyen, H. T., Tougri, G., & De Allegri, M. (2020). What happens when performance☐based financing meets free healthcare? Evidence from an interrupted time☐series analysis. *Health Policy and Planning*, *35*(8), 906-917.

Manongi, R., Mushi, D., Kessy, J., Salome, S., & Njau, B. (2014). Does training on performance-based financing make a difference in performance and quality of health care delivery? Health care provider's perspective in Rungwe Tanzania. *BMC Health Services Research*, *14*, 1-9.

Manyera, A., Zinyama, T., & Sachikonye, L. (2021). The Impact of Covid-19 Pandemic on Results-Based Finance Programmes in Developing Countries: A Literature Review. *Journal of Public Administration and Development Alternatives (JPADA)*, *6*(2), 65-81.

Mathonnat, J., & Pelissier, A. (2017). *How a Results-Based Financing approach can contribute to the health Sustainable Development Goals-Policy-oriented lessons: what we know, what we need to know and don't yet know* (No. P204). FERDI Working Paper.

19

Moro-Visconti R., Larocca A., Marconi M. (2020). Accessibility to First-Mile health services: A time-cost model for rural Uganda. *Social Science and Medicine*, Nov;265.

Moro-Visconti R., (2024). Results-Based Financing in Healthcare: Evidence from Northern Uganda, https://www.researchgate.net/publication/377781738_Results-Based_Financing_in_Healthcare_Evidence_from_Northern_Uganda

Mushasha, R., & El Bcheraoui, C. (2023). Comparative effectiveness of financing models in development assistance for health and the role of results-based funding approaches: a scoping review. *Globalization and Health*, 19(1), 39.

Oxman, A. D., & Fretheim, A. (2008). An overview of research on the effects of results-based financing. Norwegian Knowledge Centre for the Health Services.

Paul E., Albert L., et al., (2018). Performance-based financing in low-income and middle-income countries: isn't it time for a rethink? *BMJ Global Health*. January 13;3(1):e000664.

Raviglione, M.C.B., Tediosi, F., Villa, S., Casamitjana, N., Plasència, A., eds., (2023) *Global Health Essentials*, Springer, Cham.

Renmans D, et al, (2016). Opening the 'black box' of performance-based financing in low- and lower-middle-income countries: a review of the literature, *Health Policy, and Planning*, Volume 31, Issue 9, November, Pages 1297–1309

Savedoff, W. D., & Partner, S. (2010). Basic economics of results-based financing in health. *Bath, Maine: Social Insight*.

Shroff, Z. C., Bigdeli, M., & Meessen, B. (2017). From scheme to system (part 2): findings from ten countries on the policy evolution of results-based financing in health systems. *Health Systems & Reform*, 3(2), 137-147.

Soeters, R., Peerenboom, P. B., Mushagalusa, P., & Kimanuka, C. (2011). Performance-based financing experiment improved health care in the Democratic Republic of Congo. *Health Affairs*, 30(8), 1518-1527.

Turcotte-Tremblay, A. M., Spagnolo, J., De Allegri, M., & Ridde, V. (2016). Does performance-based financing increase value for money in low-and middle-income countries? A systematic review. *Health Economics Review*, *6*(1), 1-18.

Witter, S., Bertone, M.P., Namakula, J., *et al.* (2019) (How) does RBF strengthen strategic purchasing of health care? Comparing the experience of Uganda, Zimbabwe, and the Democratic Republic of the Congo. *Global Health Research and Policy* 4, 3.

Zeng, W., Shepard, D. S., Rusatira, J. D. D., Blaakman, A. P., & Nsitou, B. M. (2018). Evaluation of results-based financing in the Republic of the Congo: a comparison group pre–post study. *Health policy and planning*, 33(3), 392-400.

Annex 1
QUALITY IMPROVEMENTS IN THE CHILDREN'S WARD - CHECKLIST
Health Facility Name: _____ Hospital: _____
Date: _____   Quarter/Period Assessed: _____

CHECKLIST ITEMS 1.	CRITERIA	SCORES	Your Priority 1 to 5	
Basic infrastructures working and in acceptable conditions **1)** Doors and windows regularly checked, **2)** Beds and ward facilities repaired when required, **3)** Mattress changed when required, **4)** Baby and children height and weight scale available and in working condition	3-4 items controlled	0-3	Check 3: open/close, clean glasses Mattresses in good condition, cover intact	
Hygienic conditions appropriate **1)** Cleanliness of the ward, **2)** Accurate disposal of sick children's vomit/feces, **3)** Disposal of remains of foods	Bad, moderate, good, optimal	0-3	Ask how the mother in the diarrhea room disposes of feces and pampers Each score is 3, then the average	
Safe environment **1)** Electrical safety for children(cover etc), **2)** Children don't have access to drugs, **3)** Fire readiness	1.% safe electric 2=100 3. Accept- good- excel	0-3	Check mains, Sample three rooms, check lights and sockets, children access Check extinguishers, expiry Each scores one point	
Prevention of infections **1)** Facilities to wash hands, **2)** Alcohol available, **3)** Reduce cross-contamination among children (beds?)	Renovation of O2 room	0-3	1-check wash points avail, handwash facil for pts and clinicians, sink working 2- check alcohol Check ICU bed distance, 1 point each, can get half	
Available and functional equipment and supplies: Oxig tester, Infusion pump, Suction machine, O2 concentrator, nebulizer	O2 line coming	0-3	Check the presence/functionality of three of these, each scores one	
Are the right Drugs available when needed? **1)** Essential Medicine and Health Supplies are available **2)** Timely provision of drugs after requests	List 20 drugs % Check 3 request-time	0-3	Attached sheet/checklist of 20 drugs	

Adequate support from the laboratory? **1)** The lab is functional every day of the week **2)** Scheduled time kept as planned (delivery of samples and provision of results)	1. OK 2. Check 3 request-time	0-3	Check ten files with lab requests and see the optimacy/availability of the result Functionality 1pt, optimacy 2pts	
Adequate support from the Radiology Department? **1)** The radiology unit is functional every day of the week **2)** Scheduled time kept as planned (delivery of samples and provision of results)	US critical, Cardiac US critical	0-3	Check file 3 of radiology, see if done, otherwise detect why it is not. 1 point working, 2 points functional	
TOTAL SCORE		24		

2. HYGIENE AND CLEANLINESS

CHECKLIST ITEMS	CRITERIA	SCORES	Your priority 1 to 5	CRITICAL
Presence of cleaning products: Supply record cards indicating amounts in and out correspond to physical supplies (soap, bleach, chloramine, chlorhexidine, and at least one detergent)	Record card monthly of supplies on ordering-requisition book once a wk Thursday	0-3	To be checked within the Charge Check soap, liquid soap, jik, vim, savlon/chlorhexidine Score one point for each	
Stock Management. Reserve of disinfectants, equipment used soaked in disinfectants in treatment rooms,	Requisition book	0-3	Bucket labeled for instruments. 3 if present/unexpired	
All beds have mattresses covered with impermeable plastic intact		0-2	Most are torn/spoiled, need new covers, done locally	
Cleanliness of rooms, halls, and grounds: 1) presence of waste bins (in reception and corridor) **2)** no loose trash;**3)** sharps container in treatment rooms /duty room	N. trash bins N. special dispensers Sharp containers	0-3	Check waste bins, functionality of dispensers	
No organic waste, syringes, or dangerous products in any location that is easily accessible to the public/compound	Inspection 1 to 3 score	0-3	?remove?	
Availability of water source (running water or well, pump, or water tower/tank)	Yes/not	0-2	Check availability, sources	
Water dispensers are available in service rooms where there is no tap w.	Yes/not	0-2	Drinking water jerrycans	
Presence of latrines and showers 1) usable;	To be checked	0-3		

2) no organic matter within or outside; **3)** door that closes from the inside; **4)** covered pit (for latrines)				
Available and functional sterilization materials autoclave, or heat sterilizer	Check transport of drums from ward to sterile center, expiry dates	0-3		
Clean, neat uniforms worn by all staff	Inspection 1-3	0-2	Assess HCW on duty…	
TOTAL SCORE		26		

3. CLINICAL AND NURSING PROCESSES

CHECKLIST ITEMS	PROTOCOLS	Score	Your priority 1 to 5	CRITIC
Proper diagnosis of 10 admitted cases (analysis of randomly selected hospitalization records): **1)** identification of patient **2)** complaints or symptoms on admission reported **3)** clinical examinations guided by anamnesis **4)** no unnecessary diagnostic tests prescribed, **5)** Malaria is excluded or treated in patients with fever **6)** Malnutrition diagnosis according to WHO - Check sub-liminal malnutrition, **7)** Percentile charts available and appropriately used **8)** Anemia diagnosed according to guidelines, **9)** Sepsis: Increasing the percentage of specific diagnosis (origin)	**1. Triage of sick child 2. Paediatric Life Support 3. Malaria 4. Dehydration 5. Convulsions 6. Anemia 7. LRTI-Pneumonia 8. Urinary Tract Infect 9. Meningitis 10. Sepsis**	0-8	This is mainly from chart reviews, the form is attached. Review 8 charts Pick different conditions: ICU, Malnutrition, Pneumonia room, malaria room, neonatal… Try to vary the patients	
Proper prescription of therapy of at least 10 admitted cases (analysis of selected hospitalization records): **1)** proper treatment according to evidence from anamnesis, and accepted protocols, **2)** no unnecessary prescriptions, especially antibiotics, **3)** Appropriate prescription of drugs in children with **URTI, 4)** Appropriate use of Oxygen & Antibiotics for children with **LRTI, 5)** Appropriate request of blood transfusions. **6)** Checking regularly the vaccination record and recommending accordingly		0-8	Continue with chart review, looking at treatment chart, justifying treatments	
Proper administration of therapies for 10 admitted cases **1)** Therapies have been given properly (Oral, injection, IV line, fluids), **2)** Charts correspond to the correct patients, **4)** Fluids have been changed and are dropping correctly **5)** IV lines changed correctly **6)** doctor's check and nurse's check x24 hours for Gastroenteritis	OK, 1 to 5. N 6 important: give 500ml plastic bottle with rehydration dose for the night	0-8	Use the drug administration checklist: patient identification, checking drug, administration rate, preparation, timing of treatment Check daily review	

23

CHECKLIST ITEMS	CRITERIA FOR SCORING INDICATORS	SCORE	SCORE OBTAINED	SCORING JUSTIFI-CATION
Deaths properly reviewed **1)** Death reviews regularly carried out **2)** staff informed about findings of death reviews, **4)** evidence of follow up of consistent follow-up of findings from death reviews	In the daily morning meeting, not ready for 3 & 4	0-3	Ask for evidence(minutes/report) of death review then check details of actions from the review	
Appropriate supervision and mentorship by Specialists and the Head of the Department **1)** Clinical Audits carried out regularly, findings shared, and followed up, **2)** death reviews regularly carried out, findings shared, and followed up, **3)** Evidence of effective specialist supervision and mentoring, **4)** Evidence of proper consultation and referral with specialists **5)** evidence that staffs are encouraged to consult with Specialists and consultants	Audit in the daily morning meeting, Distribution of responsibilities between specialist and medical officer	**0-3**	specialist and MO schedule Check trace of specialist in sickest child files	
Nice and caring communication with Patients and attendance	Talk with mothers at discharge/long stay, explain problems and therapy	**0-3**		
TOTAL SCORE		**33**		

4. EMERGENCY READINESS

CHECKLIST ITEMS	CRITERIA FOR SCORING INDICATORS	SCORE	SCORE OBTAINED	SCORING JUSTIFI-CATION
Emergency CUPBOARD ready **1)** Emergency equipment checklist filled and signed correctly at each shift **2)** emergency drugs and equipment present on the box in the shelf, not expired, functioning, clean, dust free, and easily accessible		**0-4**	2 points each	
Emergency protocols available and known **1)** staff trained on the protocols **2)** Students know it and trained **3)** updated and consistent National and International Standards **4)** key parts hanging on the wall close to the emergency trolley	Refer to the Lacor-made booklet Updated WHO guidelines available in Kalongo.	**0-4**	Posters-Cartoon in preparation (dr.Smarrazzo)	
TOTAL SCORE		**8**		

5. TRAINING

CHECKLIST ITEMS		SCORE		
Student Nurses Give basic written guidelines at entry Students are exposed to basic nursing procedures	Acquire basic nursing skills, manage nursing	0-3	Observe, but also interview students on interaction with health workers, allocation, teaching	

Students actively collaborate to keep the objectives	reports, and sit with mothers also in overtime		Participation in ward meeting	
Medical Students Instruction of students about their task at entry Students are exposed to basic protocols (locally available and listed) Students participate to reaching objectives Students participate to scheduled verification	Sit at the bedside, collect anamnesis, survey therapies, learn basic nursing procedures	0-3	Observe, but also interview students on interaction with health workers, allocation, teaching Participation in ward meeting	
Post-Doc Residents acquire responsibility of medical objectives Regular audit on clinical forms to comply with 'Outcome' listed items The resident participates in data collection and reporting Residents interact regularly with the nursing staff	Presentation of cases at morning meeting Participate in the application of protocols	0-3	Observe, but also interview postdocs, and registrars on interaction with health workers, allocation, teaching Participation in ward meeting	
TOTAL SCORE		**9**		

The evaluator will select, among each group of items in the same raw, one, two, or more items to evaluate at random, without previous communication. He will assign a global score to the items in the raw. If, for any reason, it is not possible to evaluate any of the items in the same raw, the evaluator has to weigh the TOTAL score according to the number of rows that have been checked. For example, if is not possible, in the training table, to evaluate the presence of Medical Students, just because they are in rotation elsewhere, but Nurses get a score of 2 and Resident get a score of 3, he has to weigh the total score of 9 to 6 and adjust the total corresponding score (2+3)/6 = 8,33.
Supervision Team Names & Expertise/Designation: [name and signature]

Annex 2

Qualitative analysis: TO BE COLLECTED RETROSPECTIVELY (year 2016) AND PROSPECTIVELY (year 2020 and 2024)

Adherence to the protocols for the diseases subjected to revision

CHECKLIST ITEMS	PROTOCOLS
Proper diagnosis of 10 admitted cases (analysis of randomly selected hospitalization records): **1)** identification of patient **2)** complaints or symptoms on admission **3)** clinical examinations guided by anamnesis **4)** no unnecessary diagnostic tests prescribed, **5)** Malaria is excluded or treated in patients with fever **6)** Malnutrition diagnosis according to WHO - Check sub-liminal malnutrition, **7)** Percentile charts available and appropriately used **8)** Anemia diagnosed according to guidelines, **9)** Sepsis: Increasing the percentage of specific diagnosis (origin)	**1. URTI** **2. Malaria** **3. Dehydration- Diarrhoea** **4. Convulsions** **5. Anemia- Sickle Cell**
Proper prescription of therapy of at least 10 admitted cases (analysis of selected hospitalization records): **1)** proper treatment according to evidence from anamnesis, and accepted protocols, **2)** no unnecessary prescriptions, especially antibiotics, **3)** Appropriate prescription of drugs in children with **URTI, 4)** Appropriate use of Oxygen & Antibiotics for children with **LRTI, 5)** Appropriate request of blood transfusions. **6)** Checking regularly the vaccination record and recommending accordingly	**6. LRTI-Pneumonia** **7. Urinary Tract Infect** **8. Meningitis** **9. Sepsis**

15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

St. Mary's Hospital Lacor – Dr.Ambrosoli Kalongo Hospital –
Results-Based Financing Program 2018-2020-2024
CLINICAL PROCEDURES REVIEW FORM

CASE ID _____ Admitted |__|__|_____| Discharged |__|__|_____| Age mo|_____|

DIAGNOSIS:_____

Proper diagnosis	SCORE
2) report complaints or symptoms on admission	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
3) clinical examinations guided by anamnesis	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
4) no unnecessary diagnostic tests prescribed,	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
5) Malaria is excluded or treated in patients with fever	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
6) Malnutrition diagnosis according to WHO - Check sub-liminal malnutrition	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
7) Percentile charts available and appropriately used	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
8) Anemia diagnosed according to guidelines	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
9) Sepsis: Increasing the percentage of specific diagnoses (origin)	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
Sub-TOTAL SCORE	
Proper prescription of therapy	
1) proper treatment according to evidence from anamnesis, and protocols	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
2) no unnecessary prescriptions, especially antibiotic	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
3) Appropriate prescription of drugs in children with **URTI**	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
4) Appropriate use of Oxygen & Antibiotics for children with **LRTI,**	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
5) Appropriate request for blood transfusions	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
6) Checking regularly the vaccination record and recommending accordingly	**N.A. 0**☐ **NO -1**☐ **Unclear 1**☐ **YES 3**☐
TOTAL SCORE	
GRAND-TOTAL SCORE	

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65