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EFFECTS OF RESULTS BASED FINANCING ON PERFORMANCE OF THE INCENTIVIZED INDICATORS. A QUASI-EXPERIMENTAL STUDY DESIGN.

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ABSTRACT

Background

Despite the nationwide roll-out of RBF, the National performance of several key incentivized indicators showed a decline in performance in the year 2019/2020 compared to the previous year.

Method

The study took on a quasi-experimental study design. Data from HFs that were part of phase one of the RBF rollout (exposed group) was analyzed and compared to data from HFs in phase three of RBF implementation (Nonexposed group) a time before the rollout of RBF phase three in Uganda. All data analysis was done in Stata using version 16.

Results:

The study results show that in the exposed group of health facilities, Incentivised indicators changed significantly after the project implementation as regards the average number (mean) of clients served by the health facilities; $p< 0.01$, $p<0.05$, or $p<0.1$ for the difference coefficients Similar, though relatively slower effects were observable in the same indicators for an unexposed group of health facilities. IPT2 coverage declined by 6%, health facility deliveries were 59% achieved (89% national target) and declined by 3%, and under-five Vitamin A coverage declined by 9% to 21.4% far below the target of 66%. Essential drug stock declined by 7%, to 46% below the national target of 75% maternal deaths increased by 7.6%, reporting timeliness declined by 12.5% from 97.5% public health facility staffing declined by 3% to 73% against the targeted 80%.

Conclusion

RBF contributes to improved health service utilization as evidenced by the improved performance of incentivized indicators and improved data quality over time.

Recommendation

There is a need to continuously review which indicators are incentivized to achieve quality of care in all health services if it is to be mainstreamed.

Keywords: *Result Base Finance, Incentivized indicators, Performance of Incentivized indicators*
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Background

Health interventions have for so long been hindered by the ability of the population to purchase health care and among the innovative ways of improving the purchasing power of the population is results-based financing. (RBF). (McIsaac *et al.*, 2018) RBF has been implemented in many first-world countries and in Low- and middle-income countries (LMIC) it was introduced as a way of precipitating the achievement of Universal Health Coverage (UHC) goals. (McIsaac *et al.*, 2018). Very few studies have been done to understand how exactly RBF impacts health service delivery in Africa and Uganda in particular. Understanding this will help governments make informed decisions on whether or not to take on RBF as a financing mechanism for health care. Therefore it is empirical to fill the information and documentation gap on results-based financing in Uganda. To improve the performance of the health sector and increase the utilization of quality health services, LMICs are opting for RBF.

The provision of performance-based incentives through RBF is meant to alter the provider performance and offset a series of events across the health system that result in improved access to quality of health care and equity in access necessary to the attainment of UHC. (McIsaac *et al.*, 2018)

Different countries have rolled out RBF implementation in different ways with a few moving on from scheme to system. Armenia successfully implemented RBF beginning with only six indicators, the country eventually achieved more than 90% of her population attached to Primary health care (PHC) physicians with over 30 indicators for quality health care hence, improved Health Management Information System

(HMIS), and well-motivated health workers by 2011. (Petrosyan *et al.*, 2017). Ukraine showed a greater outcome of Tuberculosis treatment for patients who were on treatment under RBF compared to those who did not have the services incentivized. (Geliukh *et al.*, 2019)

The supply side schemes include the World Bank Scheme which ran from 2003 to 2005, the Cordaid Pilot study which ran from 2009 to 2015, the Northern Uganda Health project from 2011 to 2015, and the proposed Belgian Development Agency/ Ministry of Health (MOH) Pilot project from 2015 to 2019 and a program running under local government Strengthening Decentralization for Sustainability (SDS) avails performance-based grants to districts to deliver social services including health. Several demand-side schemes have been implemented in Uganda and they include the World Bank's Reproductive Health Voucher Project from 2006 to 2011, the Safe Deliveries Project from 2009 to 2011 and the Maternal & New-born Study from 2011 to 2015, the Healthy Baby Voucher Project under and proposed Reproductive health voucher project II from 2014 to 2019. (Ssennyonjo, 2015)

RBF was introduced to the national scene as one of the strategic interventions to improve healthcare purchasing in 2016. This was in the second national health financing strategy of Uganda whose main goal was to expedite the realization of Universal Health Coverage (UHC) by aiding the effective/efficient provision of and access to the essential package of health services while decreasing exposure to financial risk, by 2025. (MOH Uganda, 2017)

The approach is expected to strengthen Uganda's health sector to address the productivity gap and challenges in the delivery of health services. A wide range of mechanisms were designed in the RBF program to enhance the performance of the health system by; (a)linking financing to results; (b) provision incentives to facilities and staff ; (c) focusing on accountability for results; (d) promoting the use of evidence for decision making; (d) ensuring systematic data verification, quality and quantity, and ; (e) more involvement of staff and governance structures at the facility level in decision making, ownership of results and accountability. In other words, RBF is an intervention designed to strengthen the health system where payment of pre-agreed results is done following verification to ascertain that the agreed results have been achieved, and in the case of the Ugandan RBF model, these are outputs at the facility level as well as the quality of services which are verified every quarter as a requirement for processing of payment.

The RBF model implemented in Uganda is supply-side focused therefore there is a contract drawn up with several service providers (Health Centre (HC) IIIs, IVs, and District Health Teams (DHTS) who receive funds upon achieving the specified targets of particular indicators. (Republic of Uganda, 2018)

Verification is one of the core processes under the RBF model and this entails the review of the specific outputs in the primary source documents (HMIS registers) to ascertain that the results reported by the health facilities are accurate. In a bid to discourage the falsification of results by health facilities, penalties have been incorporated into the RBF model whereby over or under-reporting more than the 5% threshold results in the results not being purchased by the Ministry of Health for the specific indicator. In addition, when more than 3 indicators have errors beyond the 5% threshold, the health facility does not receive any funds for the rest of the indicators for the specific quarter in question.

It is therefore imperative that the implementation of successful RBF relies heavily on the use of data from the verification of health centers to offer services to the verification of the services provided to the people to qualify for incentives. (Salami, Dona Ouendo and Fayomi, 2016)

In a report published by the World Bank, Uganda's first pilot implementation of RBF in health care failed, and among the reasons was problems with data collection which was not given enough resource allocation and in the end, the data collection was not timely, accurate, or even complete. (Ssennyonjo, 2015)

In Uganda, RBF is being implemented by the Ministry of Health under the Uganda Reproductive Maternal Child and Adolescent Health Services Improvement Project (URMCHIP) and has the objectives to: i) improve the utilization, efficiency, and excellence of health services while refining impartial access to health services. ii) Increase the strategic purchasing of cost-effective services hence significant reductions in morbidity and mortality iii) Increase effective pooling of resources and enable the smooth transition to national health insurance. (Republic of Uganda, 2018)

Implementation under the current arrangement in the health sector began in January 2019 and currently, RBF is being implemented in all 135 districts and the Kampala City Council Authority (Republic of Uganda, 2018). The study assessed the effect of RBF on the performance of the incentivized indicators

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Methodology

Study design

The study took on a quasi-experimental study design. Data from HFs that were part of phase one of the RBF roll out (exposed group) was analyzed and compared to data from HFs in phase three of RBF implementation (Nonexposed group) during the time before the rollout of RBF phase three in Uganda.

This study design was chosen for the following reasons:

1. It was relatively inexpensive.
2. Need for in-depth analysis of the topic
3. Data was readily available and reliable.

The data involved in this study were data submitted by the selected study health facilities into the national DHIS2 system for the quarters FY18/19Q4, FY19/20Q1, FY19/20Q2, and FY19/20Q4 for both the exposed and non-exposed group.

Study Area

The study was conducted in four districts in Uganda Mbale, Kayunga, Mbarara, and Nebbi. These districts were chosen as they are from different regions of the country and the data used will be a good representation of what is happening in the country as a whole. The selection was by simple random sampling as explained in the sampling procedures

Study Population

The study population was health facilities and the study units were individual health facilities which were part of phase one National RBF rollout and those introduced to RBF in phase three.

Eligibility Criteria

Inclusion

For the exposed group, districts from Phase 1 of URMCHIP RBF Implementation - all MoH health facilities HC III and HC IV with data reported into the national DHIS2.

For the non-exposed group: Districts from Phase 3 of URMCHIP RBF Implementation; (Were not yet in RBF/URMCHIP during FY2018/2019). Only MoH health facilities HCIII and HC IV with data reported into the national DHIS2 system for the respective study quarters were included.

Exclusion

MoH HC III and IV without DHISII reporting system and PNFP and PFP HCI and HCIv

Sample Size Calculation

Since the study relies on secondary data, all relevant HF quarterly reports from both the exposed and the non-exposed districts will be involved in this study.

Sampling Procedures

Districts in the exposed group

Districts in Phase 1 URMCHIP were divided into regions and using simple random sampling, 2 districts were selected. Mbale and Kayunga districts were picked which are from Eastern and Central respectively. Therefore for the Phase 3 districts selection these 2 regions were not considered. For phase 3 district selection, western and northern Uganda regions were considered and 2 districts selected by simple random sampling and Mbarara and Nebbi districts were selected.

Districts from Phase 1 of URMCHIP RBF Implementation - all health facilities HC III and HC IV were included in the analysis in each of the 2 districts considered by the study from the exposed group, the target was to include all available and reporting health facilities from each district during the quarters considered.

1. Mbale district: For the Mbale district, the study included the HC III/IV health facilities from which data on the incentivized and non-incentivized indicators under assessment were reported into the national DHIS2 system as well as the electronic RBF (eRBF) system during the period being assessed for the analysis of the possible effects of Results-Based Financing on Reproductive, Maternal,

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Child and Adolescent Health Service Utilization in Uganda.

2. Kayunga district: From Kayunga district, the study included all the available HC III/IV health facilities from which data on the incentivized and non-incentivized indicators under assessment were reported into the national DHIS2 system as well as the electronic RBF system for the analysis of the possible impact of the possible effects of Results-Based Financing on Reproductive, Maternal, Child and Adolescent Health Service Utilization in Uganda.

The facilities included from the districts in the exposed group are shown in Table 1

Table 1: Number of study Health facilities by quarter from the districts exposed to URMCHIP RBF project implementation during phase 1

FY	# of health facilities	
	Kayunga district	Mbale district
FY 14/15Q1	10	26
FY 14/15Q2	10	26
FY 14/15Q3	10	26
FY 14/15Q4	10	26
FY 18/19Q4	10	29
FY 19/20Q1	10	30
FY 19/20Q2	10	30
FY 19/20Q4	9	10

A list of included health facilities from the exposed districts is included in the appendix 5

Districts in Non-exposed group

Districts from Phase 3 of URMCHIP RBF Implementation; (Were not yet in RBF/URMCHIP during FY2018/2019). Only MoH health facilities HCIII and HC IV with data reported into the national DHIS2 system for the respective study quarters were included; In the same way as done for the exposed group, in each of the 2 districts considered for the study from the non-exposed group, the target still remained to include health facilities from each district that were actively reporting into DHIS2 during the study quarters. All reporting MoH HC IIIs and HC IVs in each study district were included.

1. Mbarara district: From Mbarara district, the study included the HC III/IV health facilities from which data on the incentivised and non-incentivised indicators under assessment were reported into the national DHIS2 system as well as the electronic RBF system for

2. The analysis of the possible impact of the possible effects of Results Based Financing on Reproductive, Maternal, Child and Adolescent Health Service Utilization in Uganda.

3. Nebbi district: From Nebbi district, the study included all of the available HC III/IV health facilities from which data on the incentivised and non-incentivised indicators under assessment were reported for each of the quarters of interest into the national DHIS2 system as well as the electronic RBF system for the analysis of the possible impact of the possible effects of Results Based Financing on Reproductive, Maternal, Child and Adolescent Health Service Utilization in Uganda

The numbers of facilities included from the districts in the non-exposed group in each of the quarters are shown in the Table 2

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Table 2: Number of study Health facilities from the districts in the non-exposed group included in each of the quarters

FY	# of health facilities	
	Mbarara district	Nebbi district
FY 14/15Q1	15	11
FY 14/15Q2	15	11
FY 14/15Q3	15	11
FY 14/15Q4	15	11
FY 18/19Q4	16	11
FY 19/20Q1	16	11
FY 19/20Q2	16	11
FY 19/20Q4	11	8

A list of included health facilities is included in the appendix

Sources of Data

Data used in this study was secondary data from the district level reported into eHMIS/DHIS II and this was with authorization from the head of the RBF unit planning department of the Ministry of Health Uganda and the director general of health services MoH.

Brief description of the district-level eHMIS/DHIS2 system and the data collected

Generally, the Ministry of Health organizes routine system management data into a coordinated and elaborated system known as the Health Management Information System, HMIS. This is a hard copy paper-based system that's currently largely being upgraded into a functioning and harmonized electronic system capable of triaging patients at the Health Unit/Facility level as well as eventual reporting at the national level.

The Health Management Information System (HMIS) in Uganda is a set of integrated components and procedures used during routine (weekly, monthly, quarterly, semi-annually, or annual) health-related data collection to generate information that will improve health care management decisions at all levels of the healthcare system. At the facility or health unit level, there are a set of pre-primary, primary, and secondary data collection forms and templates used to collect routinized indicator-related data structured for detection of eminent or possible system anomalies, and coordination of health service delivery and monitoring of uptake and quality of health services. Health facility-based reporting forms such as the HMIS105 used to collect and monthly reporting of data feeding a set of key indicators, and HMIS106a for quarterly reporting among others are used to aggregate a large number of data elements related to each of the indicators. Routine reporting into the national DHIS2 system is the responsibility of the district Biostatisticians who are in charge of the data from all health facilities in their respective district.

The indicators of interest to this study were reported into the DHIS2 through the HMIS105 report that monthly data for OPD attendances, diagnoses, MCH, HIV/AIDS service,

Laboratory, stock status of essential drugs and supplies, and finances, among others

Data Collection Techniques:

Data covering the financial years from 2014/15 to 2019/20 from the four study districts of Kayunga, Mbale, Mbarara, and Nebbi from both the old and new DHIS2 In some instances, the data was routinely aggregated from the health facilities.

Study Variables

Independent variables are;Performance of specific incentivized indicators. Dependent variable is Utilization of RMCA health services This study was set based upon two categories of indicators to analyze the possible effects of the Results Financing intervention on maternal, child, and adolescent health service utilization in Uganda, specifically based upon the study observations

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and findings from 2 exposed districts and 2 districts unexposed to the intervention using the difference in differences design. Both incentivized and non-incentivised study indicators are shown in Table 3

Table 3: Incentivised and non-incentivised study indicators

Incentivized Indicators
Number of ANC 1st visit in 1st trimester
Number of ANC4 visits
Number of pregnant women who received second dose of Intermittent Preventive Treatment (IPTp)
Number of deliveries
Number of mothers referred in labor EMONC
Number of Post Natal Clinic visits
Number of new acceptance and re-attendance for modern Short-Term contraceptive methods
Number of new acceptance and re-attendance for modern Long-Term contraceptive methods
Number of children fully immunized under 1 year
Non-Incentivized Indicators
Pregnant women counseled, test and received HIV test results
Pregnant Women tested HIV+ for 1st time this pregnancy (TRR) at any visit
No of pregnant women tested for syphilis
Total HIV+ mothers attending postnatal
Mothers given Vit A supplementation
Exposed Infants Tested for HIV Below 18 Months (by 1st PCR)
No of children dewormed under 14 years

Data were extracted from the online DHIS2 data base as exported CSV files to Microsoft Excel. Data management was done using both STATA version 16 and Excel.

Data collection Techniques

Data Collection Techniques

This study will undertake the following data collection techniques

For the comparison between the periods before/after RBF implementation, data from the baseline Financial Year (FY 14/15) were extracted from the old national DHIS2 system and used for the analysis. Data on the study indicators for the quarters FY18/19Q1 to FY18/19Q3 was collected using the manual hard copy mechanism and was not entered into the electronic RBF system as it was introduced later during the URMCHIP-RBF implementation activities.

Additionally, data from such quarters explained above was not considered for this analysis as it was severely prone to the limitations of the mechanism for its collection, compilation and subsequent aggregation. It is also assumed that the data collected by the FY18/19Q4 would effectively reflect measurable effects of the RBF implementation as compared with data collected immediately from FY18/19Q1 – during phase 1 of the implementation activities which could easily spill over the before implementation effect and thus would exert limiting implications to possible conclusions and/or accurate inference.

Data Collection Tools

Data collection tools adopted with little adjustment from MOH/URMCHIP RBF unit and they are:

- Adjusted RBF invoice for the sampled health facility
- DHIS2 data collection tool

Data analysis and interpretation

All data analysis was done in Stata using version 16.

Data gathered into the national DHIS2 and electronic RBF systems during the time of the URMCHIP RBF project implementation activities as well as data collected in the selected study locations – both in the exposed and non-exposed groups during the time before project implementation activities (FY14/15) were used to analyse the effects of the Results Based Financing intervention on maternal, child and adolescent health service utilization in Uganda based upon a difference in differences method of regression analysis implemented using version 16 of a STATA software for Statistical Data analysis (STATA16). During data analysis, the following aspects were considered;

1. Possible changes in the utilization of MCH services were measured by:
   - The number of people utilizing MCH services,
   - Strata comparison: where a difference in differences method of data analysis was used to compare for each study indicator, the difference between the mean values in the

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exposed group with that observed in the non-expos

- ed group and establish any significant effect of RBF on MCH service utilization.

2. The performance of incentivized indicators was measured by:

- The number of people utilising incentivised service over a period of time after phase one of RBF roll out in comparison with the baseline and the non-exposed group

Wherever possible, the study objective above, the study leveraged the suitability of the difference in differences procedure of statistical estimation to examine the possible differences between the exposed and non-exposed groups in terms of MCH service utilization in order to profoundly derive and report the effects of the Results Based Financing intervention on maternal, child and adolescent health service utilization in Uganda.

Description and implementation of the difference in differences model of data analysis as applied in this study

A comparison at the end line between the exposed (or treatment) and control (or non-exposed) groups, may also be biased if these groups are unbalanced at the baseline. DID designs compare changes over time in the exposed and non-exposed group outcomes?

There often exist plausible assumptions under which we can control for time-invariant differences in the treatment and control groups and estimate the causal effects of the intervention. The following equations were considered so as to better understand the DID design concept (**REF**).

Based upon study output indicators, the performance, the outcome/performance, γ_{igt} of the i^{th} health facility at time t in group g (treatment or control) can be written asa function of:

$$\gamma_{igt} = \kappa_g + \lambda_t + \beta_1 G + \beta_2 t + \beta_3 G.t + \rho_{igt} + \varepsilon_{igt} \quad \ldots$$
……eqn.1

where κ_g captures group-level time-invariant (not changing over time) "fixed effects" (think of these as distinct γ_{igt} -intercepts of the baseline outcome for each group); λ_t captures period time-invariant fixed effects (e.g., election effects if the baseline was an election year); G is an indicator variable for treatment (=1) or control (=0) groups; t is an indicator variable for baseline (=0) or end line/ (=1) measurements, the β s are the regression coefficients to be estimated; ρ_{igt} captures individual-level factors that vary across groups and over time; and ε_{igt} captures random error. Let's denote the outcomes for the following four conditions as,

At baseline in treatment group:

$$\gamma_{i10} = \kappa_1 + \lambda_0 + \beta_1.1 + \beta_2.0 + \beta_3.1.0 + \rho_{i10} + \varepsilon_{i10}$$
……. eqn.2

Individual at baseline in control group:

$$\gamma_{i00} = \kappa_0 + \lambda_0 + \beta_1.0 + \beta_2.0 + \beta_3.0.0 + \rho_{i00} + \varepsilon_{i00}$$
……. eqn.3

Individual at follow-up in treatment group:

$$\gamma_{i11} = \kappa_1 + \lambda_1 + \beta_1.1 + \beta_2.1 + \beta_3.1.1 + \rho_{i11} + \varepsilon_{i11}$$
……. eqn.4

Individual at follow-up in control group:

$$\gamma_{i01} = \kappa_0 + \lambda_1 + \beta_1.0 + \beta_2.1 + \beta_3.0.1 + \rho_{i01} + \varepsilon_{i01}$$
……. eqn.5

Change over time in outcome in treatment group = (eqn.4) – (eqn.2):

$$\gamma_{i11} - \gamma_{i10} = (\kappa_1 + \lambda_1 + \beta_1.1 + \beta_2.1 + \beta_3.1.1 + \rho_{i11} + \varepsilon_{i11}) - (\kappa_1 + \lambda_0 + \beta_1.1 + \beta_2.0 + \beta_3.1.0 + \rho_{i10} + \varepsilon_{i10})$$
$$= (\lambda_1 - \lambda_2) + \beta_2 + \beta_3 + (\rho_{i11} - \rho_{i10}) + (\varepsilon_{i11} - \varepsilon_{i10})$$
……. eqn.6

Change over time in outcome in control group = (eqn.5) – (eqn.3):

$$\lambda_{i01} - \lambda_{i00} = (\kappa_1 - \kappa_2) + \beta_2 + (\rho_{i01} - \rho_{i00}) + (\varepsilon_{i01} - \varepsilon_{i00})$$
……. eqn.7

The average treatment effect (or the DID impact) = (eqn.6) – (eqn.7)

$$(\gamma_{i11} - \gamma_{i10}) - (\gamma_{i01} - \gamma_{i00}) = \beta_3 + (\rho_{i11} - \rho_{i10} - \rho_{i01} + \rho_{i00}) + (\varepsilon_{i11} - \varepsilon_{i10} - \varepsilon_{i01} + \varepsilon_{i00})$$
……eqn.8

For accurate estimation, it is expected that the regression error term has a distribution with mean 0. And that the time-variant differences over time in the exposed and non-exposed groups are equal (Parallel Trend Assumption) – thus cancelling each other out ($\rho_{igt*} = 0$). According to (Coady, Kosali, & Ricardo, 2018), this is a critical assumption made in DID analysis, allowing for causal analysis despite the absence of randomization.

Quality Control

The data collection tools are adopted from MOH, RBF Quarterly data collection tools and have been tested to collect the data required.

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Ethical Consideration

The study was carried out after guidance from Clerk International University research ethics committee and the national research Information management system.

A letter from the dean of institute of Public health and management at Clarke International University was issued to introduce the principle investigator to ministry of health so as to be able to access the data required for the study.

At MOH, the director general of health services gave permission to access the DHIS II and RBF data bases at MOH planning department RBF unit.

All COVID19 standard operating procedures were observed so as to protect the data extraction team from exposure to infection.

Table 1: Number of health facilities with data used for analysis of the difference in differences

Quarter	# Health facilities per district				
	Kayunga	Mbale	Mbarara	Nebbi	Total
FY14/15Q1	10	26	15	11	62
FY14/15Q2	10	26	15	11	62
FY14/15Q3	10	26	15	11	62
FY14/15Q4	10	26	15	11	62
FY18/19Q4	10	29	16	11	66
FY19/20Q1	10	29	16	11	66
FY19/20Q2	10	29	16	11	66
FY19/20Q4	9	10	11	8	38
Total	79	201	119	85	484

A full list of names of included health facilities is added to the appendix

RESULTS

Generally, if the outcome trend moves in parallel for the unexposed group, it likely would have continued moving in tandem in the exposed group as well. Figure 4.1 shows that the trends in the study indicators remain parallel over the time, even though data quality seemingly improves even for the unexposed facilities.

Univariable examination of the study indicators to be used in the difference in differences analysis

The study examined the distribution and variation of each study indicator, incentivised in order to establish whether all the indicators would perfectly be helpful to feed into the difference in differences analysis based on key statistics from the univariable analysis. Subsequent sub sections present results from examination of each category of study indicators;

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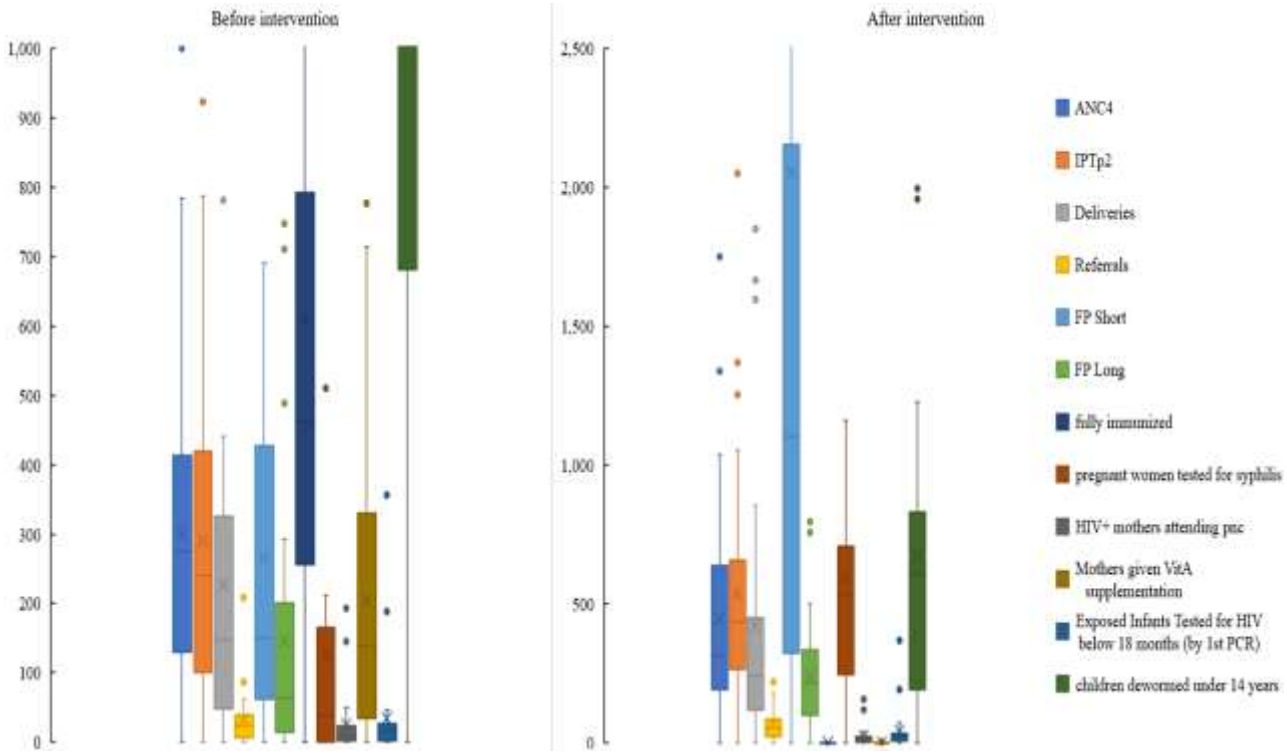

Figure 1: superimposed box plots for the unexposed group before and after the intervention

Distribution of data related to incentivised indicators

Table 5 presents the key statistics regarding the distribution of the incentivised indicators as number of ANC 1st visit in 1st trimester (ANC1), number of ANC4 visits (ANC4), number of pregnant women who received second dose of Intermittent Preventive Treatment (IPTp2), number of deliveries, number of mothers referred in labour EMONC (referrals), number of Post Natal Clinic visits (PNC), number of new acceptance and re-attendance for modern Short-Term contraceptive methods (FP short), number of new acceptance and re-attendance for modern Long-Term contraceptive methods (FP Long), and number of children fully immunized under 1 year;

The results from the uni-variable examination of the incentive indicators generally indicate acceptable variation for the study variables to be entered into the analysis based on the difference in differences design, except for ANC1 and PNC where the number of missing values in the period before the intervention were beyond acceptable levels for the variables to be kept into the next level of analysis. Additionally, the results also show that the data on these 2 variables was too kurtotic for the period after the intervention that they could not be kept in the model owing to the already existing overwhelming number of missing values in the comparison period. Therefore, based upon the results presented in Table 4.1 below, ANC1 and PNC were dropped from the list of incentivised indicators examined using the difference in differences design.

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Table 2: Key statistics on the distribution of incentivised indicators

Study period	statistic	ANC1	ANC4	IPTp2	Deliveries	Referrals	PNC	FP Short	FP Long	fully immunized
Before intervention	mean	.	86	109	69	10	0	118	24	1
	se(mean)	.	5.1	5.5	4.9	0.7	0.0	6.0	3.3	0.4
	median (p50)	.	68	80	45	7	0	107	1	0
	skewness	.	2.0	1.3	1.8	2.6	.	0.8	3.9	12.1
	kurtosis	.	8.2	4.7	6.1	11.9	.	3.4	23.2	153.7
	minimum	.	3	1	0	1	0	0	0	0
	maximum	.	449	454	376	66	0	481	430	81
After intervention	mean	66	116	152	125	16	104	683	96	106
	se(mean)	3.6	6.4	8.3	8.6	1.0	7.4	95.7	7.1	5.1
	median (p50)	52	86	112	75	11	72	284	68	87
	skewness	1.7	1.9	1.5	1.8	1.7	2.5	9.1	2.8	1.2
	kurtosis	6.6	7.2	5.2	6.0	6.3	12.0	111.6	14.1	4.3
	minimum	1	3	2	0	0	0	0	0	0
	maximum	294	567	641	648	87	758	19,226	761	422
Overall	mean	66	101	130	97	13	51	397	60	53
	se(mean)	3.6	4.1	5.0	5.1	0.6	4.3	49.1	4.2	3.5
	median (p50)	52	74	103	60	9	0	154	25	0
	skewness	1.7	2.0	1.7	2.2	2.1	3.2	12.3	3.3	1.7
	kurtosis	6.6	8.0	6.3	8.2	8.2	18.1	206.6	18.6	5.9
	minimum	1	3	1	0	0	0	0	0	0
	maximum	294	567	641	648	87	758	19,226	761	422

The results of analysis presented with the key statistics in Table 5 commonly indicated considerable amounts of kurtosis and skewed variation of study indicators. The skewness and kurtosis of the study data on incentivised indicators largely originates from the differences in the populations served by the various health facilities contributing data to the study analysis in terms of the actual catchment areas that were supposedly served the facilities at the time, either before or after the intervention.

To minimize kurtosis and skewness of the data being entered into the analysis based on the difference in differences techniques, the data were weighted based upon the catchment population of each of the study health facilities. HC IVs serve a county well as HC IIIs serve a sub county by MoH standards. Therefore, the study obtained and used district, county, and sub county population data from the UBOS website for 2015 (period before) and 2020 (period after intervention) in order to weight the data before it was used to examine the significance of intervention based on the difference in differences estimation.

Results from the difference in differences analysis

The difference in differences for each study indicator was evaluated as the difference in average outcome in the exposed health facilities before and after the URMCHIP project implementation minus the difference in average outcome in the unexposed group before and after the exposure/ project implementation. The results presented in this subsection were obtained after estimating difference in differences models for the incentivised study indicator.

Difference in differences of the incentivized study indicators

With respect to the incentivised indicators, the study results in Table 6 show that the exposed group of health facilities changed significantly after the project implementation as regards to the average number (mean) of clients served by the health facilities; $p< 0.01$, $p<0.05$, or $p<0.1$ as shown by the ***, **, and * for the difference coefficients of the exposed group; It should be noted that similar even though generally relatively slower effects were as well observable in the unexposed group of health facilities.

Results presented in Table 6 are from difference in differences regression models fitted for the incentivised indicators of the study. For each indicator, the estimated mean, standard error of the mean (SE mean) and the number of observations entered into the model (N) are presented as shown in Table 6. These key statistics about from the difference in differences regression model are presented for the exposed group, and for unexposed group. For each of these groups, the baseline statistics are presented along with other statistics relating to the difference in the before and after intervention periods

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(the regression co-efficient (Coef.), the SE mean, and the). The ultimate difference-in-difference is the difference of the differences in the exposed and the unexposed groups.

Table 6: Difference in differences for the incentivised study indicators

	Unexposed		**Exposed**		
	Baseline	Difference	Baseline	Difference	Difference-in-difference
	Mean	Coef.	Mean	Coef.	Coef.
	SE (Mean)	SE (Mean)	SE (Mean)	SE (Mean)	SE (Mean)
Indicator/variable	N	N	N	N	N
Number of ANC4 visits					
	81.13	40.45***	90.27	22.54**	-17.91
	6.74	13.34	7.20	10.24	16.55
	96	193	135	269	462
Number of pregnant women who received second dose of Intermittent Preventive Treatment (IPTp)					
	79.55	70.27***	129.82	24.08*	-46.20**
	6.36	14.38	7.82	13.27	19.86
	95	190	136	267	457
Number of deliveries					
	59.65	52.92***	76.88	57.68***	4.75
	6.66	15.06	7.03	13.12	19.96
	99	197	127	258	455
Number of mothers referred in labour EMONC					
	10.39	8.55***	9.24	4.58***	-3.96
	1.26	2.29	0.80	1.34	2.50
	82	175	115	243	418
Number of new acceptance and re-attendance for modern Short-Term contraceptive methods					
	66.52	677.96***	157.06	479.25***	-198.71
	6.75	203.92	7.73	63.28	191.51
	104	204	136	270	474
Number of new acceptance and re-attendance for modern Long-Term contraceptive methods					
	36.23	27.94***	15.07	105.25***	77.31***
	6.96	9.38	2.24	11.19	15.24
	104	204	136	270	474
Number of children fully immunized under 1 year					
	1.20	88.42***	0.00	118.49***	30.07***
	0.88	6.64	0.00	7.25	10.14
	104	204	136	270	474
Baseline means only include observations not omitted in the 1st and 2nd differences.					
The number of observations in the 1st and 2nd differences includes both baseline and follow-up observations.					
****, **, and * indicate significance at the .01, .05, and .1 percent critical level.*					

On the contrary, the study results presented in Table 6 indicate that with respect to the number of pregnant women who received the second dose of Intermittent Preventive Treatment (IPTp), the exposed group of health facilities were not different from the counterfactual – rather significantly slower than the performance exhibited by the unexposed facilities at 5% level of significance. This could be attributable to the quality of the data on this specific indicator as reported into the national DHIS2 system and extracted for entry into the difference in differences regression model of analysis.

Percentage variation between verified and reported outputs over time for incentivized indicators over time

The results reported in Table 8 are averages of indicator variances between the reported and verified outputs presented by reporting quarter and by incentivised indicator. These results show that during the initial quarters, indicator variances were mostly huge values far away from + or -5% acceptable margin of error.

As the quarters progressed during project implementation, the observed variances tend to limit well

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within the neighbourhood of 0% which indicates that the variances kept on reducing over the quarters of project implementation for most of the incentivised indicators. The tremendous reductions in indicator variances are a good sign to the performance picture of the project incentivised indicators.

Table 7: Average variation between reported and verified indicator outputs over different quarters of project implementation

Average variation between reported and verified indicator outputs									
Quarter	New OPD u5	ANC 1st visit in 1st trimester	ANC 4	IPT2	Deliveries	Referrals in labour	FP-Short	FP-Long	Fully immunized under 1 year
FY18/19Q4	0.47	0.93	-0.39	-0.55	0.24	-1.46	-1.87	2.12	-22.70
FY19/20Q1	-0.20	-0.03	-0.30	0.46	-0.40	-2.41	0.52	2.02	-29.55
FY19/20Q2	0.10	-17.31	-0.69	0.40	0.01	-13.82	0.72	-0.82	-15.70
FY19/20Q4	0.16	0.11	-0.40	0.34	0.01	-0.72	0.46	-0.57	-10.28
FY20/21Q1	0.57	0.27	-0.53	0.77	0.10	-0.26	0.33	-0.25	-6.45
FY20/21Q2	-0.38	-2.12	-1.67	-0.19	-0.10	-0.15	0.07	0.58	-4.34
FY20/21Q3	0.34	0.56	-3.78	0.39	0.13	-0.62	0.13	-0.41	1.35
FY20/21Q4	0.12	-3.43	-0.41	-22.44	0.22	1.62	0.24	0.02	-1.44
FY21/22Q1	0.10	0.33	0.06	0.48	-0.35	-0.31	0.25	0.39	-0.19
FY21/22Q3	-0.51	-1.26	0.30	2.93	-2.30	-14.59	1.23	0.50	5.97
FY21/22Q4	-2.24	0.97	0.86	-0.35	-1.68	-0.97	-2.92	-0.34	-2.03

**u5= under five years of age*

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DISCUSSIONS

The effect of RBF on the performance of the incentivized indicators of the exposed and non-exposed groups

There is a significant improvement in the incentivized indicators, as shown in the results in Table 6 show that the exposed group of health facilities changed significantly after the project implementation as regards the average number (mean) of clients served by the health facilities; $p< 0.01$, $p<0.05$, or $p<0.1$ as shown by the ***, **, and * for the difference coefficients of the exposed group and this is in agreement with It should be noted that similar even though generally relatively slower effects were as well observable in the unexposed group of health facilities. These changes in the unexposed group are expected given that all these facilities follow the same reporting mechanism into the national DHIS2 and due to possible spillover of project influence to the unexposed group especially at the early stages, among other possibilities.

This can also be explained in a way that the unexposed group had learned of RBF and which services were being targeted and to prepare and pass the prequalification assessment to join the project, they focused on improving the incentivized indicators.

The difference in differences reveals that even when expected changes as well happened among the unexposed health facilities concerning the incentivized indicators of the study, a set of incentivized indicators exists where the exposed facilities performed significantly different from the counterfactual: In terms of the number of children fully immunized under 1 year, number of new acceptance and re-attendance for modern Long-Term contraceptive methods, the exposed facilities improved exceptionally well (at 1% significance level) in terms of improvement in the average number of clients offered the respective healthcare services during the time after the intervention activities as compared to the time before the intervention which indicates that the project had an impact as shown in Table 6;

In a similar study like this one, similar methods of analysis were used to evaluate the outputs of physicians in the Medicaid children's program and the DiD analysis method showed that the incentivized physicians had superior performance output compared to their non-incentivized counterparts. Community physicians with the biggest difference being for adolescent wellness care, 3 of the 10 immunization-incentivized measures and 2 non-incentivized measures and also the control group of the non-incentivised physicians show improvement in services delivery with 8 of 14 indicators improving. (S, K and W, 2016)

Several other studies have documented the effects of incentivizing the supply side of health services. Rudasinga et al in their study in Rwanda find RBF improves service utilization and infrastructure and increases staff motivation to work (Rudasingwa, Soeters, and Bossuyt, 2015).

Sato and Belel in their quasi-experimental study also link RBF to improved HSD outcomes only in the exposed group and no improvement was noted in the control group. (Sato and Belel, 2021b). This is different from what is observed in this study where both the control group and the exposed group show improved output for the incentivized indicators. This could be due to the nationwide approach in Uganda which was rolled out in phases. The improvement in the control group could be in anticipation of the same RBF project to be implemented shortly. In a nationwide implementation of RBF in Armenia just like the one implemented in Uganda showed a 90% improvement in health services delivery.(Petrosyan *et al.*, 2017)

Ensor et al in their study in Nepal found that RBF improved the utilization of health services. (Ensor, Bhatt, and Tiwari, 2017). Several authors agree that incentivized indicators improve greatly in RBF. (Rajkotia *et al.*, no date), (Falisse *et al.*, 2015), (Langdown and Peckham, 2014)

Despite all the positive documentation of RBF on targeted indicators, a few studies have come up to disagree with these results. A study carried out in Cong associated RBF with a decline in the performance of several incentivized indicators, this study also adopts a quasi-experimental methodology but does the baseline evaluation at both household and facility levels. (Zeng, Shepard, De Dieu Rusatira, *et al.*, 2018) The poor outcome could be because this impact survey was done after 2 years of implementation of the project and as seen during this study, the preliminary stages have unstable data collection and may not be very reliable in determining the impact of the project on the population. Gage et al agree with these findings as they found no significant impact of RBF on targeted indicators in their study of RBF projects supported by the World Bank in Burundi, Lesotho, Zambia, Senegal, and Zimbabwe. (Gage and Bauhoff, 2021) David et al

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agree with the line as they found no difference in service delivery with or without the implementation of RBF. (D, M, and V, 2020)

Conclusion

RBF contributes to improved health service utilization as evidenced by the improved performance of incentivized indicators and improved data quality over time. However, the improvement in the services utilized cannot be generalized as the non-incentivised indicators show no improvement as suggested by the RBF theory. (How incentive payments support Universal Health Coverage, in Theory and in Practice | Independent Evaluation Group, 2019)

This therefore calls for more efforts to improve maternal health services as RBF is being mainstreamed as the main financing mechanism of health services in Uganda. There may be a need to have the incentivised indicators reviewed and changed after some time to ensure quality service delivery and utilization of all services hence achieving health system strengthening across all services.

Recommendations

Leadership at the health facilities and the district level should focus on evaluating the input of each health worker in achieving these incentives through advocating for individual work plans which directly feed into departmental work plans and then facility work plans and in this way the health services can be improved as a whole instead of individuals focusing on the incentivized indicators only and even not achieving the indicators directly linked with those that have incentives.

The data used during this study is implementation data and there is a need to do a study on the project impact evaluation of RBF on health service utilization and the lessons learned from URMCHIP

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List of Acronyms

LMIC; Low- and Middle-Income Countries
RBF; Results Based Financing
UHC: Universal health coverage
WHO: World Health Organization
PHC: Primary Health care
HMIS: Health Management Information System
URMCHIP: Uganda Reproductive Maternal Child and Adolescent Health Services Improvement Project
MoH: Ministry of Health
HF: Health Facility
HC: Health Center
ANC: Ante Natal Care
EMONC: Basic Emergency Obstetric and Neonatal Care
PNC: Post Natal care
IPT: Intermittent Presumptive Treatment
TB: Tuberculosis
OPD: Out Patient Department
MNCH: Maternal, Neonatal and Child Health
MCH: Maternal and Child Health
DHMT: District Health Management Team
FP: Family Planning
IUD: Intra Uterine Device
ART: Anti-retroviral Therapy
HIV: Human Immune Deficiency Virus
VHT: Village Health Team
DiD: Difference in difference
DFF: Direct Facility Financing

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