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Original Research Article

Effects of results based financing models on the performance of exposed health zones in Benin

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ABSTRACT

Background: Since 2011, Benin adhered to results-based financing (RBF), with the implementation of RBF_PRPSS model by Health System Performance Strengthening Project (PRPSS) and RBF_PASS model by health system support project (PASS). Notwithstanding the lack of evidence on this experimental phase, the Ministry of Health initiated the extension of the RBF_PRPSS model to uncovered areas. This comparative study was led to evaluate the health system performance in RBF zones.
Methods: The study examined data from sixty-seven health facilities in six health zones offering maternal and child health services, using the double difference, the Student's test and the variance comparison, with 5% significance level.
Results: The study found that between 2011 and 2014, staff numbers remained stable in the RBF strata ($p>0.05$). The cumulative duration over a six-month period of stock-outs of five key drugs (paracetamol, amoxicillin, oxytocin, iron, sulfadoxine pyrimetamine) decreased from 51 days to 29 days ($p<0.05$). Direct revenues per health facility increased more in the RBF strata ($p<0.05$). Financial viability increased in RBF_PRPSS stratum. Health services utilization improved significantly for institutional delivery, tetanus toxoid immunization, DTP (Hib) HepB 3 and MCV immunization and curative care. Decreasing of maternal and neonatal mortalities in RBF strata were not significant.
Conclusions: In sum, the RBF implementation has not yet generated a significant effect on the overall performance of the health system in exposed areas, although it is already accompanied by a significant improvement in the utilization of certain health care services.

Keywords: Performance, Financing, Health system, Benin, Mortality, Results based financing

INTRODUCTION

Results-based financing (RBF) is one of referenced contractual approaches that are attracting attention in developing countries and the support of financial partners who see it as a way to accelerate the performance of health systems.[1,2] Also known as performance-based funding, this approach, first developed in the education sector, has gradually spread to the health sector with varying practices.[2]

Indeed, important health system outcomes on service utilization and quality of care are attributed to the RBF.[3-5] These different results justify the growing interest for this intervention in sub-Saharan Africa where it is seen as a springboard that can guarantee more success to other interventions in the health sector. The tangible progress of several health sector indicators in Rwanda and Burundi is leading other countries to implement RBF programs.[6]

Benin, whose health results stagnate and do not reassure, as to the achievement of the Millennium Development

Goals and Sustainable Development Goals, joined early the RBF with a first experiment launched in 2007, on national funding.[7,8] Despite the failure of this experiment, the country has set up since 2012 new centers of experimentation. These outbreaks have generated the RBF_PRPSS model developed since July 2012 by the Health System Performance Strengthening Project (PRPSS) with World Bank financing, and the RBF_PASS model developed by the Health System Support Project (PASS Sourou) since January 2013 with the financing of Belgian Technical Cooperation (BTC).[8,9] All RBF rules were applied immediately to any selected health facility as soon as they were enrolled.

These RBF models consist of payments of financial resources (subsidies) to health facilities in proportion to their results, particularly for maternal and child health services. Their institutional arrangements involve financers, payers (such as RBF projects), service providers, checker and regulators.[1] The RBF_PRPSS model, which is managed at the national level, buys more indicators with higher prices than the RBF_PASS model which has a departmental anchoring with a strong involvement of departmental and local actors. The maximum portion of the RBF grant allocated as a staff bonus is 70% in the RBF_PASS model and 50% in the RBF_PRPSS model.[8,9]

Notwithstanding the lack of evidence of each of RBF models, the country has embarked on a process of scaling up the intervention with the RBF_PRPSS model chosen tacitly. This study was conducted to determine the effects of both models on the performance of exposed health zones.

METHODS

Study framework

Benin is a West African country with a surface area of 114,763 square kilometers and an estimated population of 10,285,527 inhabitants in 2014, of whom 51.2 percent are women. The proportion of children under one year of age is estimated at about 3.6% of the total population.[10] Benin is subdivided into 12 Departments, 77 Communes, 546 boroughs and 5,290 Villages or City neighbourhoods, and has a gross domestic product per capita of US $ 870 and about 40.1% of its population living below the poverty line in 2015. The epidemiological profile of Benin is characterized by a predominance of malaria, diarrheal diseases and respiratory infections.

Benin's health system is pyramid with three levels. The central level is the Ministry of Health, its programs and national hospitals; the intermediate level is constituted by the departmental directorates of health, their offices and the departmental hospitals, and the peripheral level is represented by the health zones. The health zone is a network of public or private health facilities organized around a reference hospital called a zone hospital.

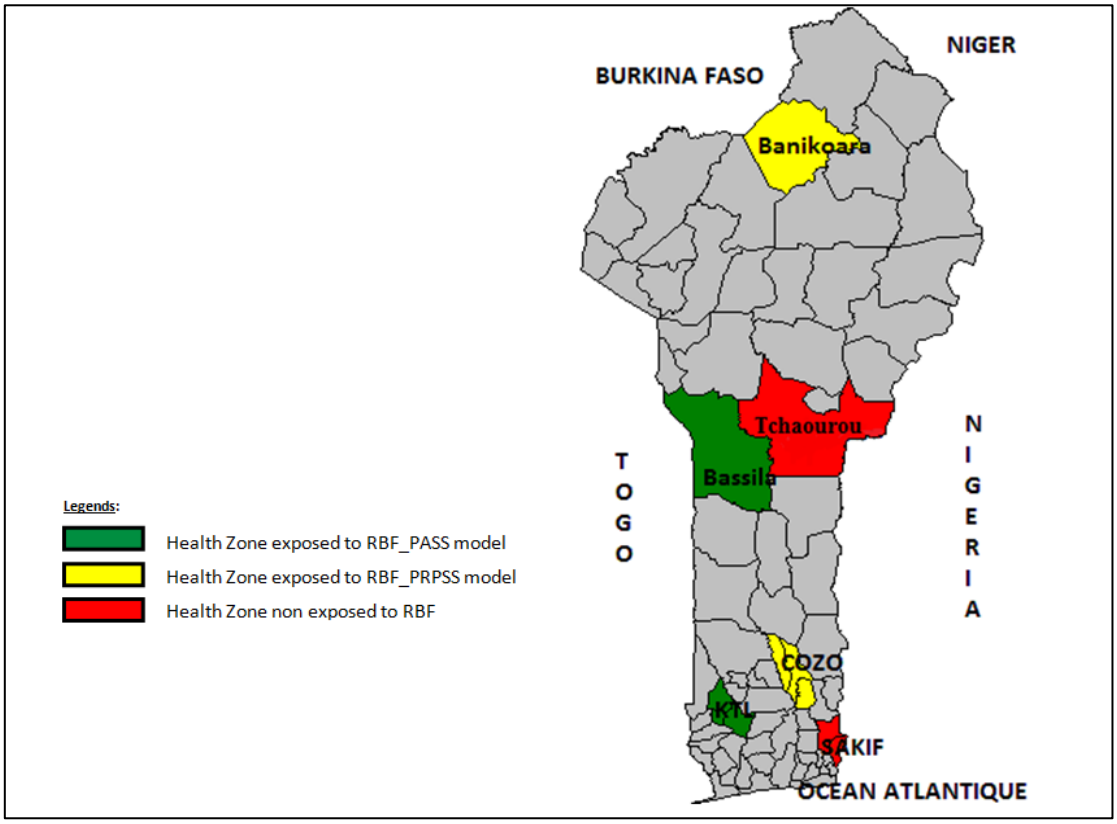

Figure 1: Localization of health zones selected for the study on RBF in Benin on 2014.
Sources : Document de cadrage du financement basé sur les résultats, version validée. PRPSS 2014 et Logiciel HMapper WHO.

In Benin, the payment of health care is direct for the vast majority of the population, not covered by health insurance. Between 2011 and 2014, except the RBF, all health zones were exposed to the same major health interventions.

Types and populations of the study

The study took place between June and December 2015 and covered the activities of the years 2011 and 2014. The study scheme is a comparison before-after (within strata) and here-elsewhere (between strata) of the performance.

The study targeted health facilities in health zones of the three strata (Figure 1):

- The Covè-Zagnanado-Ouinhi health zones (in central Benin) and Banikoara (in the north) in the RBF_PRPSS stratum, which groups the zones exposed to the RBF_PRPSS model;
- The Klouékanmè-Toviklin-Lalo (south-west) and Bassila (north-west) health zones in the RBF_PASS stratum, which groups together the health zones exposed to the RBF_PASS model;
- The Sakété-Ifangni health zones (in the south-east) and the Tchaourou health zones (in the center) in the Non_RBF stratum, which groups together the health zones where the RBF was not yet developed.

The choice of health zones was made randomly within three zones consisting of the zones of the three strata RBF_PRPSS, RBF_PASS and Non_RBF, using the criteria such as the number of communes, the geographical location (north, south), the similarity of accessibility (deprived area, area of little or no disinheritance), the similarity of the recent history of support from partners. The health facilities were enrolled exhaustively, depending on whether they offered maternal and infantile health services during the period from 2011 to 2014.

The sample sizes of the study in each stratum corresponded to the number of eligible health facilities.

Variables of the study, techniques and collection tools

The variables explored by the study concerned the performance and pillars of the health system, namely service delivery, human resources, logistics and health system financing. The "improvement of health status", dimension of performance, was appreciated through intra-institutional maternal and neonatal mortality. The other variables concerned the availability and utilization of services:

- For the mother: Antenatal Consultation 1 (ANC1), Tetanus Toxoid immunization (TT), institutional deliveries, postnatal consultation (PNC);
- For the child: DTP(Hib)HepB immunization, Measles-Containing Vaccine (MCV) immunization, healthy child consultation;
- And for health facilities: human resources (workforce, presence at the service) and financial management (revenue, expenditure).

The data were collected mainly by the review of the management and registration records of the health services utilization (coverage or monitoring curves, logiSNIGS and EPI databases, stock sheets, staff file).

Data analysis

The collected data has been processed with Epi Info 7 and Microsoft Excel software. The descriptive analysis led to the calculation of indicators such as averages and proportions related to resource availability and service utilization. The types of ratios calculated were for intra-institutional mortality. Quantitative indicators such as average time away from work, average revenue, average expenditure were presented along with their standard deviations. The financial viability ratio of health facilities was calculated in each stratum according to the following formula:

$$\text{Average viability}_{it} = \frac{\sum \text{Revenue}_{it}}{\sum \text{Expenditure}_{it}}$$ (Where i= stratum, and t= year 2011 or 2014).

The before-and-after comparison was done between 2011 and 2014 within each stratum, then the here-elsewhere comparison of the two strata exposed to the RBF with the unexposed stratum was made. The indicators on health status, utilization of services and resources before RBF (2011) were compared to those after (2014), using variances (Fisher's F test) and the Student's T test. Health status, service utilization and pre-RBF (2011) indicators were compared to those from after (2014) using the variances comparison.

The double difference method and the calculation of ratios of proportions were used during the comparisons, and the differences were assessed with the 95% confidence interval.[11] A significance level of 5% was used.

$$DD_i = (Y_{iRBF14} - Y_{iRBF11}) - (Y_{iNonRBF14} - Y_{iNonRBF11})$$

DD=difference of the difference (or double difference); Y=the indicator (proportion, average, etc.)

i=intervention or service (delivery, prenatal consultation, revenue);

RBF=one of the RBF models (RBF_PRPSS or RBF_PASS); NonRBF=No RBF

Ethical considerations

Ethical considerations were taken into account during this study by obtaining ethical approval, the authorization of the Ministry of Health and the informed consent of those responsible of the structures involved.

RESULTS

The exhaustive enrollment of the health facilities fulfilling the inclusion criteria allowed collecting data in 20 health facilities of the RBF_PRPSS stratum, 25 of the RBF_PASS stratum and 22 of the Non_RBF stratum. Two hospitals were visited in each stratum. The health facilities located in the chief town of the commune, whose technical platform and staffs are often larger, were four in the RBF_PRPSS and RBF_PASS strata, and three in the stratum Non_RBF (Figure 2).

Data availability varied, with the highest completeness recorded in the strata exposed to the RBF. Apart from the RBF, all the enlisted health facilities were exposed to the same interventions.

Availability of human resources

According to Table 1, the average of the overall workforce have not changed between 2011 and 2014 in the RBF strata, being around 15 and 13 agents (p>0.05). In the Non_RBF stratum, the data of 2011 were not available. In 2014, the average staffing level was higher in the RBF strata compared to the Non_ RBF stratum. This difference concerned the number of qualified staff which average was around 6 and 4 respectively in the RBF_PRPSS and RBF_PASS strata, in opposite to 3 in the Non_RBF stratum (p<0.001).

Table 1: Distribution of the health care personnel availability by health facility in the three strata in Benin in 2011 and 2014.

	n[i]		Year 2011	Year 2014	Difference 2011_2014	p (F test[b] 2011_2014)	p (F test[b] Rbf_Rbf)	p (T test[c] Rbf/ Non Rbf)
Number of Midwife								
RBF_PRPSS	20	Average	0.9	1.0	0.1			0.50<p<0.90
		SD[a]	1.6	1.2		>0.05	>0.05	
RBF_PASS	25	Average	0.8	1.0	0.2			0.50<p<0.90
		SD	1.0	1.3		>0.05	>0.05	
Non_RBF	22	Average	-	0.9	-			
		SD	-	1.2				
Qualified Agent								
RBF_PRPSS	20	Average	5.6	5.9	0.3			-
		SD	9.1	9.7		>0.05	<0.001	
RBF_PASS	25	Average	2.9	4.5	1.6			-
		SD	5.2	10.1		0.001<p<0.01	<0.001	
Non_RBF	22	Average	-	3.2	-			
		SD	-	3.7				
Number of staff								
RBF_PRPSS	20	Average	14.6	15.7	1.1			-
		SD	17.4	18.4		>0.05	<0.001	
RBF_PASS	25	Average	10.3	13.2	2.9			-
		SD	14.5	18.9		>0.05	<0.001	
Non_RBF	22	Average	-	8.8	-			
		SD	0.2	6.9		<0.001		
Number of absent days of midwives/quarter								
RBF_PRPSS	20	Average	53.7	26.0	-27.7			0.10<p<0.20
		SD	39.3	34.6		>0.05	>0.05	
RBF_PASS	25	Average	3.0	18.5	15.5			0.05<p<0.02
		SD	5.5	33.3		<0.001	>0.05	
Non_RBF	22	Average	-	45.0	-			
		SD	-	47.4				

[a]Standard deviation; [b]Results of the Fisher test for variances comparison (use of the F table (point 2.5%, 1%, 1%)); [c]The T-test is performed to compare the 2014 averages of RBF strata to those of the non-RBF stratum, when the difference between the 2014 variances of the two strata is not statistically significant (p>0.05); [i] Sample size.

The number of midwives which had not changed between 2011 and 2014 in the RBF strata was not different in the three strata in 2014 (p>0.05). During that same year, the duration of midwives absence from his service during one trimester, estimated at 26 days in RBF_PRPSS, 19 days in the RBF_PASS and 45 days in Non_RBF, was not different in the three strata (p>0.05).

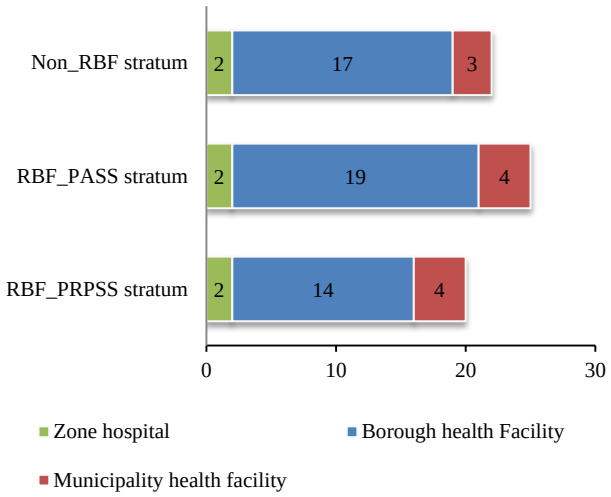

Figure 2: Distribution of surveyed health facilities of the three strata according to their type in Benin in 2014.

In sum, the overall number of staff per health facility, particularly the qualified staff, had not increased significantly between 2011 and 2014 in the strata exposed to the RBF, while the number and presence of the midwife, central link of maternal and child health interventions, were not different in all three strata in 2014.

Availability of inputs

Table 2 shows the availability of the five key drugs (paracetamol, amoxicillin, oxytocin, iron, and sulfadoxine pyrimethamine), vaccines, and HIV diagnostic tests used in the management of both mother and child.

In 2014, the average of cumulative stock-out duration for these five drugs in the first half, in the RBF_PRPSS stratum (29 days) and RBF_PASS stratum (48 days) was higher than in the Non_RBF stratum (17 days) (p<0.01). This stock-out duration fell sharply between 2011 and 2014 in the RBF_PRPSS stratum, from 51 days to 29 days, and did not significantly change in the RBF_PASS and Non_RBF strata. At the individual level, availability improved in all three strata for sulfadoxine pyrimethamine, with the highest availability noted in 2014 in the Non_RBF stratum. For paracetamol and iron, availability in 2014 was not different in all three strata (p>0.05).

With 0 to 2 days stock-out duration, DTP(Hib)HepB, MCV and TT vaccines were more available in all three strata than drugs. Between 2011 and 2014, this stock-out duration decreased for all three vaccines in the RBF_PASS stratum (p<0.001) from around 4 days to less one day, when it fell from less one day to almost two days for DTP(Hib)HepB in RBF_PRPSS stratum. In 2014, the availability of the HIV test was similar in the RBF_PRPSS and Non_RBF strata, ie 0 days of stock-out.

In total, between 2011 and 2014, and compared to the Non_RBF stratum, the decrease of the duration of stock-out was globally higher for the five key drugs and specifically lower for sulfadoxine pyrimethamine in the two strata exposed to RBF. Availability of vaccine and HIV test remained high in stratum RBF_PRPSS and improved further in stratum RBF_PASS.

Availability of financial resources

Concerning costs recovery (Table 3), the annual overall revenue average per health facility doubled in the RBF_PRPSS and multiplied by 1.6 in the RBF_PASS between 2011 and 2014 (p<0.05). In 2014, this revenue, estimated at 39,721,545 (RBF_PRPSS) and 28,037,259 (RBF_PASS), was higher in the two RBF strata, compared to the Non_RBF stratum (7,636,653 FCFA) (p<0.05). The increase of overall revenue was not solely related to RBF revenue (bonus) which average was estimated at 14,309,935 in the RBF_PRPSS and 5,248,224 in the RBF_PASS. In 2014, it was concomitant to an increase of drugs revenue in the RBF_PRPSS (+ 4,320,182 FCFA) and RBF_PASS (+2,978,901 FCFA) strata compared to the Non_RBF stratum (p<0.001). Compared to this Non_RBF stratum, the benefits revenues were increasing in 2014 by 2,048,727 and 2,479,246 respectively in RBF_PRPSS and RBF_PASS strata.

The average of total annual expenditures in 2011 were similar to that of 2014 in strata RBF_PRPSS (14,403,971 and 16,481,266 FCFA) and Non_RBF (4,090,933 and 4,950,908) (p>0.05), whereas they doubled over the period in RBF_PASS stratum (p<0.05). In 2014, these expenditures were higher in the two RBF strata compared to the Non_RBF stratum (p<0.001). This difference in expenditure level was related to higher operating costs in the two RBF strata and the larger drugs procurement in the RBF_PRPSS stratum (p<0.001). Between 2011 and 2014, financial viability increased in the RBF_PRPSS stratum from 1.3 to 2.4 and declined in the RBF_PASS and Non_RBF strata.

In sum, the implementation of the RBF was accompanied, in the health facilities exposed, by an increase in overall revenue, and particularly the revenue from drugs and benefit, and an improvement of financial viability, despite a significant increase in operating expenditures.

Table 2: Distribution of stock-out duration average (days) of drugs and other health care inputs in the first half of 2011 and 2014 in the three strata in Benin.

	n[i]		Year 2011	Year 2014	Difference 2011_2014	Ratio 2011_2014	p (F test[b] 2011_2014)	p (F test[b] Rbf_NonRbf)	p (T test[c] Rbf_NonRbf)
Paracetamol									
RBF_PRPSS	18	Average	0.7	3.1	2.4	4.7			>0.9
		SD[a]	2.2	8.6			<0.001	>0.05	
RBF_PASS	22	Average	8.4	5.9	-2.5	0.7			>0.9
		SD	15.9	13.4			>0.05	>0.05	
Non_RBF	12	Average	6.0	2.7	-3.3	0.5			
		SD	13.4	9.1			>0.05		
Amoxicillin									
RBF_PRPSS	18	Average	10.2	2.2	-8.1	0.2			0.5<p<0.9
		SD	42.6	7.2			<0.001	>0.05	
RBF_PASS	22	Average	19.8	11.7	-8.1	0.6			-
		SD	38.2	26.9			>0.05	<0.001	
Non_RBF	12	Average	0.4	3.3	2.9	8.1			
		SD	0.9	7.7			<0.001		
Oxytocin									
RBF_PRPSS	18	Average	21.1	3.3	-17.8	0.2			>0.9
		SD	49.8	13.9			<0.001	>0.05	
RBF_PASS	22	Average	30.0	19.0	-11.1	0.6			-
		SD	63.1	45.9			>0.05	<0.001	
Non_RBF	12	Average	0	3.1	3.1				
		SD	0	8.7					
Iron tablet									
RBF_PRPSS	18	Average	4.0	6.6	2.6	1.7			0.5<p<0.9
		SD	11.2	15.3			>0.05	>0.05	
RBF_PASS	22	Average	0.3	6.0	5.7	23.8			0.3<p<0.5
		SD	0.9	20.6			<0.001	>0.05	
Non_RBF	12	Average	0	10.8	10.8				
		SD	0	19.7					
Sulfadoxine pyrimethamine									
RBF_PRPSS	18	Average	24.3	19.8	-4.5	0.8			-
		SD	58.6	50.5			>0.05	<0.001	
RBF_PASS	22	Average	29.2	12.0	-17.2	0.4			
		SD	65.4	40.3			0.01<p<0.05	<0.001	-
Non_RBF	12	Average	45	8.0	-37.0	0.2			
		SD	90.0	13.3			<0.001		
Key drugs									
RBF_PRPSS	18	Average	50.6	28.5	-22.1	0.6			-
		SD	94.5	49.7			0.01<p<0.05	0.001<p<0.01	
RBF_PASS	22	Average	45.0	47.5	2.5	1.1			-
		SD	119.0	95.3			>0.05	<0.001	
Non_RBF	12	Average	9.6	17.3	7.6	1.8			
		SD	39.0	22.0			>0.05		
DTP(Hib)HepB[d]									
RBF_PRPSS	18	Average	0.5	1.6	1.1	3.2			-
		SD	1.2	6.3			<0.001	<0.001	
RBF_PASS	22	Average	3.8	0.9	-2.9	0.2			0.5<p<0.9
		SD	7.9	2.9			<0.001	>0.05	
Non_RBF	12	Average	0	0.6	0.6	-			
		SD	0	2.0					
MCV[e]									
RBF_PRPSS	18	Average	0	0	0.0	-			0.10<p<0.20
		SD	0	0					
RBF_PASS	22	Average	3.5	0.2	-3.3	0.1			-
		SD	7.9	1.1			<0.001	<0.001	
Non_RBF	12	Average	0	2.7	2.7	-			
		SD	0	8.3					

Continued.

	n[i]		Year 2011	Year 2014	Difference 2011_2014	Ratio 2011_2014	p (F test[b] 2011_2014)	p (F test[b] Rbf_NonRbf)	p (T test[c] Rbf_NonRbf)
TT[f]									
RBF_PRPSS	18	Average	0	0	0.0	-			
		SD	0	0					
RBF_PASS	22	Average	4.2	0.4	-3.7	0.1			0.30<p<0.50
		SD	8.2	2.0			<0.001		
Non_RBF	12	Average	0	0	0.0	-			
		SD	0	0					
HIV Test									
RBF_PRPSS	18	Average	0.7	0	-0.7	0			
		SD	2.4	0					
RBF_PASS	22	Average	0.7	0.3	-0.4	0.4			0.20<p<0.30
		SD	2.2	0.9			<0.001		
Non_RBF	12	Average	0	0	0.0	-			
		SD	0	0					

[a]Standard deviation; [b]Results of the Fisher test for variances comparison (use of the F table (point 2.5%, 1%, 1%)); [c]The T-test is performed to compare the 2014 averages of RBF strata to those of the non-RBF stratum, when the difference between the 2014 variances of the two strata is not statistically significant (p>0.05); [d]Immunization against diphtheria, tetanus, pertussis, hemophillus influenza, hepatitus B; [e]Measles-Containing Vaccine; [f]Tetanus toxoid immunization vaccine; [i]Sample size.

Table 3: Distribution of revenues and expenditures (in FCFA) by health facility in the three strata in Benin in 2011 and 2014.

	n[i]		Year 2011	Year 2014	Difference 2011_2014	Ratio 2014/ 2011	DD (Rbf_Non Rbf)	Ratio(R bf/Non Rbf)	p (F test[b] 2011_ 2014)	p (F test[b] Rbf/ NonRbf)	p (T test[c] Rbf/ NonRbf)
Drugs revenue											
RBF_PRPSS	20	Average	11854026	14875791	3021766	1.3	4320181	1.6			-
		SD[a]	17243569	23020506					>0.05	<0.001	
RBF_PASS	16	Average	11972423	13652908	1680485	1.1	2978901	1.5			-
		SD	14201267	16037705					>0.05	<0.001	
Non_RBF	9	Average	6135491	4837074	-1298416	0.8					
		SD	4580909	2384633					>0.05		
Benefits revenue											
RBF_PRPSS	20	Average	7319983	10535819	3215836	1.4	2048727	0.8			-
		SD	16672571	23882602					>0.05	<0.001	
RBF_PASS	16	Average	5886609	9532964	3646355	1.6	2479246	0.9			-
		SD	17146577	30281439					0.01<p< 0.05	<0.001	
Non_RBF	9	Average	1632469	2799578	1167109	1.7					
		SD	1580080	3056388					>0.05		
RBF revenue											
RBF_PRPSS	20	Average		14309935	14309935		-	-			
		SD		23515596							
RBF_PASS	16	Average		5248224	5248224		-	-			
		SD		2516757							
Non_RBF	22	Average		-	-						
		SD		-							
Overall revenue											
RBF_PRPSS	20	Average	19174008	39721545	20547537	2.1	20678843	2.1			-
		SD	33643787	70121532					0.001<p< 0.01	<0.001	
RBF_PASS	16	Average	17859031	28037259	10178227	1.6	10309534	1.6			-
		SD	27516583	51319737					0.01<p< 0.05	<0.001	
Non_RBF	9	Average	7767960	7636653	-131307	0.9					
		SD	6096837	4229104					>0.05		

Continued.

	n[i]		Year 2011	Year 2014	Difference 2011_2014	Ratio 2014/ 2011	DD (Rbf_Non Rbf)	Ratio(Rbf/Non Rbf)	p (F test[b] 2011_ 2014)	p (F test[b] Rbf/ NonRbf)	p (T test[c] Rbf/ NonRbf)
Drugs expenditure											
RBF_PRPSS	20	Average	7100736	10621690	3520954	1.5	3065831	1.3			-
		SD	9783561	16033946					>0.05	<0.001	
RBF_PASS	16	Average	4716147	7667095	2950948	1.6	2495824	1.5			0.10<p< 0.20
		SD	3011383	5102363					0.01<p< 0.05	>0.05	
Non_RBF	9	Average	3856563	4311687	455124	1.1					
		SD	2806226	2555200					>0.05		
Operating expenditure											
RBF_PRPSS	20	Average	13358047	15643741	2285694	1.2	1503173	0.9			-
		SD	27251495	28705857					>0.05	<0.001	
RBF_PASS	16	Average	7741140	16194454	8453314	2.1	7670793	1.7			-
		SD	20736850	36776551					0.01<p< 0.05	<0.001	
Non_RBF	9	Average	3680664	4463185	782521	1.2					
		SD	3562375	3891720					>0.05		
Overall expenditure											
RBF_PRPSS	20	Average	14403971	16481266	2077295	1.1	1217321	0.9			-
		SD	29840035	29048755					>0.05	<0.001	
RBF_PASS	16	Average	7948282	16456294	8508012	2.1	7648038	1.7			-
		SD	21281310	37724017					0.01<p< 0.05	<0.001	
Non_RBF	9	Average	4090933	4950908	859974	1.2					
		SD	3454309	3701115					>0.05		
Overall financial viability[d]											
RBF_PRPSS	20		1.33	2.41							
RBF_PASS	16		2.25	1.70							
Non_RBF	9		1.89	1.54							

[a]Standard deviation; [b]Results of the Fisher test for variances comparison (use of the F table (point 2.5%, 1%, 1‰)); [c]The T-test is performed to compare the 2014 averages of RBF strata to those of the non-RBF stratum, when the difference between the 2014 variances of the two strata is not statistically significant (p>0.05); [d]Financial viability is calculated by dividing the annual total revenue of the stratum by the annual expenditure of that stratum. 1$ ≈ 500FCFA and 1€ = 655.659FCFA; [i]Sample size

Level of services utilization and mortality

According to Table 4, between 2011 and 2014, institutional delivery coverage increased from 65% to 68% in the RBF_PASS stratum, and from 81% to 83% in the RBF_PRPSS stratum (p<0.001). This is an increase of 2% to 3% compared to the Non_RBF stratum over the period. The coverage of the first antenatal consultation (ANC1) had not significantly varied in the two RBF strata (p>0.05), but decreased in the Non_RBF stratum (p<0.001). Tetanus vaccination increased in zones exposed to RBF compared to unexposed zones, from 68% to 78% in RBF_PRPSS and 57% to 60% in RBF_PASS (p<0.001). Postnatal consultation (PNC) declined in all three strata, but more so in those exposed to RBF (p<0.001). The use of curative consultation services by the entire population increased by 13% to 16% in strata exposed to RBF compared to the Non_RBF stratum. Among children under 5 years old, the use of this curative consultation also increased, especially in the RBF_PASS stratum (p<0.001). Immunization coverage of children under 12 months also improved over the period in both RBF strata (p<0.001). MCV immunization ranged from 92% to 100% in RBF_PRPSS and from 94% to 99% in RBF_PASS. Coverage of healthy child consultation of children of 0 to 11 months and 12 to 35 months decreased significantly in both RBF strata between 2011 and 2014 as it increased in the Non_RBF stratum (p<0.001).

The institutional maternal mortality estimated in 2011 at 113 and 84 per 100,000 live births respectively in RBF_PRPSS and RBF_PASS strata, decreased in 2014 to 99 and 48 per 100,000 live births. That was a non-significant decrease of 27 and 50 per 100,000 live births respectively compared to the Non_RBF stratum (p>0.05). Over the period, early institutional neonatal mortality did not significantly change in RBF_PRPSS (34% in 2011 and 30% in 2014) and RBF_PASS strata (31% in 2011 and 27% in 2014) (p>0.05).

In sum, all things being equal, with the implementation of RBF, maternal and infant mortalities did not decrease significantly in exposed strata where only institutional

delivery, tetanus immunization (TT2+), infantile immunization (DTP(Hib)HepB3 and MCV) and curative consultation of all ages had improved. ANC1 coverage had not changed significantly, and PNC1 coverage and healthy child consultation had decreased.

Table 4: Level of health indicators and services utilization in the three strata in Benin in 2011 and 2014.

	Year 2011			Year 2014			P value	Difference (2014 - 2011)%	Difference of difference	
	(n)[i]	Number[ii]	%	(n)	Number	%			DD%	95% CI [Inf. Sup]
Institutional maternal death										
RBF_PRPSS	12 448	14	0.113	14 133	14	0.099	0.74	-0.013	-0.027	[-0.039; -0.016]
RBF_PASS	10 754	9	0.084	12 536	6	0.048	0.28	-0.036	-0.050	[-0.091; -0.009]
Non_ RBF	9 704	14	0.144	10 742	17	0.158	0.8	0.014		
Institutional delivery (without missing data and private HF)										
RBF_PRPSS	15 858	12 826	80.9	17 469	14 457	82.8	<0.0001	1.9	2.8	[2.7; 2.9]
RBF_PASS	16 968	11 071	65.3	18 692	12 823	68.6	<0.0001	3.4	4.3	[4.1; 4.5]
Non_ RBF	14 273	10 157	71.2	15 722	11 043	70.2	0.08	-0.9		
ANC1[a]										
RBF_PRPSS	18 237	15 792	86.6	20 090	17 499	87.1	0.14	0.5	14.3	[13.8; 14.9]
RBF_PASS	19 514	17 467	89.5	21 496	19 264	89.6	0.72	0.1	13.9	[13.4; 14.4]
Non_ RBF	16 414	16 196	98.7	18 082	15 342	84.9	<0.0001	-13.8		
TT2+ (pregnant woman)[b]										
RBF_PRPSS	18 237	12 442	68.2	20 090	15 589	77.6	<0.0001	9.4	24.4	[23.7; 25.0]
RBF_PASS	19 514	9 168	47.0	21 496	12 811	59.6	<0.0001	12.6	27.6	[26.9; 28.3]
Non_ RBF	16 414	14 937	91.0	18 082	13 747	76.0	<0.0001	-15.0		
PNC (new)[c]										
RBF_PRPSS	15 858	6 466	40.8	17 469	4 702	26.9	<0.0001	-13.9	-9.3	[-9.9; -8.7]
RBF_PASS	16 968	7 256	42.8	18 692	6 865	36.7	<0.0001	-6.0	-1.5	[-2.0; -1.0]
Non_ RBF	14 273	4 139	29.0	15 722	3 841	24.4	<0.0001	-4.6		
Curative consultation (any age)										
RBF_PRPSS	495 495	156 838	31.7	385 873	181 247	47.0	<0.0001	15.3	15.9	[15.7; 16.0]
RBF_PASS	409 068	115 015	28.1	450 620	184 417	40.9	<0.0001	12.8	13.3	[13.2; 13.4]
Non_ RBF	333 574	128 657	38.6	367 456	139 768	38.0	<0.0001	-0.5		
Institutional newborn death (early neonatal death <7 days and abortion)										
RBF_PRPSS	12 448	425	3.41	14 133	429	3.04	0.08	-0.38	-0.78	[-0.94; -0.62]
RBF_PASS	10 754	337	3.13	12 536	343	2.74	0.07	-0.40	-0.79	[-0.96; -0.63]
Non_ RBF	9 704	284	2.93	10 742	357	3.32	0.1	0.40		
Curative consultation (<5years)										
RBF_PRPSS	60 810	61 181	100.6	64 865	66 422	102.4	<0.0001	1.8	-1.8	[-2.0; -1.6]
RBF_PASS	71 014	50 762	71.5	75 748	83 001	109.6	<0.0001	38.1	34.5	[34.1; 34.9]
Non_ RBF	57 908	52 850	91.3	61 769	58 601	94.9	<0.0001	3.6		
DTP(Hib)HepB 3[d]										
RBF_PRPSS	14 012	13 806	98.5	14 036	14 707	104.8	<0.0001	6.3	13.3	[12.7; 13.9]
RBF_PASS	16 363	15 436	94.3	16 275	17 535	107.7	<0.0001	13.4	20.5	[19.8; 21.2]
Non_ RBF	13 343	14 303	107.2	13 183	13 198	100.1	<0.0001	-7.1		
MCV[e]										
RBF_PRPSS	14 012	12 873	91.9	14 036	14 097	100.4	<0.0001	8.6	8.9	[8.4; 9.4]
RBF_PASS	16 363	15 422	94.3	16 275	16 072	98.8	<0.0001	4.5	4.9	[4.5; 5.2]
Non_ RBF	13 343	13 145	98.5	13 183	12 941	98.2	0.03	-0.4		
Healthy child consultation 0-11 months (news)										
RBF_PRPSS	18 486	9 955	53.9	14 036	7 062	50.3	<0.0001	-3.5	-17.5	[-18.1; -16.8]
RBF_PASS	14 969	11 301	75.5	16 275	10 896	67.0	<0.0001	-8.5	-22.5	[-23.2; -21.7]
Non_ RBF	12 144	5 267	43.4	13 183	7 551	57.3	<0.0001	13.9		
Healthy child consultation 12-36 months (news)										
RBF_PRPSS	41 927	2 127	5.1	45 508	1 092	2.4	<0.0001	-2.7	-5.6	[-5.8; -5.4]
RBF_PASS	47 709	615	1.3	51 870	586	1.1	<0.0001	-0.2	-3.1	[-3.3; -2.9]
Non_ RBF	37 532	288	0.8	40 748	1 506	3.7	<0.0001	2.9		

[a]Antenatal Consultation (first consultation); [b]Tetanus Toxoid immunization (TT2+: second and up immunization); [c]Prenatal Consultation (first consultation); [d]Immunization against Diphtheria Tetanus Pertussis Hemophillus influenzae Hepatitus B; [e]Measles-Containing Vaccine; [i]Sample size, [ii]number or frequency of the situation (phenomenon) measured

DISCUSSION

The availability of resources to provide health care and services, particularly human resources, had not generally changed between 2011 and 2014 in the exposed RBF strata compared to the unexposed stratum. This lack of effect of RBF on the availability of personnel is similar to the finding made in Cameroon, in contrast with the improvement in the availability of qualified personnel noted in Rwanda.[12,13] It results from the centralization of human resources management and weak leadership in the health sector.[14] It is also expressive of the generalized health human resources crisis common to developing countries, and particularly of sub-Saharan African countries.[15]

Staff averages by health facility in 2011 and 2014 were below national standards.[16] These results confirm the lack of response of the RBF to the human resource deficit in the exposed zones. They reflect the lack of start-up of national policy and/or special provisions to support RBF in order to progressively achieve national staffing standards.[16]

The improvement of the availability of health care inputs, with a decrease of the stock-out duration, reflects the strengthening of the monitoring of the staff for fear of loss of points for the RBF subsidies. This improvement of inputs availability in RBF context is similar to that noted in Philippines, DRC and Cameroon.[5,12,13] However, it could be truncated by breakage avoidance provisions such as those reported in Rwanda, of not serving the last box of medicine to the clients and directing them to other supply sources.[17]

Overall annual revenues have improved in the RBF strata, especially for drugs, reflecting the increase of activities. The small increase in proportion of benefit revenues in relation to drug revenues could be a consequence of the application of real prices because of the population monitoring. This would not be the case in the Non_RBF stratum where the control mechanisms are non-existent or not functional.

These similar findings of concomitant revenue increase to the implementation of RBF, noted in Cameroon, show a near doubling of revenues from direct payment of patients.[18] Liu reported an increase in hospital income following the introduction of bonuses for the staff.[19] Spending inflation in health facilities exposed to RBF in Cameroon was only noted in the RBF_PASS stratum.[18] The small increase in benefit revenues over drug revenues, notwithstanding the relative increase in the use of services in RBF health facilities, could lead to the conclusion that care prices paid by patients have decreased as Burundi and Tanzania, or a leak of revenues.[20,21]

The increase of institutional delivery coverage in the RBF strata is lower than in Rwanda and Burundi.[4,22] Similarly to our findings, some authors have reported the lack of effect of RBF on ANC.[4,23] The improvement in childhood immunization coverage noted in Benin's RBF zones contrasts with the lack of reported effect in other countries.[12,22,23] For the vaccination of pregnant women, the increase noted in RBF health facilities correlates the findings made in 2008 in Burundi.[24] The increase in the use of curative consultation in RBF exposed health facilities versus non-exposed ones contrasts with the lack of difference in use of this service reported in Tanzania and Zambia for RBF and non-RBF areas.[25,26] In a different approach, another study reported the lack of RBF effect on the increase of activities volume in RBF zones.[27]

Concerning maternal and newborn mortalities rates in health facilities, their insignificant decreases synchronous with an overall increase of service utilization in RBF zones may reflect the slow effect of RBF on improving the health status of the population who are using greater services that have become more accessible (in terms of organization or price) and better quality (increased availability of inputs, especially medicines). These results generate interest in the quality of the data used and questions of causal plausibility due to interference from other factors, and recall that RBF is similar to other complex interventions introduced in the health sector.[27,28] The absence of effect of the RBF on mortality, consistent with its lack of effect on benefits, reinforces the doubts already made by Kalk and Ireland on the ability of the intervention to reform the health system or to induce, alone, the improvement of the performance.[14,27,29] However, seen under the prism of the major changes that it introduces in the management of health facilities, the relationship with clients and the quality of services offered, the RBF implementation could contribute in the long term to a significant reduction in morbidity and mortality of the mother and the child.

Limit of the study

The study was based mainly on the documentary review. The low completeness of some variables raises the problem of the data quality and the supports archiving in the health structures as in Burundi.[30,31] It could taint the quality of the results. The variation of the context and the influence of other sectors do not make possible to evoke a direct association of the RBF with obtained results.

The use of double difference in this before-after and here-elsewhere assessment, without associating the calculation of the propensity score, is related to the lack of detailed data. It is based on the similarity of the results produced by both methods when they are used on the same data.[11,12]

CONCLUSION

The adoption of RBF has been accompanied by an improvement in the availability of health care inputs and

increased mobilization of revenues in exposed health facilities. Over three years, the number of staff has not changed despite the increase of services utilization, and therefore the workload. The availability of staff, particularly the midwife who has a central role in emergency management and the provision of maternal and child health services, has not improved in the RBF strata. Apart from vaccination, the results of services utilization are similar to those often reported by several authors.

The lack of reduce of institutional maternal and neonatal mortalities, which is synchronous with the increased services utilization in RBF zones, indicates the complexity of health interventions and the limitations of current RBF models to induce by themselves the improvement of health system performance in Benin.

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