Power Calculations for the HRBF Impact Evaluation Network

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Introduction

The purpose of this document is to set some preliminary results in order to perform accurate power calculations for the HRBF Impact Evaluation Network, using existing data from the design for performance-based contracting (PBC) in Rwanda. The last aim of this study is to provide some guidelines for the sampling design and sample size requirements for the new program.

From all the indicators studied to assess the impact of PBC in health status, health utilization and changes in behavior of the population served by each health facility, we will only focus on the following three key indicators for mothers:

1) In-Facility Births;
2) Times received Pre-Natal Care;
3) Tetanus shot during Pre-Natal Care

In Appendix I we will assess the case of the following indicators for children:
4) Number of Sick Child (<5 years) Health Facility Visits in last 4 weeks.
5) Incidence of Child (<5 years) Diarrhea in last 4 weeks;

In the first section we describe the data employed to perform our analysis. In the second part, there is a brief description of some preliminary results concerning the evolution of the four key indicators in Rwanda. In section three we outline some possible scenarios for power calculations for each mothers' indicator. Firstly the main findings are set and then the detailed study of each variable is shown in Appendix I. Finally, in Appendix II, an extension to children indicators is performed.

1. Data

We employed the following sources of information:

- Database consisting of the panel of 2006 and 2008 variables for Rwanda PBC program. This dataset comprises information about child, male and female health; as well as individual and household records.
- 2006 and 2008 questionnaires.

The sampling strategy followed in Rwanda PBC program consisted in selecting randomly household within the area of influence of some health facilities. Those health facilities were randomly assigned to treatment or to control group.

Therefore, due to the sampling design, we do not have a random sample of the population for Rwanda. Instead, we have information about a random sample of the population most likely affected by the program implementation (those households in the catchment area of health facilities). So the gains in outcomes should be understood in this same manner; they will not correspond to the average treatment effect for a random selected household or individual in Rwanda, but for a random unit within a health facility area of influence.

2. Preliminary Results of Rwanda's data

Using the database of 2006 and 2008 survey we compared the outcomes corresponding to four key indicators. In Table 1 we provide some basic summary statistics (mean and standard deviation) and also the intra-class correlation for all the variables in the two years comprised in the panel.

The intra-class correlation (ICC) is a variable of special interest because of its influence in the power calculations we perform in the following section. In the case of the five indicators, we have data of individual units which belong to one determined groups or class. The class is defined by the health center's area of influence under which their household lies. Therefore, the sample is clustered at the health facility level[1]. As this is a panel dataset, the same households surveyed in 2006 were surveyed in 2008.

Table 1: *Key Indicators for 2006 and 2008*

	Key Indicators	2006				2008			
	Variable	Obs. N	Mean	Std. Dev	Intraclass Correlation	Obs. N	Mean	Std. Dev	Intraclass Correlation
Mothers	In-Facility Births	1455	44.19%	0.463	0.010	1052	53.12%	0.493	0.012
Mothers	A. In-Facility Births for last birth	1455	45.02%	0.498	0.008	1052	53.32%	0.499	0.014
Mothers	B. In-Facility Births for second-to-last birth	924	40.26%	0.491	0.014	87	48.28%	0.503	0.000
Mothers	C. In-Facility Births third-to last birth	322	43.48%	0.497	0.007	4	50.00%	0.577	n.a.
Mothers	Times received PNC	1831	2.623	1.267	0.006	1093	2.864	1.090	0.007
Mothers	Tetanus shot during PNC	1831	69.25%	0.462	0.007	1093	64.68%	0.478	0.012
Children	Number of Sick Child (<5 years) HF Visits in last 4 weeks	1425	0.382	0.819	0.013	1310	0.544	0.116	0.008
Children	Incidence of Child (<5 years) Diarrhea in last 4 weeks	3567	15.11%	0.382	0.007	3129	14.89%	0.356	0.000

In-Facility Births indicator is analyzed in some detail. The first line corresponds to the proportion of the births in the lapse considered for each mother that was born in a health facility. The second indicator (A) focuses on whether the delivery has been institutional or not, only for the last child born in the last two years. The third and fourth indicators (B and C) are the analogous of A for the first to last and second to last births. Although the gain was very similar for all the variants of in-facility births, we will discard B and

[1] ICC is defined as the share of the total variance that corresponds to the group variance. In this case, it is the ratio of the "between health center variance" and the total variance, which is: "between + within health center variance".

C because of the small number of observations for 2008 (which especially affects the ICC computation). And we will continue the analysis using version "A" because the first line is also affected by the low number of second and third children born in the 2008 sample[2].

From Table 1, we can see that there has been a gain in almost all the indicators from 2006 to 2008; especially for the number of sick children health facility visits and institutional delivery. The decline in the incidence of child diarrhea was relatively modest. The only indicator which showed a worse record is tetanus shots during pre-natal care. One reason that may be adduced to explain the decrease in the proportion of pregnant women immunized for tetanus is that if they had another pregnancy within 10 years before the last one and kept the appropriate vaccination certificate, they may have already been given the tetanus shot and not require it.

The standard deviation shows little change between 2006 and 2008 in all the indicators, both for mothers and children.

Finally, as regards ICC, the five indicators show a low level, ranging from 0 (absence of group effect) to 0.014. The variation of ICC between the years examined is not univocal: it nearly doubled for in-facility birth or tetanus shot, while it remained unchanged in the case of PNC and declined for both incidence of child diarrhea and sick children HF visits.

Using the data of Table 1, the power calculations of the next section are performed, considering as baseline level that of 2006.

[2] Using In-Facility Birth instead of A.In-Facility Birth, does not change considerably the results because all the statistics are very similar.

3. Some Possible Scenarios for Power Calculations – Indicators for Mothers

- Main Results-

In the following section we perform some power calculation exercises, to determine the possible combinations of number of clusters (groups; health facilities in this case) and observations per cluster (members; mothers in this case) that enable us to attain a certain power and significance level.

The main results are shown in this section, and the detailed calculations in addition to further scenarios are presented in Appendix I.

We will perform power calculations for the three mothers' indicators, assuming different scenarios that vary in their minimum detectable difference in outcomes.

<u>*General Assumptions*</u>

In all the scenarios for every indicator, we assume:

- Power of 0.8
- Significance level of 0.05.
- Cluster defined as the catchment area surrounding a health facility. We assume that the survey is a random sample from that area.
- Baseline level and standard deviation of 2006.
- Intra-class correlation corresponding to the average ICC between 2006 and 2008.
- The expected Gain is supposed to be the average gain from the population of the cluster (not from those households attending the health facility). For example, if we assume a detectable increase of 50% in the outcome for those attending the facility, and only half of the population visits health centers, the population's gain would be of 25% (0.5 x 0.5 = 0.25).
- Perfect Compliance.

Table 2: *Scenarios – Different Minimum Detectable Differences*

Indicator	Baseline Level - RW '06-	Scenario	Minimum Detectable
In-Facility Births for last birth	45.02%	Scenario A	0.1
		Scenario B	0.2
		Scenario C	0.05
Times received PNC	2.623	Scenario A	10%
		Scenario B	15%
		Scenario C	5%
Tetanus shot during PNC	69.25%	Scenario A	0.1
		Scenario B	0.15
		Scenario C	0.05

__Figure 1:__ Main Results for Mothers' Indicators – Scenario A

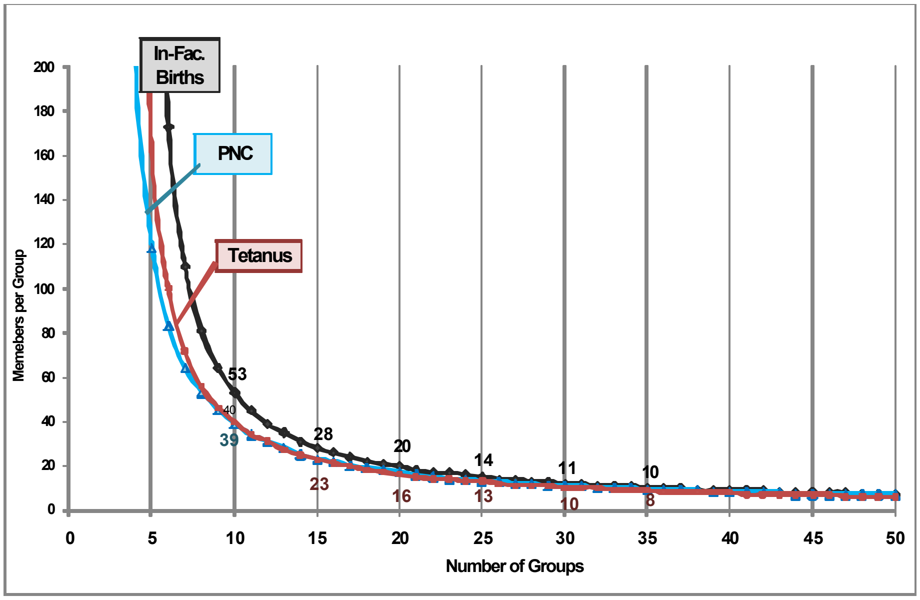


__Table 3:__ Main Results for Mothers' Indicators

		Per treatment		1 Treatment + Control Groups	
		N° Health Facilities	N° Mothers	N° Health Facilities	N° Mothers
In-Facility Births for last birth	Scenario A	10	53	20	1060
		15	28	30	840
		20	20	40	800
		25	15	50	750
	Scenario B	10	10	20	200
		15	6	30	180
		20	5	40	200
		25	4	50	200
	Scenario C	10	-	-	-
		15	1679	30	50370
		20	212	40	8480
		25	113	50	5650
Times received PNC	Scenario A	10	39	20	780
		15	23	30	690
		20	17	40	680
		25	13	50	650
	Scenario B	10	9	20	180
		15	6	30	180
		20	4	40	160
		25	4	50	200
	Scenario C	10	442	20	8840
		15	151	30	4530
		20	91	40	3640
		25	66	50	3300
Tetanus shot during PNC	Scenario A	10	40	20	800
		15	23	30	690
		20	16	40	640
		25	13	50	650
	Scenario B	10	15	20	300
		15	9	30	270
		20	7	40	280
		25	6	50	300
	Scenario C	10	-	-	-
		15	247	30	7410
		20	113	40	4520
		25	74	50	3700

Sampling Strategy Considerations

Design

To detect a gain in the three indicators for mothers analyzed in the previous table, there should be a random draw of households in the catchment area of health facilities both assigned and not assigned to treatment. Then a mean difference estimator would be computed to estimate the effect of the treatment.

If there were a baseline and follow -up survey, the contribution of these data would be detecting regional differences, not individual ones, because of the targeted population in this case (recent mothers or pregnant women).

Eligible Population for the Survey

The eligible households for the survey would be those where there are females between 15 and 49 who either had children or were pregnant after the treatment took place. For example, if the treatment starts in June 2009, and the survey is held in June 2011, then the sample should be of mothers who had children in the last two years.

According to the data from Rwanda, in 2008, on average in almost half of the households surveyed, there was a woman who had a child since January 2006. So in order to find households where eligible women live, the interviewer would probably have to try in twice as many the required number of surveys.

Sample Size

In Table 3, there are three scenarios for each indicator according to the minimum detectable differences assumed. Then, the necessary members per group are reported for 10, 15, 20 and 25 groups per treatment. Scenario A (baseline scenario; see Appendix I) is shaded.

If we consider the case of Scenario A, 10 health facilities, and one treatment and control group, we would need: i) 1060 mothers who had children after treatment for in-facility births; ii) 780 pregnant after treatment for PNC and iii) 800 pregnant after treatment for tetanus shots. For the scenario stated as baseline and under the assumptions previously mentioned, in-facility births seems to be the most sample-size demanding indicator.

It is important to firstly determine the number of health centers to be considered as treated and control. Once the maximum and minimum number of health facilities is determined, it should be verified the number of mothers needed according to the Table 3, or other tables in Appendix I for different assumptions. Finally, it is very relevant to perform a demographic study of the catchment area of the health centers before performing the survey (using, for example, census data of the corresponding countries), because it is not trivial that there will be the necessary number of households and – much more complicated- the number of mothers who had children after treatment in the catchment areas.

For instance in the case of 10 health facilities per treatment, there are 72 recently mothers needed. It could happen that it is a lot for determined catchment areas, so the sample must be redistributed, considering that on average there must be 72 per health center. A criterion to distribute the sample could be population in the catchment area.

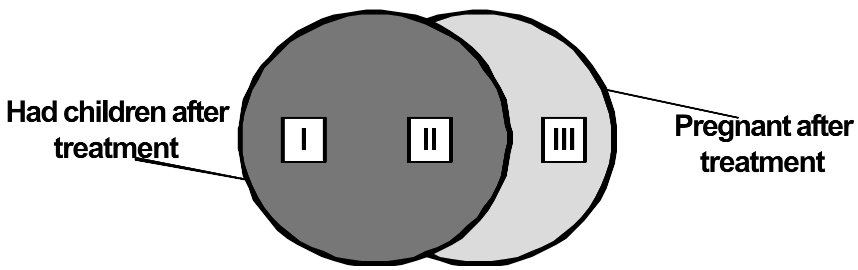
In the case of the 2008 data for Rwanda, there was an average of 52 women that had children in the last two years per catchment area surrounding a health center. However, there was a health center with 3 observations and the other extreme was another with 118.

Sample Distribution

Another issue to be considered when defining the sample size is whether all the indicators will be measured in the same sample; or if in order to obtain a more representative sample, more observations will be considered.

To make this point clear, consider that surveys are held 2 years after treatment starts. Then, we would have the following population of women affected by treatment:

Figure 2: *Women affected by treatment*



-Group I: Those who had children after treatment but most of their pregnancy was not affected by treatment (they should be more than 5 months pregnant when treatment started)

-Group II: Women that got pregnant after the treatment started and had their children within the time span considered (in this case 2 years).

-Group III: Women that got pregnant during treatment and are still pregnant.

Once we know the type of eligible women we could find, let's return to the sample size requirements. For example, in the case of Scenario A, with 20 health facilities (10 treated and 10 controls) we need:

i) 1060 mothers who had children after treatment for in-facility births;

ii) 780 pregnant after treatment for PNC;

iii) 800 pregnant after treatment for tetanus shots.

One alternative we have is to look for 1060 women that belong to group II (pregnant and had children after treatment), so as to fulfill the sample size requirements of the three indicators. However, to obtain a more representative sample, we could also include observations of groups I and III for some of the variables.

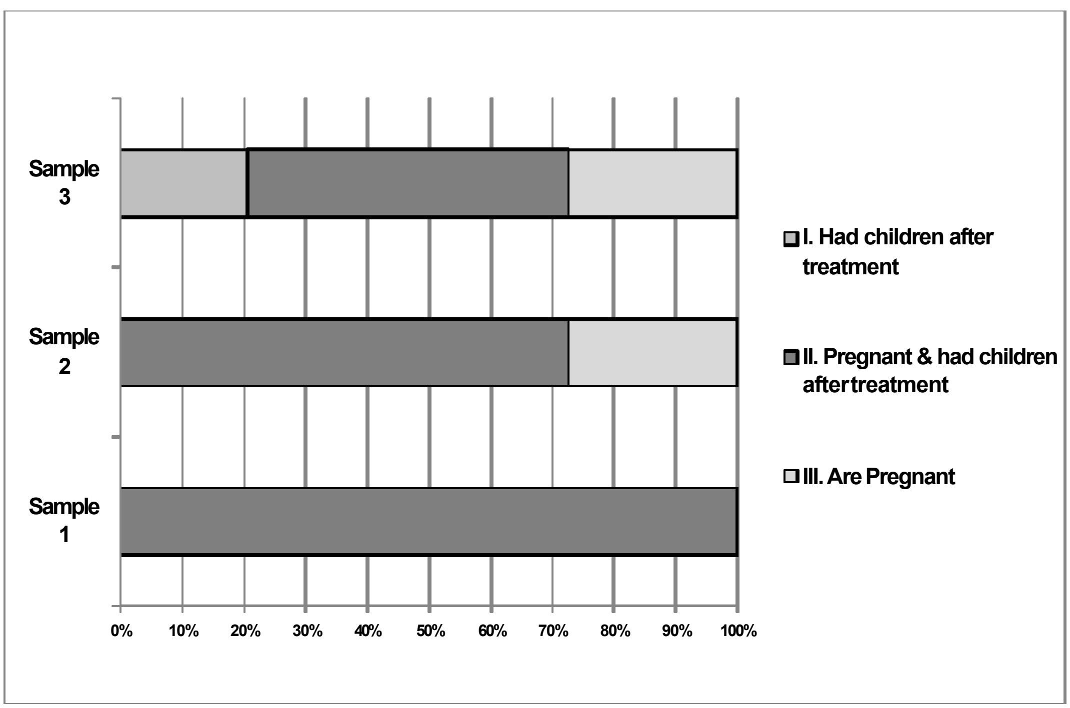
For example, we could sketch different sample distributions using observations from groups II, II and III.

Table 4: *Different samples using groups I, II and III*

	Sample 1				Sample 2				Sample 3			
	In-Facility Birth	Times PNC	Tetanus shot	Minimum Req.	In-Facility Birth	Times PNC	Tetanus shot	Minimum Req.	In-Facility Birth	Times PNC	Tetanus shot	Minimum Req.
I. Had children after treatment									300			300
II. Pregnant & had children after treatment	1060	790	800	1060	1060	390	400	1060	760	390	400	760
III. Are Pregnant						390	400	400		390	400	400

Notice that in sample 1, the same mothers used for the first indicator (in-facility births) are the same that are surveyed for the other two. However, in sample 2, for PNC and tetanus shots, half of the mothers are those from group II, and the others belong to group III (currently pregnant). In sample 2 we gain representativeness of the sample, but we increase in 400 the sample size in comparison to sample 1. Finally, sample 3 is similar to sample 2, but we include mother of group I, who had children soon after the treatment was implemented (and consequently their pregnancies were not during the treatment).

Figure 3: *The composition of the different samples*



Furthermore, we could sub-divide even more the population of women who had children and/or were pregnant after treatment took place, considering separately those for which that birth/pregnancy was their first one, and those for which it is not the case. This would be especially important for the tetanus shots indicator, because when women have already been immunized within the previous ten years, and have the proper certifications, the vaccine is not necessary.

More Treatments

In Table 3, it is stated the number of health facilities and eligible women required for the case of one treatment and one control group. In case we add treatments and we expect the same gain Scenarios as in Table 3 over control group, to obtain the sample size we should multiply the number of groups per treatment arm and then multiply by that number the amount of members per group per treatment.

Table 5: *Two Treatments*

		1 Treatment + Control Groups		2 Treatments + Control Groups	
		N° Health Facilities	N° Mothers	N° Health Facilities	N° Mothers
In-Facility Births for last birth	Scenario A	20	1060	30	1590
		30	840	45	1260
		40	800	60	1200
		50	750	75	1125
	Scenario B	20	200	30	300
		30	180	45	270
		40	200	60	300
		50	200	75	300
	Scenario C	-	-	-	-
		30	50370	45	75555
		40	8480	60	12720
		50	5650	75	8475
Times received PNC	Scenario A	20	780	30	1170
		30	690	45	1035
		40	680	60	1020
		50	650	75	975
	Scenario B	20	180	30	270
		30	180	45	270
		40	160	60	240
		50	200	75	300
	Scenario C	20	8840	30	13260
		30	4530	45	6795
		40	3640	60	5460
		50	3300	75	4950
Tetanus shot during PNC	Scenario A	20	800	30	1200
		30	690	45	1035
		40	640	60	960
		50	650	75	975
	Scenario B	20	300	30	450
		30	270	45	405
		40	280	60	420
		50	300	75	450
	Scenario C	-	-	-	-
		30	7410	45	11115
		40	4520	60	6780
		50	3700	75	5550

For example, if we have Treatment 1(T1) and Treatment 2 (T2) -apart from the control group- and we want to estimate the gain of each treatment over control (expected to be the same), we would have the sample size of the last column from the previous Table.

Consider now the case in which we take the situation of the previous section, but we also want to detect the difference between T1 and T2, and we expect a gain of Scenario A from T2 over T1, and a gain of Scenario B from T1 over control (Gain 2).

Table 6: *Gain assumptions for two treatments*

Gain 1	Treatment 1	Treatment 2
Control	Scenario A	Scenario A

Gain 2	Treatment 1	Treatment 2
Control	Scenario B	Scenario B
Treatment 1	-	Scenario A

If we compute the sample size necessary for this exercise, in comparison to a situation referred to as Gain 1 (gain of Scenario A for T1 and T2 over control), we will see a reduction in the sample size needed for the situation corresponding to Gain 2, because although the number of members of T1 and T2 must be equal, the control group can be reduced because there is a larger detectable difference that we want to detect (Scenario B).

Table 7: *Sample size requirements for two treatments with different gain assumptions*

	Gain 1 Assumption		**Gain 2 Assumption**	
	2 Treatments + Control Groups		**2 Treatments + Control Groups**	
	N° Health Facilities	**N° Mothers**	**N° Health Facilities**	**N° Mothers**
In-Facility Births for last birth	30	1590	30	1160
	45	1260	45	930
	60	1200	60	900
	75	1125	75	850
Times received PNC	30	1170	30	870
	45	1035	45	780
	60	1020	60	760
	75	975	75	750
Tetanus shot during PNC	30	1200	30	950
	45	1035	45	825
	60	960	60	780
	75	975	75	800

Including Children Indicators

Consider the case of the indicator four: sick children under five health facility visits. As stated in Appendix II, the following number of children would be necessary to detect the stipulated minimum differences, under the previously mentioned general assumptions:

Table 8: *Sample size requirements for sick children HF visits in last month*

		Per treatment		1 Treatment + Control Groups		
		N° Health Facilities	N° Sick Children	N° Health Facilities	N° Sick Children	N° Children
Number of Sick Child (<5 years) HF Visits in last 4 weeks	Scenario A MDD: 0.15	10	72	20	1440	3600
		15	36	30	1080	2700
		20	25	40	1000	2500
		25	19	50	950	2375
	Scenario B MDD: 0.2	10	30	20	600	1500
		15	18	30	540	1350
		20	13	40	520	1300
		25	10	50	500	1250
	Scenario C MDD: 0.1	10	14766	20	295320	738300
		15	162	30	4860	12150
		20	82	40	3280	8200
		25	55	50	2750	6875

The column of N° of children is calculated according to Rwanda's data, for which one in every 2.5 children was sick in the last month.

If we sampled mothers that had children in the last two years, for example, we will have almost the same amount of children under 2 years easily detected in those households (discrepancies may occur in the case of children that die or live no longer in the mother's household).

In case we consider scenario A, with 20 health facilities (10 treated and 10 in control group), the number of sick children required would be 1440, that according to Rwanda's 2008 survey, it would demand 3600 children. In the Table 9, we show the case in which 1060 of those children come from the households' whose mothers where surveyed. Then, to obtain a more representative sample, the suggested number or children per age is stated. On the other hand, Sample 2 would contain the same amount of children per age (under 5).

Table 9: *Distribution of the sample among children under five*

Age	Sample 1	Sample 2
0-1	1060	720
1-2		720
2-3	845	720
3-4	845	720
4-5	845	720

Appendix I. Indicators for Mothers in detail

For each of the three indicators concerning mothers, the figures of the three scenarios are first presented, using 2006 baseline mean level and standard deviation, and the average 2006-2008 intra-class correlation.

The following results are exposed per treatment arm. So, the number of members per group must be multiplied by different-treatments' types times, to obtain the total number of members. If there is one treatment and one control group, the results should be multiplied by two. In all the cases, the sample refers to women who had children/were pregnant after treatment.

Scenario A is the closest to the gain observed in Rwanda's data (except for the case of tetanus shot).

Table A.I.1 : *Scenarios – Different Minimum Detectable Differences*

Indicator	Baseline Level - RW '06-	Scenario	Minimum Detectable
In-Facility Births for last birth	45.02%	Scenario A	0.1
		Scenario B	0.2
		Scenario C	0.05
Times received PNC	2.623	Scenario A	10%
		Scenario B	15%
		Scenario C	5%
Tetanus shot during PNC	69.25%	Scenario A	0.1
		Scenario B	0.15
		Scenario C	0.05

Figure A.I.1: *Groups and Members per Group for In-Facility Births for last birth.*

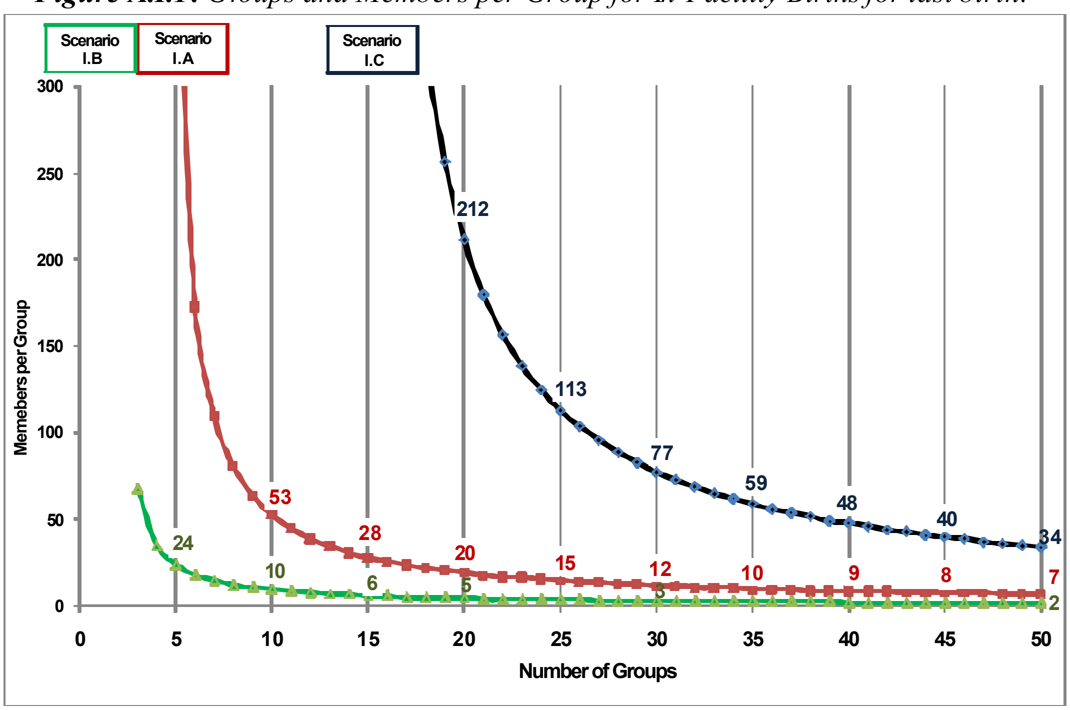


Figure A.I.2: *Groups and Members per Group for Times Received Pre-Natal Care. Scenarios I.A, I.B and I.C*

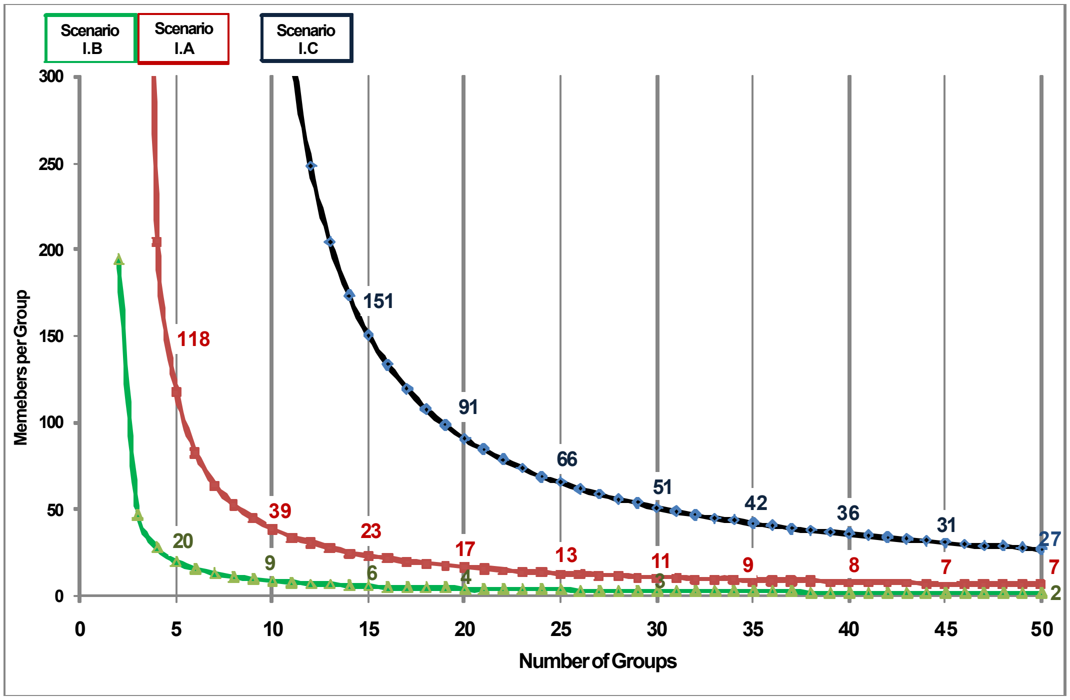
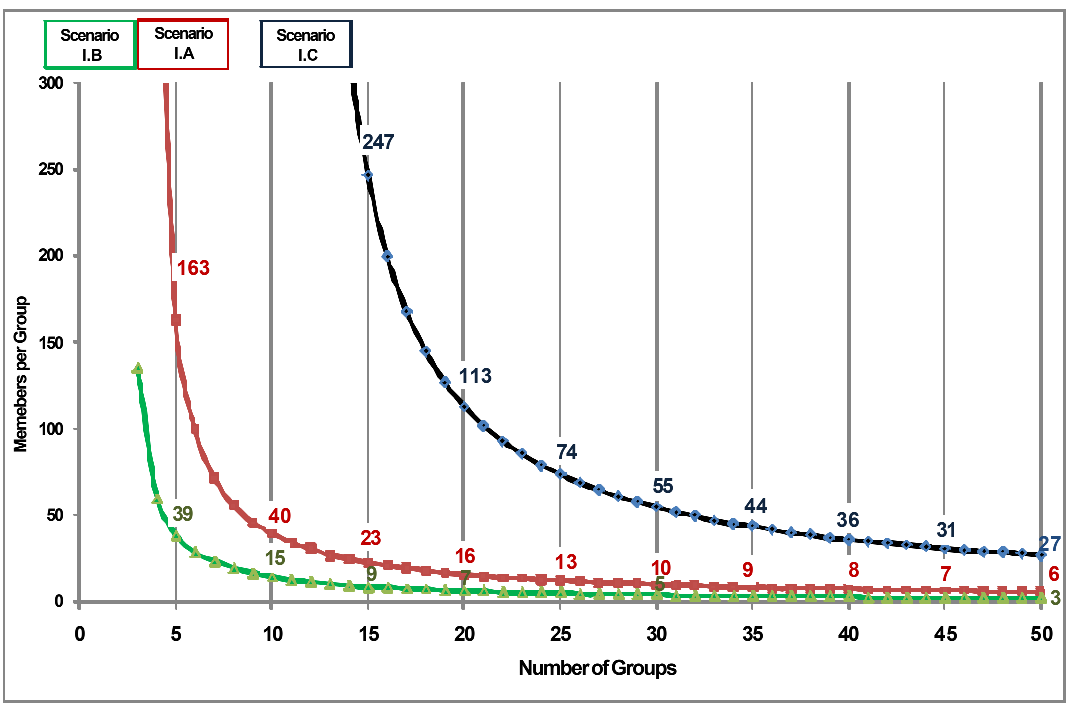


Figure A.I.3: *Groups and Members per Group for Tetanus Shot during PNC*

Scenarios I.A, I.B and I.C



In the following Table, all the members per group required are presented, for the three indicators, considering scenarios A, B, and C, with average ICC

***Table A.I.2:** Detailed results for Scenarios A, B and C –Avg. ICC*

Groups per Condition	Members per Groups for Different Scenarios and Indicators - Avg. ICC 2006/8								
	In-Facility Births of Last Birth			Times Received PNC			Tetanus shots during PNC		
	Scenario III.C	Scenario III.A	Scenario III.B	Scenario III.C	Scenario III.A	Scenario III.B	Scenario III.C	Scenario III.A	Scenario III.B
	MDD: 0.05	MDD: 0.1	MDD: 0.2	MDD: 5%	MDD: 10%	MDD: 20%	MDD: 0.05	MDD: 0.1	MDD: 0.15
2						195			
3			68		892	47			136
4			35		205	28		469	60
5		419	24		118	20		163	39
6		173	18		83	16		100	29
7		110	15		64	13		72	24
8		81	12	1967	53	11		56	20
9		64	11	720	45	10		46	17
10		53	10	442	39	9		40	15
11		45	9	319	34	8	4706	34	13
12		39	8	249	31	7	851	31	12
13		35	7	205	28	7	468	27	11
14		31	7	174	25	6	323	25	10
15	1679	28	6	151	23	6	247	23	9
16	703	26	6	134	22	5	200	21	9
17	445	24	5	120	20	5	168	20	8
18	325	22	5	108	19	5	145	18	8
19	257	21	5	99	18	5	127	17	7
20	212	20	5	91	17	4	113	16	7
21	180	18	4	85	16	4	102	15	7
22	157	17	4	79	15	4	93	14	6
23	139	17	4	74	14	4	86	14	6
24	125	16	4	69	14	4	79	13	6
25	113	15	4	66	13	4	74	13	6
26	104	14	4	62	13	3	69	12	5
27	96	14	3	59	12	3	65	11	5
28	89	13	3	56	12	3	61	11	5
29	83	13	3	54	11	3	58	11	5
30	77	12	3	51	11	3	55	10	5
31	73	12	3	49	11	3	52	10	4
32	69	11	3	47	10	3	50	10	4
33	65	11	3	45	10	3	47	9	4
34	62	11	3	44	10	3	45	9	4
35	59	10	3	42	9	3	44	9	4
36	56	10	3	41	9	3	42	8	4
37	54	10	3	39	9	3	40	8	4
38	52	9	3	38	9	2	39	8	4
39	49	9	3	37	8	2	37	8	4
40	48	9	2	36	8	2	36	8	4
41	46	9	2	35	8	2	35	7	3
42	44	9	2	34	8	2	34	7	3
43	43	8	2	33	8	2	33	7	3
44	41	8	2	32	7	2	32	7	3
45	40	8	2	31	7	2	31	7	3
46	39	8	2	30	7	2	30	7	3
47	37	8	2	29	7	2	29	6	3
48	36	7	2	29	7	2	29	6	3
49	35	7	2	28	7	2	28	6	3
50	34	7	2	27	7	2	27	6	3

As per Table A.I.2, in the first and third indicators, there is a change in the ICC between 2006 and 2008. In the following table, the scenario A (baseline) is presented for all the ICC tried: 2006, 2008 and their average. Notice that when the number of groups is more than 15, differences dissipate.

Notice that keeping the variance of 2006, but increasing (reducing) the ICC, makes a redistribution of the variance between its individual and group component; giving more (less) weight to the group effect and less (more) to the individual effect.

Table A.I.3: *Scenario A for the three ICC variants*

Groups per Condition	Members per Groups for Baseline Scenario - Every ICC						
	In-Facility Births of Last Birth			PNC	Teatanus Shot during PNC		
	Scenario III.A	Scenario II.A	Scenario I.A	Scenario I.A	Scenario III.A	Scenario II.A	Scenario I.A
	ICC 2006	ICC 2008	Avg. ICC	ICC	ICC 2006	ICC 2008	Avg. ICC
2							
3				**892**	2001		
4	577			**205**	216		**469**
5	194		**419**	**118**	116	275	**163**
6	117	323	**173**	**83**	80	132	**100**
7	84	155	**110**	**64**	61	87	**72**
8	66	102	**81**	**53**	50	65	**56**
9	54	76	**64**	**45**	42	52	**46**
10	46	61	**53**	**39**	36	44	**40**
11	40	51	**45**	**34**	32	38	**34**
12	36	44	**39**	**31**	28	33	**31**
13	32	38	**35**	**28**	26	29	**27**
14	29	34	**31**	**25**	24	26	**25**
15	27	31	**28**	**23**	22	24	**23**
16	24	28	**26**	**22**	20	22	**21**
17	23	26	**24**	**20**	19	20	**20**
18	21	24	**22**	**19**	18	19	**18**
19	20	22	**21**	**18**	16	18	**17**
20	19	21	**20**	**17**	16	17	**16**
21	18	19	**18**	**16**	15	16	**15**
22	17	18	**17**	**15**	14	15	**14**
23	16	17	**17**	**14**	13	14	**14**
24	15	16	**16**	**14**	13	13	**13**
25	15	16	**15**	**13**	12	13	**13**
26	14	15	**14**	**13**	12	12	**12**
27	13	14	**14**	**12**	11	12	**11**
28	13	14	**13**	**12**	11	11	**11**
29	12	13	**13**	**11**	10	11	**11**
30	12	13	**12**	**11**	10	10	**10**
31	11	12	**12**	**11**	10	10	**10**
32	11	12	**11**	**10**	9	10	**10**
33	11	11	**11**	**10**	9	9	**9**
34	10	11	**11**	**10**	9	9	**9**
35	10	11	**10**	**9**	9	9	**9**
36	10	10	**10**	**9**	8	9	**8**
37	10	10	**10**	**9**	8	8	**8**
38	9	10	**9**	**9**	8	8	**8**
39	9	9	**9**	**8**	8	8	**8**
40	9	9	**9**	**8**	7	8	**8**
41	9	9	**9**	**8**	7	8	**7**
42	8	9	**9**	**8**	7	7	**7**
43	8	8	**8**	**8**	7	7	**7**
44	8	8	**8**	**7**	7	7	**7**
45	8	8	**8**	**7**	7	7	**7**
46	8	8	**8**	**7**	7	7	**7**
47	7	8	**8**	**7**	6	7	**6**
48	7	8	**7**	**7**	6	6	**6**
49	7	7	**7**	**7**	6	6	**6**
50	7	7	**7**	**7**	6	6	**6**

Appendix II. Indicators for Children

A. II. 1 Number of Sick Child HF Visits in last 4 weeks

We use the data of 2006 as the baseline parameters to perform the power calculations:

Table A.II.1 : *2006 baseline data for power calculations*

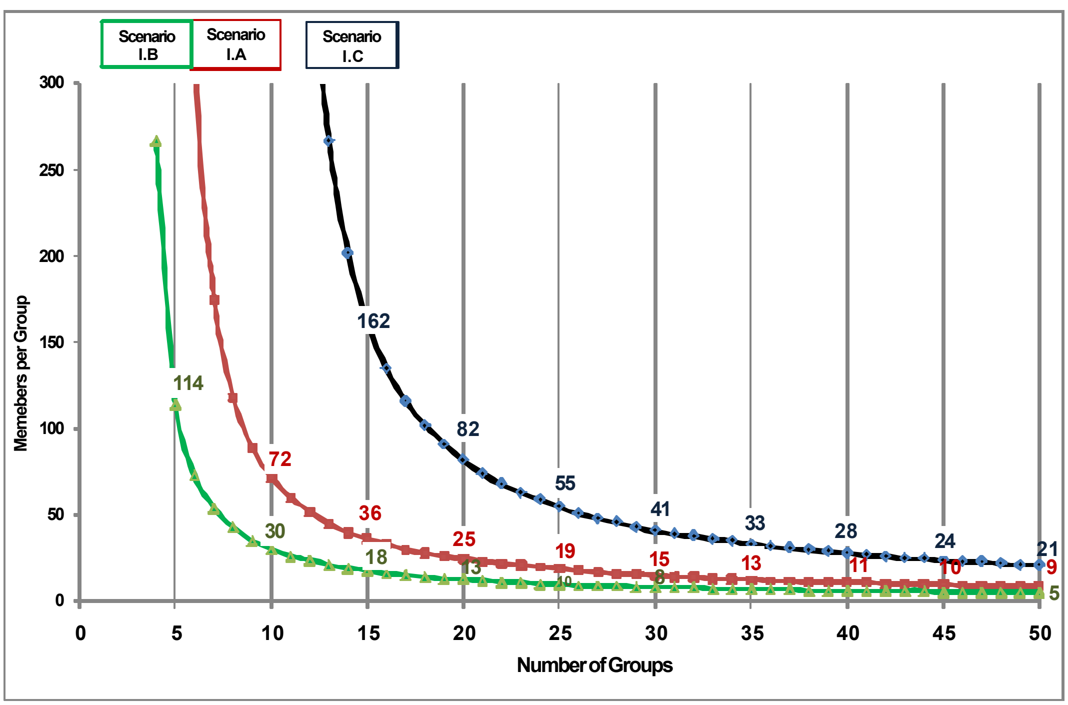
Variable	Mean	Std. Dev	Intraclass Correlation
Number of Sick Child (<5 years) HF Visits in last 4 weeks	0.382	0.819	0.013

There are three alternative Scenarios contemplated in this analysis, corresponding to different assumptions regarding the minimum detectable differences (MDD) in the outcome of interest:

Scenario I.C	Scenario I.A	Scenario I.B
MDD: 0.1	MDD: 0.15	MDD: 0.2

The increase between 2006 and 2008 observed for Rwanda was 0.16, so our baseline Scenario is I.A that assumes MDD: 0.15.

Figure A.II.1 : *Groups and Members per Group for Sick Child HF Visits. Scenarios I.A, I.B and I.C – Avg. ICC*



In the case of this indicator, the members refer to sick children under five. So, if this indicator were to be included in the new program, there should be special care in the selection of households, because not only do we have to take into account the amount of children that live in each household, but also if there are children that were sick in the last month.

For example, in the case of Rwanda database, both for 2006 and 2008, the percentage of sick children in the last months to children sampled is about 40%. Then, if this were indicative of the number of children we have to survey to find sick children in the lapse required, the sample sizes provided should be multiplied by 2.5 to interpret them as the number of children surveyed. To have the sample sizes per household, we need to set assumptions about the households' composition (according to Rwanda sample, there are 1.5 children under 5 per household).

Table A.II.2: *Groups and Members per Group for Sick Child HF Visits. Scenarios A – Every ICC*

Groups per Condition	Sick Child HF Visits		
	Scenario III.A	Scenario II.A	Scenario I.A
	ICC 2006	ICC 2008	Avg. ICC
4		2106	
5		300	**9113**
6	1234	163	**342**
7	277	112	**175**
8	157	86	**118**
9	109	70	**89**
10	84	59	**72**
11	68	51	**60**
12	58	44	**52**
13	50	40	**45**
14	44	36	**40**
15	39	33	**36**
16	36	30	**33**
17	32	28	**30**
18	30	26	**28**
19	28	24	**26**
20	26	23	**25**
21	24	22	**23**
22	23	20	**22**
23	21	19	**21**
24	20	18	**20**
25	19	18	**19**
26	18	17	**18**
27	17	16	**17**
28	17	16	**16**
29	16	15	**16**
30	15	14	**15**

In the previous table, we can see that again, as in the case of the indicators for mothers, the number or children required is the same one the amount of groups are more than 15.

We use the data of 2006 as the baseline parameters to perform the power calculations:

A.II. 2. Incidence of Child Diarrhea in last 4 weeks

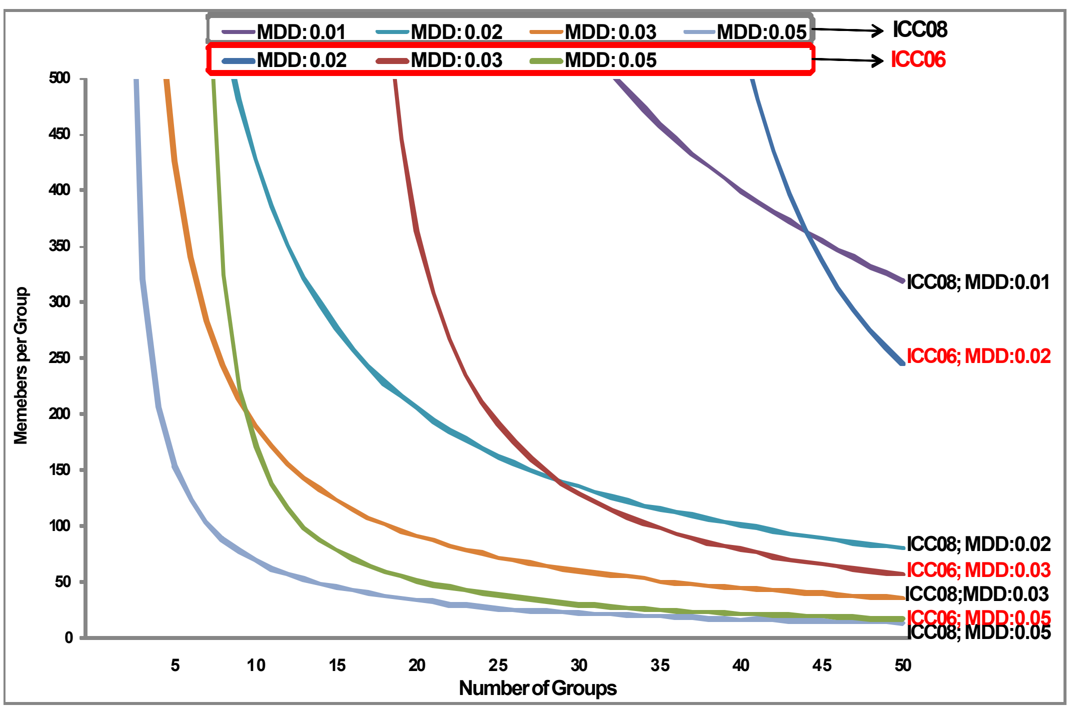
Table A.II.3 : *2006 baseline data for power calculations*

Variable	Mean	Std. Dev	Intraclass Correlation
Incidence of Child (<5 years) Diarrhea in last 4 weeks	15.11%	0.382	0.007

According to the data from Rwanda, this indicator showed a difference of 0.0022 between 2006 and 2008: it declined from 15.11% to 14.89%. Such a subtle reduction cannot be detected for the assumptions stated about power and significance level, using neither ICC_{2006} nor ICC_{2008} (that is equal to zero, the minimum possible value, meaning no group effect).

Using ICC_{2008}, the minimum detectable difference is of 1 p.p. and requires astronomical sample sizes. If we assume MDD of 2 p.p., the minimum sample size (if there are two treatment status) is 7900, and drops to 3500 when detecting a decrease of 3 p.p. This sample size refers to children less than 5 years old, so depending on the assumptions about the composition of households; we could estimate the household's sample size.

Figure A.II.2: *Groups and Members per Group for Incidence in Diarrhea in Children. Different ICC and MDD*



Consider that in this case the sample size refers to number of children less than 5 years old. Then, if we set assumptions about the number of children of that age per household, we could convert these sample size requirements in terms of that unit. In the case of Rwanda, there are on average 1.5 children under five per household.

Table A.II.4: *Groups and Members per group for different ICC and MDD Assumptions*

N° of groups (if 2 cond.)	Groups per Condition	Incidence of Diarrhea in Children						
		ICC 2006			ICC 2008			
		MDD: 0.02	MDD: 0.03	MDD: 0.05	MDD: 0.01	MDD: 0.02	MDD: 0.03	MDD:0.05
4	2				20091	5023	2233	804
6	3				7982	1996	887	320
8	4				5146	1287	572	206
10	5				3832	958	426	154
12	6			4081	3062	766	341	123
14	7			600	2554	639	284	103
16	8			325	2192	548	244	88
18	9			223	1921	481	214	77
20	10			170	1710	428	190	69
22	11			137	1541	386	172	62
24	12			115	1402	351	156	57
26	13			99	1287	322	143	52
28	14			87	1189	298	133	48
30	15		4314	78	1105	277	123	45
32	16		1360	70	1032	258	115	42
34	17		808	64	968	242	108	39
36	18		575	59	912	228	102	37
38	19		446	55	862	216	96	35
40	20		364	51	817	205	91	33
50	25		191	38	648	162	72	26
60	30		129	30	537	135	60	22
70	35	1351	98	25	459	115	51	19
80	40	539	79	21	400	100	45	16