

SUPPLEMENTARY INFORMATION APPENDIX

Early changes in intervention coverage and mortality rates following the implementation of an integrated health system strengthening intervention in Madagascar

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Appendix S1 – Detailed description of interventions in Ifanadiana District

1. HSS Intervention carried out by PIVOT (based on the TIDieR template)

1. BRIEF NAME
Integrated health system strengthening initiative in Ifanadiana district, Madagascar
2. WHY
GOAL/RATIONALE: To create a model public health district with universal access to care aiming for broad-based population health impact on mortality. Based upon the World Health Organization’s building blocks of Health System Strengthening: 1) service delivery; 2) health workforce; 3) health information systems; 4) medicines and supplies; 5) financing; 6) leadership.
WHAT
<p>3. MATERIALS (by level of care and above enumerated building blocks)</p> <p>At district hospital level</p> <p>(1) <u>Service delivery</u>: Overall infrastructure upgrades and outfitting for service delivery, bringing inpatient bed capacity from 25 to 40, upgrades to waste management system, specific renovations of the emergency and triage department, pediatric unit, inpatient ward, isolation ward, and laboratory; support to specific service delivery, including emergency care and provision of a network of 3 ambulances with 24/7 coverage and 9 PIVOT paramedics for referrals; maternal and obstetrical care; laboratory service (staffing and equipment upgrades meant tuberculosis could be diagnosed in the district again); social support for vulnerable patients.</p> <p>(2) <u>Health workforce</u>: Staffing of health workers to reach MoH norms through joint PIVOT-MoH hires of 7 clinicians, including a trauma surgeon and an anesthesiologist; staffing supplemented further with fulltime presence of 2 PIVOT doctors and 2 nurses by end of 2016; non-clinical PIVOT staff including a team of 4 social workers, support staff (janitors, guards, etc.), a laboratory technician, and a radiology technician; ongoing mentorship and frequent trainings of medical staff in key clinical areas, such as emergency medicine and postoperative care.</p> <p>(3) <u>Health information systems</u>: Creation of a hospital-based M&E team to follow progress of activities and improve quality of HMIS data; implementation of a system for baseline and follow-up facility readiness surveys.</p> <p>(4) <u>Medicines and supplies</u>: Supply chain management and reduction of stock-outs, initially through frequent donations which evolved into a reimbursement program paired with pharmacy management training; provision of medical and non-medical equipment for service delivery, including full laboratory capacity.</p> <p>(5) <u>Financing</u>: Cost of outpatient and inpatient care fully covered for patients referred by district-wide health centers and self-referred patients who necessitated urgent inpatient care (more than 5,300 patients by the end of 2016); cost of referral to and care at higher levels of care (e.g. university hospital) fully covered for services not available at district hospital.</p> <p>(6) <u>Leadership</u>: Creation of a joint PIVOT-MoH executive committee for hospital management and transparency; creation of sub committees for specific projects such as infection control or quality of care.</p> <p>At health center level</p> <p>(1) <u>Service delivery</u>: Overall infrastructure renovations and/or extensions for service delivery at the 4 target health centers, including ensuring electricity, water, waste management/sterilization capacity, proper pharmacy conditions; provision of medical and non-medical equipment, including beds, armoires, furniture; support to launching specific service delivery of Integrated Management of Childhood Illnesses and malnutrition protocols for every child under 5 attending the health center; ensuring timely referrals and emergency care.</p> <p>(2) <u>Health workforce</u>: Staffing through joint MoH-PIVOT hires to bring all 13 primary care health centers up to MoH norms (1 doctor, 1 nurse, 1 midwife, 1 dispenser, 1 support staff at each facility); at target health facilities, hiring exceeded norms and PIVOT clinicians were permanently present (~2 clinicians per health center) to implement service delivery protocols (IMCI, malnutrition); by end of 2016, there were 42 joint MoH-PIVOT hires, comprising 58% of total MoH health center staff in the district; trainings for medical staff (some district-wide) such as obstetrical and neonatal care; ongoing supervision and mentorship in target</p>

centers for IMCI and malnutrition.

(3) Health information systems: Joint MoH-PIVOT training and supervision to improve HMIS data quality (district-wide); implementation of system for baseline and follow-up of facility readiness surveys.

(4) Medicines and supplies: Supply chain management and reduction of stock-outs, initially through frequent donations which evolved into a reimbursement program paired with pharmacy management training.

(5) Financing: Essential medicines and consumables provided free of charge to all patients (more than 60,000 patients between October 2014 launch and end of 2016); full details of this program are available at [1].

(6) Leadership: Close collaboration with district health managers for the planning and implementation of activities.

At community level

(1) Service delivery: Construction of 21 community health posts; specific service delivery in Integrated Management of Childhood Illnesses and malnutrition protocols for every child under 5, community sensitization and mass testing, urgent care, and mobile clinics with direct care provision by PIVOT clinicians every other month.

(2) Health workforce: Training, coaching and monthly supervision of ~40 community health workers by mobile teams of trained nurses by the end of 2016 (6 nurses for ~40 health workers); community IMCI training provided for CHWs in all 13 communes.

(3) Health information systems: Joint MoH-PIVOT training to improve HMIS data quality on community health.

(4) Medicines and supplies: Monthly provision and follow-up of MNCH medicine stocks, including malaria diagnosis and treatment, oral rehydration salts, NSAIDS, antibiotics and zinc.

(5) Financing: cost of MNCH medicine stocks fully covered; financial and non-financial incentives to community health workers and local leadership.

(6) Leadership: Community engagement and participation (e.g. community health posts are built by the community, with PIVOT support for roofing, painting, furniture and equipment).

4. PROCEDURES

All interventions were aimed at fulfilling existing Madagascar Ministry of Health protocols and standards.

5. WHO PROVIDED

At district hospital level

Ministry of Health clinicians provided the majority of service delivery. PIVOT clinicians are integrated in the hospital staff and provide direct care as any other clinician during external consultations and clinical rounds, but also carry out frequent training. Non-clinical PIVOT staff provided social support to vulnerable patients, helped manage the patient circuit to benefit from fee exemptions (registration, validation).

At health center level

Ministry of Health doctors and nurses provided the majority of service delivery. By MoH norms each health center (CSB2) should have 1 doctor, 1 nurse, 1 midwife, 1 dispenser, and 1 support staff. Additional PIVOT clinicians (~2 per health facility) provided some direct care, especially for the implementation of malnutrition and IMCI protocols, but focused mostly on training and supervision.

At community level

Two community health workers per fokontany (a cluster of villages, lowest administrative unit) provided basic MNCH care, supervised monthly by the clinicians of their respective health center. PIVOT mobile teams of nurses provided on-site mentoring and supervision of CHWs every two months. They also provided direct care at community level during on-site supervisions for fokontany located >10 kilometers from a health center.

6. HOW (modes of delivery)

PIVOT employees worked in partnership with existing networks of MoH clinicians and community health workers within existing public health facilities. Wherever possible, such as in the case of supply chain management, leadership, and financing- the intervention deliberately avoids the creation of parallel systems

of care.
7. WHERE
<p>At district hospital level</p> <p>The initial PIVOT catchment area comprised the only district hospital, located in Ifanadiana city. Most referrals to higher levels of care (tertiary) were sent to the university hospital in Fianarantsoa (2h away by car), and some to specialized facilities in Antananarivo (capital, ~1 day by car).</p> <p>At health center level</p> <p>Full health center activities were implemented in the health centers of the four communes closest to the hospital on the district's sole paved road (i.e. Ranomafana, Kelilalina, Ifanadiana, Tsaratanana); all 13 health centers in the district received trainings, staffing support to reach MoH norms, and some access to the referral network (limited by accessibility).</p> <p>At community level</p> <p>By 2016, community activities had been rolled out in 21 fokontany from two out of the four communes within the PIVOT catchment area (out of a total of 195 total fokontany in the district).</p>
8. WHEN AND HOW MUCH
<p>All interventions were progressively rolled out during the study period.</p> <p>The earliest intervention activities implemented (starting in April-May 2014, at the beginning of the study period) included the ambulance network, staffing of health centers and district hospital, and provision of medical equipment.</p> <p>The renovation of health centers also began in April-May 2014 but the date of completion varied for each health facility.</p> <p>The renovation of the emergency and triage unit and pediatric guard at the district hospital were completed by early 2016.</p> <p>Removal of user fees at health centers and hospital began in October of 2014.</p> <p>Implementation of IMCI and malnutrition protocols at all health centers began in October 2015.</p> <p>Community-level activities began in November 2015.</p>
9. TAILORING
N/A
10. MODIFICATIONS
N/A; The intervention is progressively being implemented, as explained in section 8 (when and how much)
HOW WELL
N/A; The aim of this study was to study the evolution of intervention coverage in Ifanadiana District. Full details of the impact assessment are available in the main text.

2. World Bank project “PAUSENS”

The project “Emergency Support to Critical Education, Health and Nutrition Services” (PAUSENS), funded by the World Bank, was implemented in 5 out of 22 regions of Madagascar to provide critical services to vulnerable populations. While the project included multiple interventions to improve nutrition, education and health (full details are available at [2]), the intervention most relevant to this study was a financial program aimed at improving access to health care for children under 5 and pregnant women. The program provided a basic package of services free of charge at the health facility level for these vulnerable groups to remove out-of-pocket spending, through a voucher reimbursement system managed by three local NGOs in Ifanadiana (Taratra, Maintso an’Ala and Cafed/Fafed). The project also included trainings, support for child vaccination in remote areas, and donations to health centers to improve health care quality such as furniture, medical equipment, cellphones or solar-powered refrigerators.

The basic package of services for pregnant women, from antenatal to postnatal care, included: prevention of mother-to-child transmission, treatment of syphilis, prevention and treatment of HIV/AIDS, supplementation with iron and folic acid, tetanus vaccination, intermittent preventive medication against malaria, and distribution of safe delivery kits. The basic package for children under 5 included: activities to promote good practices, breastfeeding and nutrition, Vitamin A supplementation, vaccinations, distribution of bed nets, treatment of diarrhea, prevention and treatment of malaria, and support to integrated management of childhood illness (IMCI), covering the full cost of treatments. Implementation of the program in Ifanadiana started in February 2014 and covered all thirteen CSB2s in the district. In each of these CSB2s, every woman attending the health center for antenatal, delivery or postnatal care (first 6 weeks), or for any children under five illness would receive a voucher from an agent. After consultation, medicines prescribed by MoH health staff that were included in the program would then be provided free of charge through this voucher.

3. USAID Mikolo project

The Mikolo project, funded by USAID, was implemented in 8 out of 22 regions of Madagascar to provide support to a network of more than 5,000 community health workers (CHWs) in Fokontany located further than 5 kilometres from a health center [3]. By Ministry of Health norms, every Fokontany should have two CHWs, who provide services related to maternal and child health. All the CHWs of a commune are supervised monthly by the corresponding health center (CSB2). While CHWs do not receive a salary, they make a profit from a small margin in the sale of medicines. Each CHW is responsible of buying their own medicines and managing their stocks, buying them from public providers (e.g. health centers) or private providers (e.g. PSI or other local NGOs). The Mikolo project supported this system by providing i) formal training and certification every year; ii) frequent coaching and mentorship; iii) performance monitoring, evaluation and supervision at the health facility; iv) job aids, equipment, supplies, and an initial stock of products and medicines.

Implementation of this project in Ifanadiana started in 2014 and covered approximately 150 CHWs in 8 communes, four in PIVOT catchment and four in the rest of the district. Activities in the district were carried out by the local NGO “Ny Ainga”, who assigned one technical assistant (clinical or non-clinical staff) to every two communes (~15-35 CHWs), with a total of 4 assistants for the

district. A regional Mikolo coordinator for Vatovavy Fitovinany supervised the work of the local NGOs in Ifanadiana and the other districts in this region.

Appendix S2 - Methodological details

1. Per capita utilization rates using population estimates from Worldpop

We carried a complementary analysis of per capita utilization rates in all 13 major primary health centers in Ifanadiana using information from WorldPop to address potential biases associated with official MoH population estimates. For this, we obtained from the WorldPop website (<http://www.worldpop.org.uk/>) available spatial layers for Madagascar on number of people, children under age 5, pregnancies and births for the years 2010 and 2015 [4–6]. Using spatial polygons available for each of the health centers' catchment area, we extracted total catchment populations of all these categories, with the “extract” function available in R package “raster”. Then, we calculated the annual population growth rate between 2010 and 2015 and used these to estimate catchment populations for each year. Populations per year for each indicator were then used to estimate per capita utilization rates for all patients, children under five, pregnant women and births, and the rest of the analysis was performed as explained in the main text. Results from this analysis were consistent with results using MoH estimates (Table S1).

2. Estimation of the Composite Coverage Index (CCI)

Following methods developed by the Countdown to 2015 initiative, the CCI is defined as the weighted average of eight preventive and curative interventions for maternal and child health along the continuum of care [7]. The interventions are: (1) family planning interventions (FPC); (2) births attended by a skilled professional (SBA); (3) antenatal care (at least one visit to a skilled provider, ANC1); (4) bacille Calmette–Guérin (BCG) vaccination; (5) three diphtheria–tetanus–pertussis vaccinations (DTP3); (6) measles vaccination (MSL); (7) oral rehydration therapy for infant diarrhoea (ORT); and (8) care-seeking for childhood pneumonia (CAREP). The index, CCI, is calculated according to the formula:

$$CCI = \frac{1}{4} \left(FPC + \frac{SBA + ANC1}{2} + \frac{2xDTP3 + BCG + MSL}{4} + \frac{ORT + CAREP}{2} \right)$$

Since our 2014 survey did not include information about family planning, we excluded this intervention from the estimation of the CCI and reweighted the formula as follows:

$$CCI = \frac{1}{3} \left(\frac{SBA + ANC1}{2} + \frac{2xDTP3 + BCG + MSL}{4} + \frac{ORT + CAREP}{2} \right)$$

3. Analysis of coverage trends controlling for wealth and proximity to the paved road

In addition to the analysis of coverage trends in Ifanadiana presented in the main text, we carried-out a separate analysis to explore whether the different trends seen in each area could have been driven by changes in wealth or proximity to the paved road. For this, we first estimated the Euclidean distance of each survey cluster (twenty households) to the nearest health center and we created a dummy variable to classify households as being within 5km or further. We also estimated the wealth scores of each household in 2016 using the variable weights from the 2014 Principal Component Analysis of durable assets, to obtain consistent wealth scores for each household and the evolution of wealth over time. Second, we carried out a multivariate difference-in-difference analysis that included the wealth and distance variable. Model estimates for each indicator were predicted at the mean values of these two variables for the District during the study period. DiD estimates and associated p-values were consistent with results presented in the main text (Table S1).

Appendix S3 – Supplementary tables

Table S1. Changes in health system coverage in PIVOT catchment and the rest of Ifanadiana District (RoD) after controlling for wealth and proximity to the main paved road

		2014		2016		Trends		
Indicator	Catchment	% Coverage (SE)	PIVOT vs RoD (p-val)	% Coverage (SE)	PIVOT vs RoD (p-val)	Relative change (%)	Absolute change (%)	2014-2016 PIVOT vs RoD (p-val)
Composite MNCH indicator								
Composite coverage index ¹	PIVOT	40,3	-	54,84	-	36,07	14,54	-
	RoD	47,96	-7,66	49,48	5,36	3,17	1,52	-
Children								
All vaccines (12-23 months)	PIVOT	27.35 (6.01)	-	38.22 (6.01)	-	39,73	10,87	-
	RoD	38.86 (6)	-11,51	42.69 (6)	-4,47	9,85	3,83	7,04
Oral rehydration therapy for diarrhea (<5 years)	PIVOT	27.13 (6.37)	-	51.2 (6.37)	-	88,74	24,07	-
	RoD	33.83 (5.92)	-6,71	21.01 (5.92)	30.19 ***	-37,9	-12,82	36.89 **
Care seeking for fever (<5 years)	PIVOT	50.31 (7.13)	-	72.07 (7.13)	-	43,27	21,77	-
	RoD	41.95 (3.99)	8.36 *	36.62 (3.99)	35.45 **	-12,69	-5,32	27.09 *
Care seeking for ARI (<5 years)	PIVOT	31.75 (5.8)	-	51.85 (5.8)	-	63,29	20,1	-
	RoD	39.78 (4.46)	-8,03	40.17 (4.46)	11.68 *	0,96	0,38	19.71 *
Maternal care (last birth last 2 years)								
Antenatal care (1+ visit with skilled provider)	PIVOT	62.35 (6.78)	-	74.16 (6.78)	-	18,94	11,81	-
	RoD	76.12 (3.7)	-13,77	86.33 (3.7)	-12,17	13,42	10,21	1,6
Antenatal care (4+ visits with skilled provider)	PIVOT	27.85 (5.61)	-	37.68 (5.61)	-	35,3	9,83	-
	RoD	33.36 (3.87)	-5,51	44.89 (3.87)	-7,21	34,56	11,53	-1,7
Birth delivered at public health center	PIVOT	10.18 (2.84)	-	22.35 (2.84)	-	119,5	12,17	-
	RoD	19.87 (3.53)	-9,69	25.14 (3.53)	-2.79 *	26,55	5,27	6,89
Birth delivered by cesarian section	PIVOT	2.56 (5.02)	-	8.41 (5.02)	-	228,5	5,85	-
	RoD	5.88 (3.3)	-3,32	6.77 (3.3)	1.65 *	15,05	0,89	4,97
Postnatal care (within 48h with skilled provider)	PIVOT	12.21 (3.06)	-	21.26 (3.06)	-	74,09	9,05	-
	RoD	20.92 (4.18)	-8,7	23.19 (4.18)	-1.93 *	10,86	2,27	6,78
All household members								
Household care seeking for illness last 4 weeks	PIVOT	22.1 (3.05)	-	27.24 (3.05)	-	23,24	5,14	-
	RoD	30.56 (2.96)	-8,45	33.51 (2.96)	-6,27	9,66	2,95	2,18

.p<0.1 *p<0.05 **p<0.01 ***p<0.001; ¹Modified CCI; does not include family planning

Table S2. Patterns of wealth inequality in health system coverage in PIVOT catchment population between 2014-2016.

Indicator	Wealth Quantile	2014			2016			Trends		
		% Coverage (SE)	Relative inequality (RCI)	Absolute inequality (SII)	% Coverage (SE)	Relative inequality (RCI)	Absolute inequality (SII)	Relative change (%)	Relative inequality (RCI)	Absolute inequality (SII)
Composite MNCH indicator								0		
Composite coverage index ¹	Q1-Q2 (Poorest)	37,55	-	-	48,7	-	-	29,71	-	-
	Q3-Q5 (Richest)	55,01	-	-	71,94	-	-	30,76	-	-
Children										
All vaccines (12-23 months)	Q1-Q2 (Poorest)	21.15 (7.26)	-	-	38.45 (10.15)	-	-	81,84	-	-
	Q3-Q5 (Richest)	48.24 (8.53)	0,276	58,97	56.64 (8.69)	0,198	57,11	17,42	-0,078	-1,86
Oral rehydration therapy for diarrhea (<5 years)	Q1-Q2 (Poorest)	23.12 (11.4)	-	-	42.77 (8.38)	-	-	84,98	-	-
	Q3-Q5 (Richest)	37.83 (6.94)	0,167	34,01	63.74 (12.87)	0,165	53,8	68,48	-0,002	19,79
Care seeking for fever (<5 years)	Q1-Q2 (Poorest)	54 (11.53)	-	-	77.19 (16)	-	-	42,95	-	-
	Q3-Q5 (Richest)	56.66 (5.46)	0,044	14,54	78.37 (10.1)	-0,049	-21,91	38,32	-0,093	-36,45
Care seeking for ARI (<5 years)	Q1-Q2 (Poorest)	31.4 (8.49)	-	-	41.42 (13.88)	-	-	31,9	-	-
	Q3-Q5 (Richest)	46.12 (6.31)	0,073	18,06	69.51 (9.19)	0,181	63,66	50,73	0,108	45,6
Maternal care (last birth last 2 years)								0		
Antenatal care (1+ visit with skilled provider)	Q1-Q2 (Poorest)	58.88 (11.39)	-	-	74.5 (8.77)	-	-	26,53	-	-
	Q3-Q5 (Richest)	76.38 (5.27)	0,088	36,94	86.58 (4.94)	0,066	33,19	13,36	-0,022	-3,75
Antenatal care (4+ visits with skilled provider)	Q1-Q2 (Poorest)	32.34 (6.74)	-	-	28.29 (6.54)	-	-	-12,54	-	-
	Q3-Q5 (Richest)	39.55 (5.96)	0,116	25,7	57.03 (7.72)	0,251	65,57	44,18	0,135	39,87
Birth delivered at public health center	Q1-Q2 (Poorest)	3.7 (2.36)	-	-	17.71 (6.84)	-	-	378,81	-	-
	Q3-Q5 (Richest)	29.43 (5.24)	0,517	66,23	44.25 (7.27)	0,37	71,28	50,34	-0,147	5,05
Birth delivered by cesarian section	Q1-Q2 (Poorest)	0 (0)	-	-	5.77 (5.65)	-	-	NaN	-	-
	Q3-Q5 (Richest)	8.07 (4.3)	-0,041	-2,15	14.56 (8.17)	0,594	50,97	80,34	0,635	53,12
Postnatal care (within 48h with skilled provider)	Q1-Q2 (Poorest)	3.7 (2.36)	-	-	18.78 (7.56)	-	-	407,73	-	-
	Q3-Q5 (Richest)	32.6 (6.53)	0,551	75,98	42.58 (7.09)	0,351	67,1	30,6	-0,2	-8,88
All household members								0		
Household care seeking for illness last 4 weeks	Q1-Q2 (Poorest)	18.36 (2.61)	-	-	27.03 (4.88)	-	-	47,24	-	-
	Q3-Q5 (Richest)	32.17 (4.24)	0,207	35,31	35.61 (4.71)	0,125	25,22	10,68	-0,082	-10,09

.p<0.1 *p<0.05 **p<0.01 ***p<0.001; ¹Modified CCI; does not include family planning

Table S3. Complete list of coverage indicators evaluated to assess 2014-2016 changes in PIVOT catchment area and the rest of the district

Indicator	Catchment	2014		2016		Trends		
		% Coverage (SE)	PIVOT vs RoD	% Coverage (SE)	PIVOT vs RoD	Relative change (%)	Absolute change (%)	2014-2016 PIVOT vs RoD
Composite MNCH indicators								
Composite coverage index ¹	PIVOT	49.27	-	64.12	-	30.14	14.85	-
	RoD	43.16	6.1	44.86	19.26	3.93	1.69	-
Children under 5								
BCG vaccine	PIVOT	50.94 (7.66)	-	73.95 (5.88)	-	45.18	23.01	-
	RoD	55.32 (5.71)	-4.38	64.73 (5.22)	9.22	17.01	9.41	13.6
Polio vaccine (3 doses)	PIVOT	66.7 (6.4)	-	78.12 (6.25)	-	17.12	11.42	-
	RoD	55.2 (6.67)	11.5	66.31 (6.72)	11.81	20.12	11.11	0.31
DTP vaccine (3 doses)	PIVOT	67.89 (5.71)	-	71.76 (6.4)	-	5.7	3.87	-
	RoD	51.91 (6.92)	15.98	53.4 (6.97)	18.36	2.87	1.49	2.38
Measles vaccine	PIVOT	62.82 (5.56)	-	73.17 (6.95)	-	16.48	10.35	-
	RoD	54.54 (6.48)	8.28	54.84 (6.19)	18.33	0.55	0.3	10.05
All vaccines	PIVOT	37.57 (7.29)	-	50.39 (7.13)	-	34.12	12.82	-
	RoD	32.95 (6.36)	4.62	35.82 (6.22)	14.57	8.69	2.86	9.96
Vitamin A supplementation	PIVOT	71.51 (4.02)	-	70.91 (3.46)	-	-0.84	-0.6	-
	RoD	54.33 (3.52)	17.18 **	68.06 (2.75)	2.85	25.28	13.73	-14.33 *
Diarrhea last 2 weeks	PIVOT	14.63 (2.09)	-	11.66 (1.49)	-	-20.31	-2.97	-
	RoD	14.26 (1.3)	0.37	12.51 (1.45)	-0.85	-12.28	-1.75	-1.22
Care seeking for diarrhea (public health center)	PIVOT	32.37 (9.26)	-	41.29 (10.08)	-	27.56	8.92	-
	RoD	23.22 (5.56)	9.15	27.8 (5.8)	13.49	19.71	4.58	4.34
Care seeking for diarrhea (public provider)	PIVOT	39.81 (9.08)	-	62.15 (7.51)	-	56.13	22.34	-
	RoD	32.38 (6.25)	7.43	29.71 (5.92)	32.44 **	-8.24	-2.67	25.01 *
Care seeking for diarrhea (public or private provider)	PIVOT	41.64 (9.14)	-	65.09 (7.33)	-	56.34	23.46	-
	RoD	36.69 (5.88)	4.95	40.97 (5.55)	24.13 *	11.66	4.28	19.18
Oral rehydration therapy for diarrhea	PIVOT	34.42 (6.51)	-	56.5 (9.5)	-	64.15	22.08	-
	RoD	29.99 (5.59)	4.43	18.39 (4.02)	38.11 ***	-38.67	-11.6	33.68 **
Fever last 2 weeks	PIVOT	21.33 (2.3)	-	6.42 (1.03)	-	-69.9	-14.91	-
	RoD	39.83 (2.56)	-18.49 ***	16.66 (1.51)	-10.24 ***	-58.17	-23.17	8.25 *

Care seeking for fever (public health center)	PIVOT	30.36 (6.7)	-	55.45 (10.79)	-	82.61	25.08	-
	RoD	24.45 (4.37)	5.91	27.94 (5.27)	27.51 *	14.26	3.49	21.6
Care seeking for fever (public provider)	PIVOT	48.19 (5.97)	-	72.32 (9.27)	-	50.05	24.12	-
	RoD	32.29 (3.99)	15.9 *	30.89 (5.68)	41.43 **	-4.35	-1.4	25.53 *
Care seeking for fever (public or private provider)	PIVOT	55.69 (6.03)	-	78.03 (8.61)	-	40.11	22.34	-
	RoD	40.43 (3.92)	15.26 *	35.51 (5.7)	42.52 **	-12.17	-4.92	27.26 *
Antimalarial therapy for fever	PIVOT	29.9 (4.7)	-	21.12 (7.2)	-	-29.35	-8.78	-
	RoD	33.11 (3.92)	-3.21	24.54 (4.85)	-3.41	-25.9	-8.57	-0.2
ARI last 2 weeks	PIVOT	25.9 (2.72)	-	11.61 (1.55)	-	-55.17	-14.29	-
	RoD	28.77 (2.15)	-2.86	17.54 (1.89)	-5.93 *	-39.01	-11.22	-3.07
Care seeking for ARI (public health center)	PIVOT	28.51 (5.5)	-	46.49 (9.99)	-	63.1	17.99	-
	RoD	22.48 (3.89)	6.03	24.57 (4.21)	21.92 *	9.32	2.1	15.89
Care seeking for ARI (public provider)	PIVOT	37.95 (5.63)	-	56.11 (9.86)	-	47.86	18.16	-
	RoD	27.55 (4.71)	10.4	30.8 (5.08)	25.31 *	11.8	3.25	14.91
Care seeking for ARI (public or private provider)	PIVOT	41.02 (5.45)	-	61.66 (9.81)	-	50.32	20.64	-
	RoD	35.44 (4.55)	5.58	36.84 (4.83)	24.83 *	3.93	1.39	19.25 .
Maternal care								
Antenatal care (1+ visit with skilled provider)	PIVOT	70.83 (6.35)	-	82.22 (5.33)	-	16.07	11.39	-
	RoD	71.81 (3.75)	-0.98	81.93 (3.78)	0.28	14.1	10.12	1.26
Antenatal care (4+ visits with skilled provider)	PIVOT	37.27 (5.3)	-	46.66 (6.94)	-	25.18	9.39	-
	RoD	28.57 (4)	8.7	40 (5.15)	6.65	40.02	11.43	-2.05
Antenatal care (1+ visit at public health center)	PIVOT	69.29 (6.41)	-	79.26 (5.2)	-	14.39	9.97	-
	RoD	70.18 (4.29)	-0.89	77.47 (4.68)	1.79	10.39	7.29	2.68
Birth delivered by skilled provider	PIVOT	24.56 (5.37)	-	39 (7.86)	-	58.84	14.45	-
	RoD	14.89 (4.05)	9.66	18.8 (4.03)	20.21 *	26.2	3.9	10.55
Birth delivered at public health center	PIVOT	21.28 (4.33)	-	34.67 (6.75)	-	62.93	13.39	-
	RoD	13.66 (3.94)	7.62	19.05 (3.91)	15.62 *	39.46	5.39	8
Birth delivered by caesarean section	PIVOT	7.64 (4.09)	-	13.04 (7.06)	-	70.84	5.41	-
	RoD	2.4 (2.5)	5.23	1.68 (1.73)	11.36 *	-30.02	-0.72	6.13
Posnatal care	PIVOT	64.22 (6.03)	-	63.31 (5.01)	-	-1.42	-0.91	-
	RoD	63.89 (3.73)	0.33	60.84 (4.51)	2.47	-4.78	-3.05	2.14
Postnatal care (with skilled provider)	PIVOT	24.54 (5.33)	-	35.54 (6.71)	-	44.83	11	-
	RoD	17.06 (4.77)	7.48	17.98 (3.98)	17.56 *	5.36	0.91	10.09

Postnatal care (within 48h)	PIVOT	54.42 (6.38)	-	59.11 (5.17)	-	8.63	4.7	-
	RoD	57.62 (4.44)	-3.21	58.48 (4.4)	0.64	1.48	0.86	3.84
Postnatal care (within 48h with skilled provider)	PIVOT	23.45 (5.27)	-	33.99 (6.61)	-	44.97	10.54	-
	RoD	14.55 (4.65)	8.89	16.98 (3.84)	17.01 *	16.69	2.43	8.11
Postnatal care (within 24h)	PIVOT	51.54 (6.31)	-	53.81 (5.28)	-	4.42	2.28	-
	RoD	54.73 (4.18)	-3.19	55.17 (4.11)	-1.35	0.8	0.44	1.84
Postnatal care (within 24h with skilled provider)	PIVOT	22.72 (4.83)	-	32.7 (6.41)	-	43.95	9.98	-
	RoD	13.06 (3.94)	9.66	15.85 (3.56)	16.86 *	21.3	2.78	7.2
All household members								
Individual illness last 4 weeks	PIVOT	46.17 (1.69)	-	28.09 (1.43)	-	-39.16	-18.08	-
	RoD	46.83 (1.63)	-0.66	30.09 (1.25)	-2	-35.76	-16.75	-1.33
Household care seeking for illness last 4 weeks	PIVOT	28.88 (3.7)	-	33.15 (4.03)	-	14.82	4.28	-
	RoD	26.02 (2.96)	2.86	29.22 (3.84)	3.93	12.31	3.2	1.08

Indicators in black were included in the main text whereas those in grey were not

.p<0.1 *p<0.05 **p<0.01 ***p<0.001; ¹Modified CCI; does not include family planning

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