

Appendix I Study intervention

Summary description of intervention

The PBF program offers a quarterly financial reward to health facilities based on their verified delivery of a well-prioritized, high-impact package of 16 MCH services at rural health center (RHC) level, and five referral services at secondary hospital level (Tables S1 and S2).

Health facility teams can use 25% of the PBF payment for staff incentives and 75% to improve delivery and quality of health services. Incentives are divided among individuals based on a formula that gives more weight to health workers working in higher positions, having longer tenure, and assuming more direct responsibility for the incentivized services.

An internal verification process is undertaken by Cordaid, an international NGO that audits self-reported quantity data by health providers. Quarterly quality audits by the District Health Executive (DHE) and Provincial Health Executives (PHEs) verify the quality of services provided based on a standard protocol. Community-based organizations (CBOs) undertake client tracer and satisfaction surveys using a predefined instrument. Client feedback and assessment of services received constitutes 20% of the overall quality score received by a health provider in a given quarter. An external verification undertaken by the University of Zimbabwe Department of Community Medicine independently audits the reported data. At the district level, hospitals receive performance-based contracts to improve the quality of emergency

Table S1 PBF services and subsidies in rural health centers (primary level)

Indicator number	Indicator	Current price (after Sept. 2013), \$	Price before Sept. 2013, \$
1	OPD new consultations ¹	0.10/0.05	0.16
2	1st ANC Visit during first 16 weeks ²	3.00	3.00
3	ANC 4+ visits completed	3.00	3.00
4	HIV VCT in ANC	1.00	2.00
5	ARVs to HIV+ pregn. Women (PMTCT)	2.50	2.00
6	Tetanus TT2+	0.45	0.45
7	Syphilis RPR test	0.45	0.45
8	IPT (×2 doses)	0.45	0.45
9	Normal deliveries	12.50	12.50
10	High risk perinatal referrals	3.00	3.00
11	PN visits 2 or more	4.50	3.00
12.a	Family planning, short term methods	1.00	2.50
12.b	Family planning, long term methods	5.00	50.00
13	Pri. course completed, immunization	3.50	3.50
14	Vit. A supplementation	0.18	0.18
15	Growth monitoring, children <5 yrs	0.18	0.18
16	Acute Malnutrition cured & discharged children <5 yrs ³	Moved to sec level	3.00

¹, \$0.05 for peri urban/high volume; \$0.10 for other facilities. ², indicator added after the PBF technical review. ³, indicator added after the PBF technical review.

Table S2 PBF services and subsidies in district hospitals

Indicator number	Indicator	Current price (after Sept, 2013), \$	Price before Sept, 2013, \$
1	Normal deliveries ¹	12.50/25	25
2	Deliveries with complications	50	80
3	Caesarean sections	140	140
4	Family planning tubal ligations	30	30
5	High-risk per-natal referrals	3	3
6	Acute malnutrition cured & discharged children <5 yrs ²	3	

¹, normal deliveries are not supposed to be done at a hospital except for refereed complicated deliveries. For hybrid hospitals, normal deliveries are paid \$12.50 for walk in and \$25.00 for referred cases. ², indicator added after the PBF technical review.

obstetric care and district health management teams are contracted to strengthen quality of supervision. Remote facilities receive higher payments for the delivery of the package of services.

Main project components include: (I) performance-based contracts with health facilities in urban and rural areas; (II) management and capacity building in PBF; (III) monitoring and documentation; and (IV) vouchers for maternal and neonatal services in low-income urban communities.

The formula below shows how the PBF bonus is calculated for the facilities:

$$P = (1 + Q) \left\{ \sum_{i=1}^n a_i b_i + R \right\}$$

where P = PBF payment; Q = quality score; a_i = unit price for indicator I_i ; b_i = quantity achieved for indicator i ; R = remoteness bonus. Until June 2013, Q was simply the raw score on the quality index. From September 2013, Q is 0–25%, depending on the facility's score on the quality index.

In its regulatory role, the DHE monitors the performance of the health facilities (HFs), which are responsible for direct health care service delivery to communities. The DHE provides feedback and supportive supervision to HFs to enhance their skills and improve their performance. The Health Center Committee: (I) assists the HFs to manage and mobilize locally available resources from communities within an HF's catchment area; and (II) helps ensure the community has a platform to voice their input and perspectives on the project. CBOs are tasked with conducting quality and patient satisfaction surveys.

Appendix II Methodology for matching health facilities and communities

This brief paper outlines the methodology of the geographic match made between communities and health facilities (HFs) in the Zimbabwe PBF program. It explains the algorithm and its underlying assumptions and concludes with a brief explanation of the resulting dataset.

The data

The World Bank conducted a Results-Based Financing (i.e., PBF) program in Zimbabwe during 2010/2011 and 2014 (baseline and end line years). These surveys went out to treatment health facilities and nearby households, selected control districts and their respective health facilities, and households in catchment areas. No household data was collected at baseline, so the Demographic Health Survey for Zimbabwe was used in lieu of a formal, separate sample.

Matching methodology

During data cleaning, all communities without geographical data were excluded from the analysis. The algorithm then calculated the distance between each community and each health facility. Every community and health facility pair within 10 kilometers (km) of each other received an indicator

and were removed to a separate dataset. The procedure was then repeated with a radius of 20 km, this time deleting all instances of communities and health facilities that had at least one match in the 10 km search before determining which communities/health facilities were within 20 km of each other. Matches at the 20 km radial level were then appended to the 10 km dataset. These two steps were repeated once more for a 30 km radius, again eliminating all community/health facility pairs that matched in either the 10/20 km search and appending to the 10/20 km dataset, and stopped after this point.

The resulting matched dataset attempted to pair communities to their nearest health facilities, on the assumption that they will most likely frequent the health facilities closest to them. This procedure did not pair households with health facilities across district lines. The particular circumstances in Zimbabwe suggest that households will not travel to health facilities in another district, so matching them would be improper.

The reasoning behind the radial search procedure tried to balance three principles simultaneously. They were, in order of priority:

- (I) Find communities to pair with as many health facilities in our dataset as possible;
- (II) Match communities to their closest health facilities (avoid Type I error); and
- (III) Since the sample does not include every single health facility in the country, ensure we do not match communities to health facilities when they would actually go to a different, non-sampled health facility that is closer (avoid Type II error).

Type I errors would occur if we say communities do not match to a health facility when they, in fact, do. This would likely happen if we do not match a community to a “nearby” health facility, based on some measure of geographic distance. No communities more than 30 km away from a health facility will ever be matched, and the radial search brings some extra rigor to the nearest health facility principle. Type II errors occur if we say a community matches with a health facility when it in fact does not. We are fairly confident that communities within 10 km of a health facility would use that health facility, so the first radial search should be fairly error-free. The second 20 km search only searches for health facilities that do not have any communities yet paired with them. This searches over a list of communities that have not been paired up yet either. A similar procedure occurs with the 30 km search. The algorithm stops after 30 km because we assume that no community will travel more than 30 km to a health facility, at least for the services this survey addresses.

Results

These cleaning and matching procedures produced a dataset with 84 health facilities paired with 91 community centers. There were 1,740 total observations, where an observation represented most recent births to women in households within 10/20/30 km of a paired health facility.

Appendix III Questionnaire on patient satisfaction

2	Treatment and counseling		Record response
(2.01)	Do you have an antenatal-care card/book, or an immunisation card with you today? If yes: ask to see the card/book.	Yes No, card kept with facility No, card/book used	1 2 ▶ (2.06) 3 ▶ (2.06)
(2.02)	Check antenatal-care card/book, or immunisation card. Indicate whether there is any note or record of the client having received tetanus toxoid.	Yes, 1 time Yes, 2 or more times No	1 2 3
(2.03)	How many weeks pregnant is the client, according to the ANC card? In weeks	Information not available	99
(2.04)	Does the card indicate the client has received IPT? (if non malarious area, choose "not applicable")	Yes, 1 dose Yes, 2 doses No Not applicable	1 2 3 98
(2.05)	Does the card/book mention the client's blood group?	YES NO	01 02
(2.06)	How long have you been pregnant? (record months or weeks) Record 99, if not known	a. Weeks b. Months	
(2.07)	Is this your first pregnancy?	Yes No	1 2
(2.08)	Is this your first antenatal visit at this facility for this pregnancy?	Yes No	1 ▶ (2.10) 2
(2.09)	Including this visit, how many antenatal care visits have you had for this pregnancy to this health facility?		
(2.10)	How many antenatal care visits have you had for this pregnancy to other health facilities?		
(2.11)	During this visit, were you weighed?	Yes No	01 02
(2.12)	During this visit or earlier visit, was your height measured?	Yes No	01 02
(2.13)	During this visit, did someone measure your blood pressure?	Yes No	01 02
(2.14)	During this visit, did you give a urine sample?	Yes No	01 02
(2.15)	During this visit, did you give a blood sample?	Yes No	01 02
(2.16)	During this visit, did you schedule your delivery in the facility?	Yes No	01 02
(2.17)	During this visit, was your abdomen measured with a tape?	Yes No	01 02
(2.18)	During this visit, did the provider palpate your abdomen?	Yes No	01 02
(2.19)	During this visit or earlier visit, did the health worker estimate your delivery or due date?	Yes No	01 02
(2.20)	During this visit, did a health worker ask for your blood type/group?	Yes No	01 02
(2.21)	During this visit, did a health worker give you advice on your diet (this is, what to eat and drink) during pregnancy?	Yes No	01 02 ▶ (2.23)
(2.22)	What did the health worker advise you to eat during pregnancy? Do not cite answers, but for each option record "1" if mentioned, "2" if not mentioned. you may probe without using specific answers (e.g., "anything else?")	a. Green leafy vegetables b. Milk c. Meat and poultry d. Fruits and nuts e. Sadza/rice/potatoes/cassava f. Other (specify: _____)	
(2.23)	During this visit, or previous visits, did the provider give you iron pills, folic acid or iron with folic acid, or give you a prescription for them?	Yes, this visit Yes, previous visit No Don't know	1 2 ▶ (2.25) 3 ▶ (2.28) 99 ▶ (2.28)
(2.24)	Ask to see the client's iron/folic acid/iron with folic acid pills.	Saw pills Saw prescription No pills or prescription	1 2 3
(2.25)	During this visit or previous visits, has a provider explained to you how to take the iron pills?	Yes, this visit Yes, previous visit No	1 2 3
(2.26)	During this or previous visits, has a provider discussed with you the side effects of the iron pill?	Yes, this visit Yes, previous visit No	1 2 3
(2.27)	Please tell me any side effects of the iron pill that you know of. Record "1" if mentioned, "2" if not mentioned. for each option. do not read the list.	a. Nausea b. Black stools c. Constipation d. Other Specify	
(2.28)	During this or previous visits, has a provider given or prescribed any anti-malarial pills for you? Show the client capsules of Fansidar.	Yes, this visit Yes, previous visit No	1 2 3 ▶ (2.30)
(2.29)	Did a provider explain to you how to take the anti-malarial pills?	Yes, this visit Yes, previous visit No	1 2 3
(2.30)	Do you own an ITN, that is a net that has been treated with an insecticide to protect you from mosquito bites?	Yes No	1 2
(2.31)	During this visit or a previous visit, did a provider offer you an ITN free of charge or offer to sell you one? If the client will pick up or buy the ITN within the facility, that counts as provider offering the ITN.	Yes, offered free now Yes, offered free in previous visit Yes, offered for sale now Yes, offered for sale in previous visit No, not offered	1 2 3 4 5
(2.32)	During this visit or a previous visit, did a provider discuss the importance of sleeping under an insecticide treated net?	Yes, this visit Yes, previous visit No	1 2 3
(2.33)	Last night, did you sleep under an insecticide treated net?	Yes No	1 2
(2.34)	During this visit or previous visits, has a provider asked you whether you had ever received a tetanus toxoid (TT) injection?	Yes, this visit Yes, previous visit No	1 2 3
(2.35)	Have you ever received a tetanus toxoid (TT) injection, including one you may have received today? If yes: including any TT injection you received today, how many times in total during your lifetime have received a tetanus toxoid injection? (injection may have been received either at this facility or elsewhere.)	Yes Never	1 2 ▶ (2.37)
(2.36)	Number of tetanus injections received		
(2.37)	During this visit or previous visits, has a provider discussed things you should have in preparation for your delivery? This may include planning in case of emergency, things you should bring to a facility, or things you should prepare at home for home delivery.	Yes No	1 2
(2.38)	Please tell me any things you know of that you should have in preparation for your delivery. record "1" if mentioned, "2" if not mentioned. Do not read the list.	a. Emergency transport b. Money c. Methylated spirit d. Sterile blade/scissors to cut cord e. Layette f. Sanitary pads/cotton wool g. Other Specify	
(2.39)	Do you have money set aside for the delivery? IF YES, PROBE	Yes, enough Yes, but not enough Yes, not sure No	1 2 3 4 ▶ (2.42)
(2.40)	How much do you currently have set aside for delivery?	a. US Dollar b. ZA Rand c. Others (Specify)	
(2.41)	How much do you need to have set aside for delivery?	a. US Dollar b. ZA Rand c. Others (specify)	
(2.42)	During this visit or previous visits, has a provider talked with you about any signs of complications (danger signs) that should warn you of problems with the pregnancy?	Yes, this visit Yes, previous visit No	1 2 3 ▶ (2.45)
(2.43)	Please tell me any signs of complications (danger signs) during pregnancy that you know of. Do not cite answers, but for each option record "1" if mentioned, "2" if not mentioned. you may probe without using specific answers (e.g., "anything else?")	a. Any vaginal bleeding b. Fever c. Swollen face, hands or legs d. Tiredness or breathlessness e. Severe headache F. Blurred vision g. Convulsions/fits h. Lightheadedness/dizziness/blackout i. Severe pain in lower belly j. Baby stops moving or reduced fetal movement k. Bag of water breaks or leaks l. Difficulty breathing m. Other (specify: _____)	
(2.44)	What did the provider advise you to do if you experienced any of the warning signs? Record "1" if mentioned, "2" if not mentioned for all responses the client mentions. probe without using specific answers.	a. Seek care at facility b. Decrease activity c. Change diet d. Other (specify: _____)	
(2.45)	Do you know any danger signs during/after delivery?	Yes No	1 2 ▶ (2.47)
(2.46)	What danger signs do you know? Record "1" if mentioned, "2" if not mentioned for all responses the client mentions. probe without using specific answers.	a. Bleeding b. Fever c. Genital injuries d. Other	
(2.47)	During this visit or previous visits, has a provider spoken to you about breastfeeding?	Yes, this visit Yes, previous visit No	1 2 3 ▶ (2.51)
(2.48)	During the discussion, did the provider discuss exclusive breastfeeding (giving the baby nothing apart from breast milk)?	Yes No	1 2 ▶ (2.51)
(2.49)	When did the provider explain you should start exclusive breastfeeding?	FIRST HOUR FIRST DAY FIRST WEEK FIRST MONTH	01 02 03 04
(2.50)	For how many months did the provider recommend that you exclusively breastfeed, that is, that you do not give your baby liquid or food in addition to your breast milk?		
(2.51)	During this visit or previous visits, did the provider talk to you about where you plan to deliver your baby?	Yes, this visit Yes, previous visit No	1 2 3
(2.52)	Have you decided where you will go for the delivery of your baby? If yes: probe for whether the plan is to deliver in a facility or at home	At this health facility At other health facility In a private home Other Specify	1 2 3 96
(2.53)	During this or previous visits, did a provider talk with you about using family planning after the birth of your baby?	Yes, this visit Yes, previous visit No Don't know	1 2 3 ▶ (2.55) 99
(2.54)	Which methods did the provider discuss? Record "1" if mentioned, "2" if not mentioned for all responses the client mentions. Probe without using specific answers.	a. Female sterilization b. Male sterilization c. Contraceptive pill d. Intrauterine device (IUD) e. Injunctable contraceptives f. Implants g. Male condoms h. Female condoms i. Diaphragm j. Foam/jelly k. Lactational amenorrhoea l. Rhythm method m. Withdrawal	
(2.55)	During this or previous visits, did a provider talk with you about HIV testing?	Yes, this visit Yes, previous visit No Don't know	1 2 3 99
(2.56)	During this or previous visits, did a provider talk with you about HIV counseling?	Yes, this visit Yes, previous visit No Don't know	1 2 3 99

Appendix IV Results

Table S3 Impact of PBF on quality of care, all health facilities

Quality of care index	Mean at baseline		Mean at end line		Impact (%)	P value
	PBF	Control	PBF	Control		
ANC	0.68	0.67	0.74	0.68	5.6	0.105
Institutional delivery	0.74	0.75	0.74	0.69	5.6	0.185
PNC	0.67	0.66	0.61	0.68	6.3	0.213
EPI	0.84	0.83	0.82	0.84	1.6	0.617
Curative care	0.77	0.75	0.73	0.71	0.3	0.936
Overall	3.56	3.65	3.67	3.5	18.7	0.334

Clustered at district level.