Performance-based financing of maternal and child health: non-experimental evidence from Cambodia and Burundi

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PBF of maternal and child health

- Capitation or salary based payments in primary care lead to weak provider incentives
  - Low quality of care
  - Low utilization patterns
  - High absenteeism
- PBF - move to financing that rewards performance
  - Linking payments and results
  - Financial autonomy for health centers
  - Verification cycle
Introduction of PBF across Africa

Source: Meessen, 2013
Evidence scarce

- Basinga et al. (2011) evaluate PBF in Rwanda using RCT – largest effect on institutional deliveries of around 20%, no effect on ANC and vaccination
- Bushan et al. (2007) evaluate randomized pilot scheme in Cambodia and find large effects on some, but not all outcomes
- Internal validity of both studies somewhat compromised
... but quickly growing

- World Bank is funding 42 PBF projects, all but 8 are scheduled to produce an impact evaluation, many using RCT
- Recent iHEA conference: 35 sessions on PBF in LMICs!
Why quasi-experimental evaluation?

- Evidence is lacking on effectiveness of different designs, distributional impact, interactions of PBF with demand side schemes
- Difficult to obtain such evidence through RCTs
  - Too complex design
  - Very large sample size needed
- Unclear whether results from RCTs will hold up when programs are scaled up nationwide
Why quasi-experimental evaluation?

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• This presentation: evidence from retrospective studies. Exploit the gradual rollout of at-scale programs to evaluate their impact
PBF in Cambodia

Table: Performance-based financing schemes in Cambodia by Operational District (OD), 1999-2010
# PBF in Burundi

<table>
<thead>
<tr>
<th>Provinces</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
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<tbody>
<tr>
<td>Bubanza</td>
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<td>Bujumbura-mairie</td>
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<td>Bujumbura-rural</td>
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<td>Kayanza</td>
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<td>Kirundo</td>
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<td>Makamba</td>
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<td>Muramvya</td>
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<td>Muyinga</td>
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<td>Mwaro</td>
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<td>Ngozi</td>
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<td>Rutana</td>
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<td>Ruyigi</td>
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</tbody>
</table>

Table: Performance-based financing schemes in Burundi by province, 2007-2010
PBF in Burundi

Retrospective payment based on quantity and quality of provided services, mainly maternal and child care.

Or more formally:

$$PBF\ subsidy_{it} = \left( \sum_{j=1}^{J} P_j N_{ijt} \right) \times Q_{it} \quad \text{with} \quad 1 \leq Q_{it} \leq 1.25$$

- $P_j$ = subsidy received by facility per health care service $j$
- $N_{ijt}$ = # services $j$ delivered in facility $i$ in period $t$
- $Q_{it}$ = quality bonus which health care facility $i$ receives in period $t$
Items for quality score

- Infrastructure & communication
- Outpatient consultations
- Maternal care
- Family planning
- Vaccinations
- Laboratory services
- Drug availability
- Medical consumables availability
Data

• Demographic Health Survey data
  – Nationally representative household data
  – Asks women retrospectively about births in 5 years preceding the survey
  – Cambodia 2000, 2005 & 2010
  – Burundi 2010

• Outcomes: ANC, delivery, vaccinations
  – Burundi: quality indicators in Burundi
  – Cambodia: mortality
Data

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- Burundi: repeated cross sectional household survey data (2006, 2008, 2010) and facility panel data collected by Cordaid (but only selected provinces)
Empirical strategy

• Difference-in-Differences
  – Compare trends in outcomes in districts/provinces that got PBF with those that did not
Empirical strategy

Outcome for child/pregnancy $j$ in district $d$ born at time $t$:

$$y_{idt} = \beta PBF_{dt} + X_{idt}\Omega + OD_d + \tau_t + \epsilon_{idt}$$

- OD and birth period FE
- $PBF_{dt} = 1$ if a PBF scheme in operation on OD $d$ at time $t$
- $X_{idt}$ are ind/ birth/ mother/hh specific controls
- Standard errors adjusted for clustering on OD level
Empirical strategy

Outcome for child/pregnancy j in district d born at time t:

\[ y_{idt} = \beta PBF_{dt} + X_{idt}\Omega + OD_d + \tau_t + \varepsilon_{idt} \]

- OD and birth period FE
- \( PBF_{dt} = 1 \) if a PBF scheme in operation on OD d at time t
- \( X_{idt} \) are ind/ birth/ mother/hh specific controls
- Standard errors adjusted for clustering on OD level

Cambodia: add indicators for voucher schemes, Health Equity Funds, Government schemes

\[ +\lambda_1 Voucher_{dt} + \lambda_2 HEF_{dt} + \lambda_3 SUBO_{dt}d + \]
Empirical strategy

• Difference-in-Differences
  – Compare trends in outcomes in districts/provinces that got PBF with those that did not
  – Parallel trends assumption (PTA): trend in control district is a good counterfactual

• Assesses plausibility of PTA
  – Compare baseline characteristics across both groups
  – Compare pre-PBF trends in outcomes across both groups
Burundi

Trends in mother and child care

- Early adopters
- Middle adopters
- Later adopters
Cambodia

- **Delivery in public facility**
- **Vaccinations**
- **Antenatal care**

ODs in which PBF introduced by 2010
ODs still without PBF by 2010
Empirical strategy – weaken PTA

• Control for rich battery of observable characteristics

• Cambodia:
  – select only controls with similar pre-treatment trends in outcomes (PSM)
  – weigh the controls on the basis of similarity in pre-treatment trends (IPW)
    • Probit of treated on outcomes and time trend in pre-treatment period (4 years) -> propensity score
    • Nearest neighbor matching without replacement
    • Weighting controls by inverse of pscore
Cambodia
Empirical strategy – heterogeneity of effects

- Heterogeneity of effects across different implementation models and across patients’ socioeconomic status
- Burundi:
  - pilot versus scaling-up phase
  - poor/non-poor
Empirical strategy – heterogeneity of effects

- Heterogeneity of effects across different implementation models and across patients’ socioeconomic status
- Burundi:
  - pilot versus scaling-up phase
  - poor/non-poor
- Cambodia:
  - different PBF models (varying in the degree of management authority of the contractor, and the credibility of the link between pay and performance)
  - poor/non-poor
  - urban-rural
  - PBF in combination with demand side subsidies (vouchers)
Empirical strategy – heterogeneity of effects

- Heterogeneity of effects across different implementation models and across patients’ socioeconomic status

\[ \gamma_{idt} = \delta PBF_{dt} + \gamma_1 PBF_{dt} \times Voucher_{dt} + \gamma_2 PBF_{dt} \times Poor_{idt} + \gamma_3 PBF_{dt} \times Urban_{dt} + \theta_1 Voucher_{dt} + \theta_2 HEF_{dt} + \theta_3 SUBO_{dt} + X_{idt} \Psi + OD_{dt} + \tau_t + \nu_{idt} \]
### Burundi – overall effects of PBF

<table>
<thead>
<tr>
<th>outcome</th>
<th>marginal effect</th>
<th>baseline mean</th>
<th>note</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1 antenatal care visit</td>
<td>no sig effect</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>1st trimester antenatal visit</td>
<td>no sig effect</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td>BP measured during pregnancy</td>
<td>0.06*</td>
<td>0.53</td>
<td>only among <strong>non-poor</strong></td>
</tr>
<tr>
<td>≥1 anti-tetanus vaccination</td>
<td>0.100*</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>institutional delivery</td>
<td>0.051*</td>
<td>0.46</td>
<td>only among <strong>non-poor</strong></td>
</tr>
<tr>
<td>child fully vaccinated</td>
<td>0.044*</td>
<td>0.29</td>
<td>only among <strong>poor</strong></td>
</tr>
<tr>
<td>quality score</td>
<td>17.24**</td>
<td>38.68</td>
<td></td>
</tr>
<tr>
<td>reported satisfaction with quality</td>
<td>no sig effect</td>
<td>0.9</td>
<td></td>
</tr>
</tbody>
</table>

**Effects of pilot typically much larger than scale-up**
### Cambodia – overall effects of PBF

<table>
<thead>
<tr>
<th>outcome</th>
<th>Marginal effect</th>
<th>Baseline mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥2 antenatal visits</td>
<td>no sig effect</td>
<td>0.25</td>
</tr>
<tr>
<td>institutional delivery</td>
<td>0.075**</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>(0.30)</td>
<td></td>
</tr>
<tr>
<td>child fully vaccinated</td>
<td>no sig effect</td>
<td>0.35</td>
</tr>
<tr>
<td>neonatal mortality</td>
<td>no sig effect</td>
<td>0.04</td>
</tr>
</tbody>
</table>
Cambodia – delivery in public facility

25% compared to counterfactual

0.075**
Cambodia – delivery in public facility

- Any facility: 0.075** (full sample)
- Any facility: 0.045* (any facility)
Cambodia – delivery in public facility

![Graph showing delivery rates in public facilities in Cambodia, with percentage points for full sample, any facility, and non-poor groups.](image-url)
Cambodia – delivery in public facility

Percentage points

- full sample
- any facility
- poor
- non-poor
- with vouchers
- without vouchers

0.26***
0.134***
0.075**
0.045*
0.024
0.07**
Cambodia – delivery in public facility

**OUT:** NGO full autonomy to hire and fire and set incentives

**IN:** NGO required to operate within MoH rules
Cambodia – delivery in public facility

**IN:**
- management within MoH
- threat of not paying out

**Internal:**
- management within NGO
- FFS+paying bonuses
  (e.g. for absence of informal payments)
Cambodia

- Effect on institutional deliveries
  - partly driven by switch from private to public
  - only among non-poor
  - quadrupled when implemented with vouchers
  - strongest in schemes where contractor had clear management authority
Key points – Which services?

• PBF has increased institutional deliveries by 10% (Burundi) - 25% (Cambodia)
  – Effects generally not pro-poor
• PBF not had significant impact on ANC and vaccinations
  – ANC: high marginal cost compared to small monetary incentive
  – Vaccinations heavily targeted by vertical programs (GAVI in Cambodia)
Key points – How to incentivize?

• Variation across subperiods in Cambodia suggest that PBF has most impact if
  – Contractor has management authority
  – Finance is explicitly & credibly linked to verifiable performance targets
  – Incentives are large enough
Key points – Quality?

- Quality (Burundi): some effect on BP measurement and tetanus shots, large increase in quality score, not perceived as such by patients

- But, no effects on neonatal mortality in any of the periods in Cambodia might suggest quality is not sufficiently high to raise health outcomes?
  - None of the other PBF evaluations (including Rwanda’s RCT has established mortality effects)
What next?

- How to best measure and incentivize quality?
- How to improve distributional impact?
- What is broader health system impact of PBF schemes?
References


Additional slides
## PBF in Cambodia

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Period</th>
<th># ODs to 2010</th>
<th>OD management responsibility</th>
<th>Payment explicitly linked to performance targets?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I Pilot</td>
<td>1999-2003</td>
<td>5</td>
<td>OUT: NGO IN: NGO within MoH rules</td>
<td>At discretion of NGO</td>
</tr>
<tr>
<td>Phase II IN</td>
<td>2004-2008</td>
<td>11</td>
<td>NGO within MoH</td>
<td>At discretion of NGO</td>
</tr>
<tr>
<td>Internal</td>
<td>2005-2010</td>
<td>8</td>
<td>MoH with advisors</td>
<td>Yes</td>
</tr>
<tr>
<td>Phase III SOA</td>
<td>2009-now</td>
<td>22</td>
<td>Autonomous within MoH</td>
<td>At discretion of facility head</td>
</tr>
<tr>
<td>FFS</td>
<td>2007-now</td>
<td>10</td>
<td>MoH</td>
<td>Pay-for-procedure not targets (fee-for-service)</td>
</tr>
</tbody>
</table>
PBF subsidies in Burundi

- TB patient correctly treated during 6 months
- Patient diagnosed with TB (3 sputum checks)
- Family planning: implant or IUD
- Institutional delivery by qualified staff
- HIV mother referred to hospital
- Family planning: new and re-attendants, oral &
- HIV case diagnosed and referred
- Child under 1 completely immunized
- Bed net distributed
- Person voluntarily counseled and tested for HIV
- Pregnant woman counseled and tested for HIV
- Patient referred to hospital and feedback obtained
- HIV mother treated
- Family planning: referral of tubal ligation and...
- Child treated after birth HIV mother
- Latrine newly constructed
- Small surgery intervention
- Pregnant woman fully immunized
- Inpatient bed day
- Diagnosis and treatment of STD
- Antenatal care: new and standard visits
- Outpatient consultancy - new case
- Children 6 - 59 months receiving Vit A

Subsidy in US dollar
Spending the PBF subsidies

- Additional funding through PBF, 40% of total average facility budget

- Money spend by facility managers based on business plan
  - max. 60% to increase staff salaries
  - other expenditures often to increase quality
Methods Burundi

- 3 repeated cross-sections
- panel data on quality scores from 75 health care facilities

Difference in differences analyses in regression framework:

- **Effect of phase I of PBF (controls are untreated):**
  \[ (\bar{Y}_{2008,I} - \bar{Y}_{2006,I}) - (\bar{Y}_{2008,II} - \bar{Y}_{2006,II}) \]

- **Effect of phase II of PBF (controls are already treated):**
  \[ (\bar{Y}_{2010,II} - \bar{Y}_{2008,II}) - (\bar{Y}_{2010,I} - \bar{Y}_{2008,I}) \]