Design and Effectiveness of Public Health Subsidies in Less Developed Countries

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Good health is a critical economic asset, particularly in less developed countries

- many people rely on farming or other forms of self-employment
- when sick, cannot work and cannot generate income

Good health is also valuable in itself

- Life is more pleasant when one is healthier and one’s kids don’t die

But good health is lacking in less developed countries
The most visible part of the problem

- Some progress towards MDG, but still, as of 2015, it is estimated that 6 to 7 million children under five die every year, most of them in sub-Saharan Africa.
Introduction

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- Up to 2/3 of these deaths could be averted using existing health products
  - vaccines, antimalarial bednet, water chlorination or water filter, etc.
The most visible part of the problem

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- Up to 2/3 of these deaths could be averted using existing health products:
  - Vaccines, antimalarial bednet, water chlorination or water filter, etc.

- How to increase adoption of these products?
The most obvious solution
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- Subsidize
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- Economic theory provides two rationales for such subsidies:
The most obvious solution

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  - limiting spread of infectious diseases is a public good
The most obvious solution

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- Economic theory provides two rationales for such subsidies:
  - limiting spread of infectious diseases is a public good
  - subsidies more than pay off for themselves over time, as healthier children grow into more productive adults who will pay more taxes over their lifetime
Can this solution work?

For the hoped-for impacts to be realized, need a number of things to hold:

1. beneficiaries of subsidized inputs/products must put them to (appropriate) use
   - obviously the case for vaccines
   - less so for inputs that require proactive behavior on part of subsidy recipient (condoms, bed nets, latrines, etc.)
   - may be if subsidized too much, many beneficiaries end up wasting inputs?
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  2. Subsidies have to reach the intended beneficiaries in the first place....
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For the hoped-for impacts to be realized, need a number of things to hold:

1. beneficiaries of subsidized inputs/products must put them to (appropriate) use
2. Subsidies have to reach the intended beneficiaries in the first place....
   - concern: subsidized inputs left to rot in storage room by absentee health workers
   - or stolen along the way by corrupt public health officials
Today’s talk

1. Demand side: Designing subsidies so as to balance access and targeting to those who will use inputs
2. Supply side: how serious are governance issues in the delivery of subsidies?
Today’s talk

- How to design and deliver subsidies so that both criteria are satisfied?
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1. Demand side: Designing subsidies so as to balance access and targeting to those who will use inputs

2. Supply side: how serious a concern are governance issues in the delivery of subsidies?
Principal’s problem

- A principal values the health benefit of a health product, non-health utility, alternative uses of funds
- Maximizes

\[ W = \sum (b_i \cdot z_{DALY} \cdot h_i + u_i) - \lambda S + \text{continuation value} \]

where

- \( b_i \) = DALY value of total health benefit when \( i \) uses product appropriately
- \( z_{DALY} \) = dollar value of DALY to principal
- \( h_i \) = binary variable indicating whether \( i \) uses product appropriately
- \( u_i \) = individual \( i \)’s non-health utility
- \( S \) = total cost of the subsidy program
- \( \lambda \) = marginal cost of public funds
Principal’s problem

- Benefit to marginal increase in subsidy ($ds$) exceeds costs if:

\[ use_{mar} \cdot (b_{mar} \cdot z_{DALY}) > (take_{mar} \cdot s + take_{inf} \cdot ds) \cdot \lambda \]

- $use_{mar}$ = proportion induced to use by policy change
- $b_{mar}$ = health benefit among those induced to use by policy change
- $take_{mar}$ = proportion induced to take by policy change
- $s$ = post-policy change subsidy per taker
- $take_{inf}$ = proportion taking up product before policy change
- $\lambda$ = marginal cost of public funds
Tradeoffs when increasing subsidy level?

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- If $use_{mar} < take_{mar}$ ⇒ subsidy policy induces some people to take input but they end up not using it appropriately

- If $b_{mar}$ low ⇒ subsidy policy induces low-return people to take and use input

- If $take_{inf}$ high ⇒ high cost of program

Increasing the price (reducing the subsidy level) reduces these issues, but may reduce access considerably

Ultimately, relative importance of these problems is an empirical question (and context-specific)
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Do marginal takers use subsidized inputs?
**Study 1: Bed nets**  
*(Cohen & Dupas, QJE 2010)*  
Kenya, 2006  
Pregnant women  
2-mo usage

**Study 2**  
*(Dupas, ECMA 2014)*  
Kenya, 2007  
Households  
1-year usage
Study 3
(Dupas et al., 2015)
Kenya, 2008
Mothers of young children
4-mo usage

Water Purification Product (Chlorine)

Study 4
(Cohen et al., AER 2015)
Kenya, 2010
Households

Anti-malarial treatment (ACT)
Do marginal users have lower returns?
Study 1
(Cohen & Dupas 2010)
Kenya
Pregnant women
2-mo usage

Study 2
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Kenya, 2010  
Households  
**ACT**
Evidence from other contexts / products
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- In most other existing studies, price also appears a poor targeting tool: marginal takers do not seem to have lower usage or lower returns
  - Those more likely to buy deworming medication in Kenya don’t have more worms (Kremer and Miguel, 2007)
  - Those with higher WTP for water filters in Ghana don’t see greater drop in diarrhea incidence from using filter (Berry, Fischer, Guiteras, 2012)
  - Same for flip-flops in Kenya, soap and vitamins in Uganda, Guatemala and India (Meredith et al., 2014)
  - Ashraf, Berry and Shapiro (AER 2010): Zambia, water purification product (chlorine)
    - selection effect of prices, but selection on wealth, not need
When price is not a good allocation mechanism, how to target?

- We just saw that using price as a targeting tool can create too many errors of exclusion (poor people who need product but can’t afford fee)

**Ordeal mechanism:** Non-monetary cost to obtain a benefit.

Can such mechanisms help screen non-users?
When price is not a good allocation mechanism, how to target?

- We just saw that using price as a targeting tool can create too many errors of exclusion (poor people who need product but can’t afford fee)
- But for some products, free distribution can lead to too many errors of inclusion (people who take product but don’t use for health purpose, e.g. chlorine)
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- For such products, is it possible to change design of subsidy to reduce this trade-off?
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  - Can such mechanisms help screen non-users?
Today’s Outline

1. Demand side: Self-Screening tools
   - 1. Price
   - 2. Non-monetary cost (“ordeal”)

2. Supply side: Provider agency concerns in delivery
   - Local Capture vs. Local information
Ordeal mechanism

- Sometimes used to target resources to the poor (Nichols and Zeckhauser, 1982; Parsons, 1991; Alatas et al., 2012); National Rural Employment Guarantee scheme in India
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Ordeal mechanism

- Sometimes used to target resources to the poor (Nichols and Zeckhauser, 1982; Parsons, 1991; Alatas et al., 2012); National Rural Employment Guarantee scheme in India
- The more attractive the benefit, the greater the ordeal must typically be; may impose a significant welfare cost
- For many preventive health products (e.g. chlorine), benefit to non-health users is very small, so a small ordeal may be sufficient
Subsidy with ordeal

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- \(du_{inf}\) = change in non-health utility to inframarginal users
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- If there is heterogeneity in relative cost of effort and money (e.g. due to different wage levels), and heterogeneity in willingness to use

  - Joint distribution determines impact of screening through price vs. ordeal.
Micro-ordeal and Targeting

- Dupas, Hoffmann, Kremer and Zwane (2013), Kenya, Chlorine
- We estimate the number of inframarginal and marginal users, inframarginal and marginal takers, under three policies through a randomized evaluation:
  - 50% subsidy
  - 100% subsidy with micro-ordeal (1-year supply)
  - 100% subsidy with free delivery (1-year supply)
- Also have non-experimental estimate of take up at full price from baseline survey
- **Micro-ordeal:** 12 dated coupons for free 1-month supply each. Coupons redeemable at nearby shop.
  - Average distance to shop 3.9 km
  - For 22% of participants shop was in nearest market center
- **Free Delivery:** 1-year supply delivered in two installments (clinic visit, then home visit)
Coupon micro-ordeal

Coupon redemption over time

Fraction of coupons redeemed

Coupon number (= months since distribution)

Pascaline Dupas (Stanford)
Coupon micro-ordeal reduces inclusion error without increasing exclusion error
Micro-ordeal and Targeting

Ordeal mechanism
Optimal density of redemption sites?

- Size of ordeal is a choice variable for the principal
Optimal density of redemption sites?

- Size of ordeal is a choice variable for the principal
- Larger ordeal reduces errors of inclusion, increases errors of exclusion:

<table>
<thead>
<tr>
<th>Redeemed</th>
<th>Not redeemable</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.514</td>
<td>0.377</td>
</tr>
<tr>
<td>0.382</td>
<td>0.337</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Redeemable at nearest market</th>
<th>Positive chlorine test</th>
</tr>
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<tbody>
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<td>0.514</td>
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Preferred policy?

- Can calibrate model with assumptions on health impact of water treatment, cost of policy
- Identify regions of parameter space (principal’s valuation of health benefit, utility cost of ordeal) over which each policy is preferred
- For plausible range of valuations of DALY and ordeal cost, 100% subsidy with micro-ordeal is preferred to no subsidy, and to 50% and 100% subsidy with free delivery
Preferred Policy

- **100% subsidy with delivery**
- **100% subsidy with micro-ordeal**
- **50% subsidy with delivery**

WDR cost-effectiveness benchmark ($241)

Walking time @ 50% avg wage ($0.13)
Relevance of ordeal mechanism depends on characteristics of product
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- Micro-ordeal will fail to affect targeting and creates unnecessary welfare loss...
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  - If private returns to inappropriate use are very high
    - Cohen, Dupas, Schaner (2015) – 60% of adults who redeem coupon for heavily subsidized antimalarial drug (ACT) are malaria-negative but don’t know it, highly value presumptive treatment
    - Pb there is lack of access to reliable diagnostic test
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- Sometimes the ordeal can be too costly (because of the nature of the product, e.g. family planning product that people may be embarrassed to obtain from a local store) and it reduces take-up considerably even among high-return folks
Product considered: Male Condoms

- Redeemed at least one voucher
- Took at least some
- Took all 150 condoms

**VOUCHER SCHEME** (2008)
- Adolescent Girls: 0.01
- Adolescent Boys: 0.15

**HOME DELIVERY** (2009)
- Adolescent Girls: 0.98
- Adolescent Boys: 0.99
- Adolescent Girls: 0.52
- Adolescent Boys: 0.85
1. **Take-up: Self-Screening tools**
   1. Price
   2. Non-monetary cost ("ordeal")

2. **Delivery: Provider agency**
   - Local Capture vs. Local information
Agency in delivery

- Potential concerns:
  - Leakage:
    - Olken (2006): at least 18% of the rice provided in an Indonesian relief program disappeared between the government warehouse and households.
    - Reinikka and Svensson (2004): only 13% of education grants given by the Uganda government were recorded as being received by schools.
Agency in delivery

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  - Extortion:
    - Anecdotal evidence from many countries of side payment requests for free drugs/services
  - Shirking by government providers/agents:
    - Das’s work in India, Leonard’s work in Tanzania
    - Chaudhury et al. (2006): absenteeism of health providers common in many developing countries
    - Banerjee et al. (2011), Udaipur: lack of reliability of health staff causes full immunization rates among children to drop from 23% to 10%
Focus on WHO-recommended program of distributing free antimalarial bed nets (LLINs) to pregnant women through antenatal clinics (ANCs)
Focus on WHO-recommended program of distributing free antimalarial bed nets (LLINs) to pregnant women through antenatal clinics (ANCs)

Audited such a program in three countries:
- Ghana, 72 health centers (TI rank: 64/178)
- Kenya, 48 health centers (TI rank: 139/178)
- Uganda, 48 health centers (TI rank: 130/178)
Measurement: Outcomes of interest

- Leakage of nets to ineligibles
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- Leakage of nets to ineligibles
  - randomly surveyed community members and asked them if they could access LLIN at health center
  - sent ineligibles to health centers and recorded if they could obtain LLIN and if so at what price ("mystery clients")

Examples
Measurement: Outcomes of interest

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- Coverage, Extortion among eligibles:
Measurement: Outcomes of interest

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- **Coverage, Extortion among eligibles**:
  - randomly surveyed ANC clients and asked them whether they received LLIN at health center, whether had to pay for it
Result 1: Very modest leakage to ineligibles

- Ghana
- Kenya
- Uganda

<table>
<thead>
<tr>
<th>Event</th>
<th>Ghana</th>
<th>Kenya</th>
<th>Uganda</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC asked for bribe</td>
<td>0.05</td>
<td>0.036</td>
<td>0.011</td>
</tr>
<tr>
<td>MC got free net</td>
<td>0.009</td>
<td>0.087</td>
<td>0.11</td>
</tr>
<tr>
<td>Community thinks MC can get net</td>
<td>0.093</td>
<td>0.093</td>
<td>0.113</td>
</tr>
</tbody>
</table>
Leakage or Efficient Targeting?
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- Dep. Var: Ineligible “Mystery Client” was able to get a free net

<table>
<thead>
<tr>
<th>Requested for pregnant woman</th>
<th>0.012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[0.023]</td>
</tr>
<tr>
<td>Requested for child</td>
<td>0.18***</td>
</tr>
<tr>
<td></td>
<td>[0.045]</td>
</tr>
<tr>
<td>If asked, said that had child</td>
<td>0.11**</td>
</tr>
<tr>
<td></td>
<td>[0.047]</td>
</tr>
<tr>
<td>MC signaled that educated</td>
<td>0.0077</td>
</tr>
<tr>
<td></td>
<td>[0.016]</td>
</tr>
<tr>
<td>Healthworker female</td>
<td>-0.012</td>
</tr>
<tr>
<td></td>
<td>[0.022]</td>
</tr>
</tbody>
</table>

Health facility Fixed effects

X

Observations 683
R-Squared 0.402
Mean of the Dependent Variable 0.0378
Result 2: Fairly High Coverage among Eligibles, no extortion
Errors of exclusion or Efficient Targeting?

- Dep. Var: Pregnant woman received free net at first prenatal visit, as per program rule:

<table>
<thead>
<tr>
<th>Years of education</th>
<th>-0.0068**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health facility Fixed effects</td>
<td>X</td>
</tr>
<tr>
<td>Observations</td>
<td>2,028</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.357</td>
</tr>
<tr>
<td>Dep. Var. Mean</td>
<td>0.762</td>
</tr>
</tbody>
</table>

Notes: Standard errors in brackets, clustered at the level of the health facility. Ghana sample: Only includes facilities sampled for direct distribution. Regressions have month fixed effects to control for potential stockouts, and include controls for registrant age and parity. The mean number of years of education among clients surveyed is 5 (4.2 in Ghana, 4.6 in Kenya and 6.9 in Uganda, which adopted free primary education much earlier). The gap between the 25th and the 75th percentile in terms of years of education is 4.5 years.
Summary of Results

- Very little leakage
Summary of Results

- Very little leakage
- No extortion, high coverage among eligibles
Summary of Results

- Very little leakage

- No extortion, high coverage among eligibles

- Suggests that for very simple, easy to verify targeting rule, and obvious health benefits for beneficiaries, health workers can be relied upon
  - aware of health benefits to targeted beneficiaries and intrinsically motivated to deliver those
Conclusion

- Public subsidies are a substantial part of what developing country governments do
  - health subsidies, subsidies for agricultural inputs, food distribution

1. Subsidies must be targeted/assigned to those for whom the returns are highest
2. Leakage has to be limited
3. Beneficiaries of subsidized inputs/products must put them to (appropriate) use
Conclusion

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  - health subsidies, subsidies for agricultural inputs, food distribution
- Rationale for these subsidies is that they could have large effects on health, nutrition, etc.
Conclusion

- Public subsidies are a substantial part of what developing country governments do
  - health subsidies, subsidies for agricultural inputs, food distribution
- Rationale for these subsidies is that they could have large effects on health, nutrition, etc.
- But for the hoped-for impacts to be maximized, need a number of things to hold:
  1. subsidies must be targeted/assigned to those for whom the returns are highest
  2. leakage has to be limited
  3. beneficiaries of subsidized inputs/products must put them to (appropriate) use
Conclusion

- Price is often too blunt a tool for targeting in areas where people are poor and credit constrained
  - Too many exclusion errors when subsidy level is low
  - Identifying the subsidy level that optimally balances risk of exclusion and risk of inclusion errors requires local experimentation as it is context specific
- In some contexts / for some products (water purification), “ordeal mechanism” alongside full subsidy can reduce wastage of subsidized inputs on people with low returns
- Agency problems on the delivery size are not first order for products that are high impact and easy to target
- Indeed, massive increase in free distribution of bed nets throughout sub-Saharan Africa over past 10 years (Roll Back Malaria) has led to important decrease in under-5 mortality (Cogneau and Rossi, 2016)
References Cited

Increasing the price changes how households allocate subsidy across members

(Source: drug shop redemption data)
Price of non-ACT antimalarials, by age group

(Source: drug shop transaction records data)
(Source: surprise RDT tests at drug shops)
Calibration

- Estimated health benefit:
  - Focus on child deaths averted; excludes adult health benefit, diarrhea impact on child development
  - Child mortality 8.25% in Kenya, 20% of which due to diarrhea
  - Point of use water treatment reduces diarrhea episodes by 39% (Arnold and Colford systematic review, adjusted for compliance)
  - One child death = 30.28 DALYs
  - 1.7 children under 5 per household in the sample
  - Annual health benefit of water treatment per household = 8.25% U5MR x 20% x 39% x 30.28 DALYs x 1.7 children/5 years = 0.068 DALYs

- Cost of program: Assume cost of each policy is the cost of water treatment solution only
  - In reality, direct delivery more costly than coupon system
Calibration

- **Valuation of DALY**
  - WHO considers interventions costing less than GDP per capita / DALY "highly cost effective"
    - Kenyan GDP = $768
  - 1993 WDR implicitly recommended $150 US/DALY as threshold of cost effectiveness (= $241 in 2013 dollars)

- **Value of time to walk to shop to redeem coupon**
  - Average distance to shop to redeem coupon was 3.9 km
  - At walking pace of 5 km/hour, round trip takes 1.56 hours
  - Given agricultural wage of $0.16/hour, standard assumption of travel cost as 50% of wage rate, time cost is $0.13
  - Likely upper bound, since may be going to the market anyway, principal may put low value on time cost
In the case of ITNs in Kenya, demand curve remains stubbornly steep...

Source: Dupas AER P&P (2009)
Mystery Client Narratives

- “MC: good afternoon madam
- HW: afternoon my brother
- HW: please can i help you?
- MC: yes, please madam. I need a mosquito net
- HW: we don’t have bednets in this facility. It was last month that, a certain NGO brought some and they said we should be giving it to only pregnant women for free and that one also got finished for about three weeks ago
- MC: please madam check inside and see, may be you will get one for me
- HW: no, but i told you that, it has finished, even yesterday some pregnant women came here but they didn’t get some. And you are not even qualified for the nets because it is restricted to only pregnant women.
- MC: so madam when will you get some?
- HW: i dont know
- MC: then let me give you my phone number, so that when you get some you can call me to come
- HW: no, because when we get some, i can’t call you to come, because you are not eligible
- MC: ok. thank you madam. “
“The facility looked very quiet. After several knocks, a sleepy voice answered. After some time, a young lady came out with a sleepy face.

- MC: Good morning Madam. Please can I get a net here?
- HW: No! We don’t have nets here!
- MC: Ah! But someone told me he got his nets here. Or is there another facility around?
- HW: *(She was getting irritated)*. I say we don’t have nets. Let that person you believe get the net for you.

*She left me and entered the room she had come from.*"
Mystery Client Narratives

- **MC:** good afternoon madam. can i get a bednet here
- **HW:** do you have money?
- **MC:** how much?
- **HW:** the round one is GHC 15 and the square one is GHC 20
- **MC:** wow! that is very expensive
- **HW:** that is how it is sold
- **MC:** is that the same type you give to pregnant women?
- **HW:** are you pregnant?
- **MC:** i learnt it is the best quality
- **HW:** the one i have is among the best.
- **MC:** can i see it.
- **HW:** if you can’t pay, then there is no need to bring it.
- **MC:** oh! how can i buy what i haven’t seen.
- **HW:** ok! then when you bring the money, i will go and bring. if you don’t like it, i will take it and give you your money back.
- **MC:** please i will give you. GHC 8.
- **HW:** then go and come another day when the one in-charge is around. for now, my duty is to sell it at the price i have just told you
- **MC:** when?
- **HW:** tomorrow, i will help talk on your behalf for her to reduce the price.
Preferred Policy without micro-ordeal option

- 100% subsidy with delivery
- 50% subsidy with delivery
- 50% subsidy without delivery

WDR cost-effectiveness benchmark ($241)

PSI price

$ cost of ordeal

$ value / DALY saved

walking time @ 50% ag wage ($0.13)
 Preferred Policy with micro-ordeal option

WDR cost-effectiveness benchmark ($241)

100% subsidy with delivery

100% subsidy with micro-ordeal

50% subsidy with delivery

50% subsidy with delivery

PSI price

walking time @ 50% ag wage ($0.13)
YOU HAVE RIGHTS TO QUALITY HEALTH CARE