

Lack of sanitation (toilets) in urban slums



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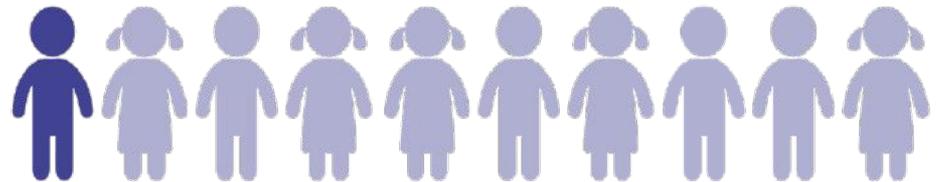
ETH (Eidgenössische Technische Hochschule)

Swiss Federal Institute of Technology

March 2017

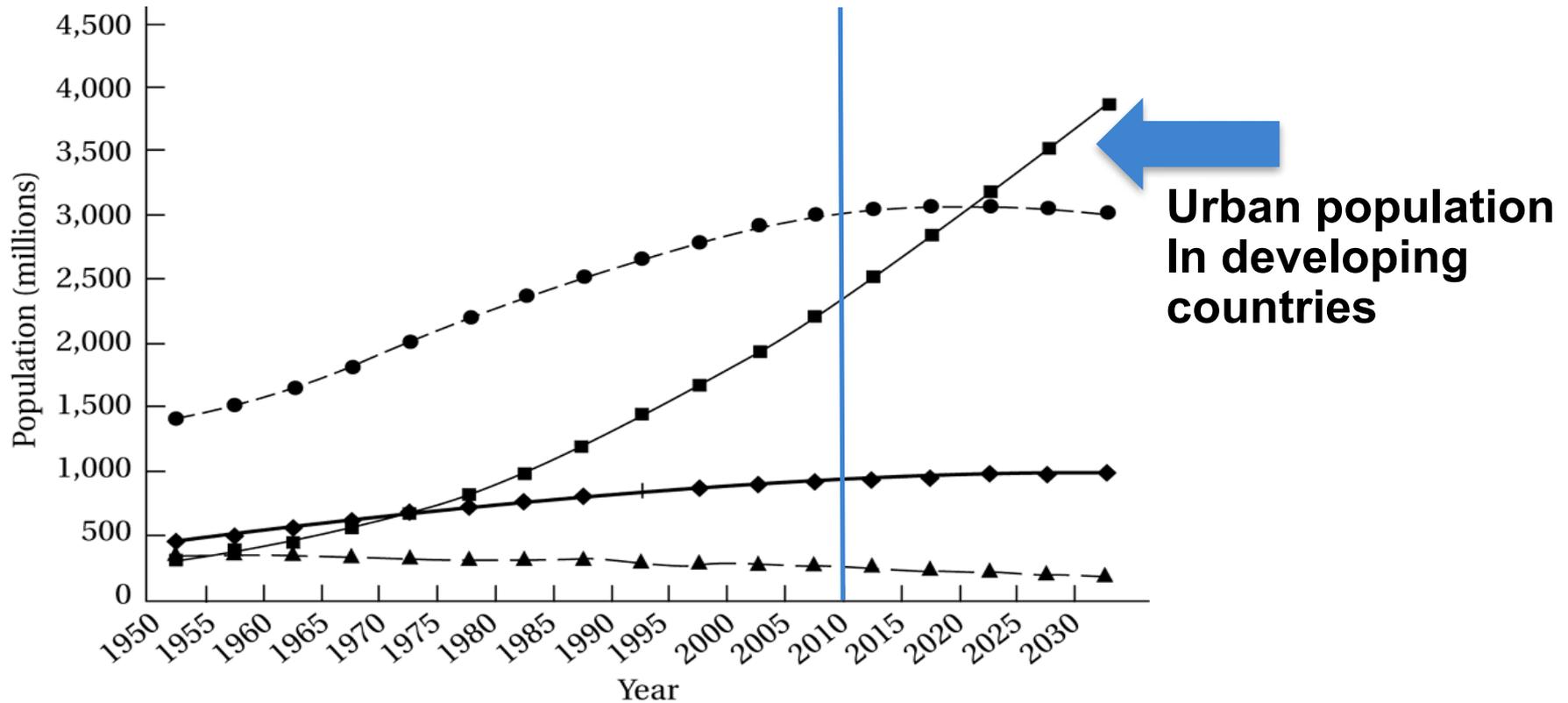
Global Access to Sanitation

- 1 out of 10 child deaths (2015) were due to diarrhoea (UNICEF, 2016)
That means: 1 child death per minute



- More than the child deaths from malaria, HIV/AIDS and measles (WHO 2015)
- 2.4 billion without access to improved sanitation (1 in 3 people) (UN 2015)
- 70% of sub-Saharan Africa without access to improved sanitation (UN 2015)

Fast Urbanization...



- ◆— Urban - More developed regions
- ▲— Rural - More developed regions
- Urban - Less developed regions
- Rural - Less developed regions

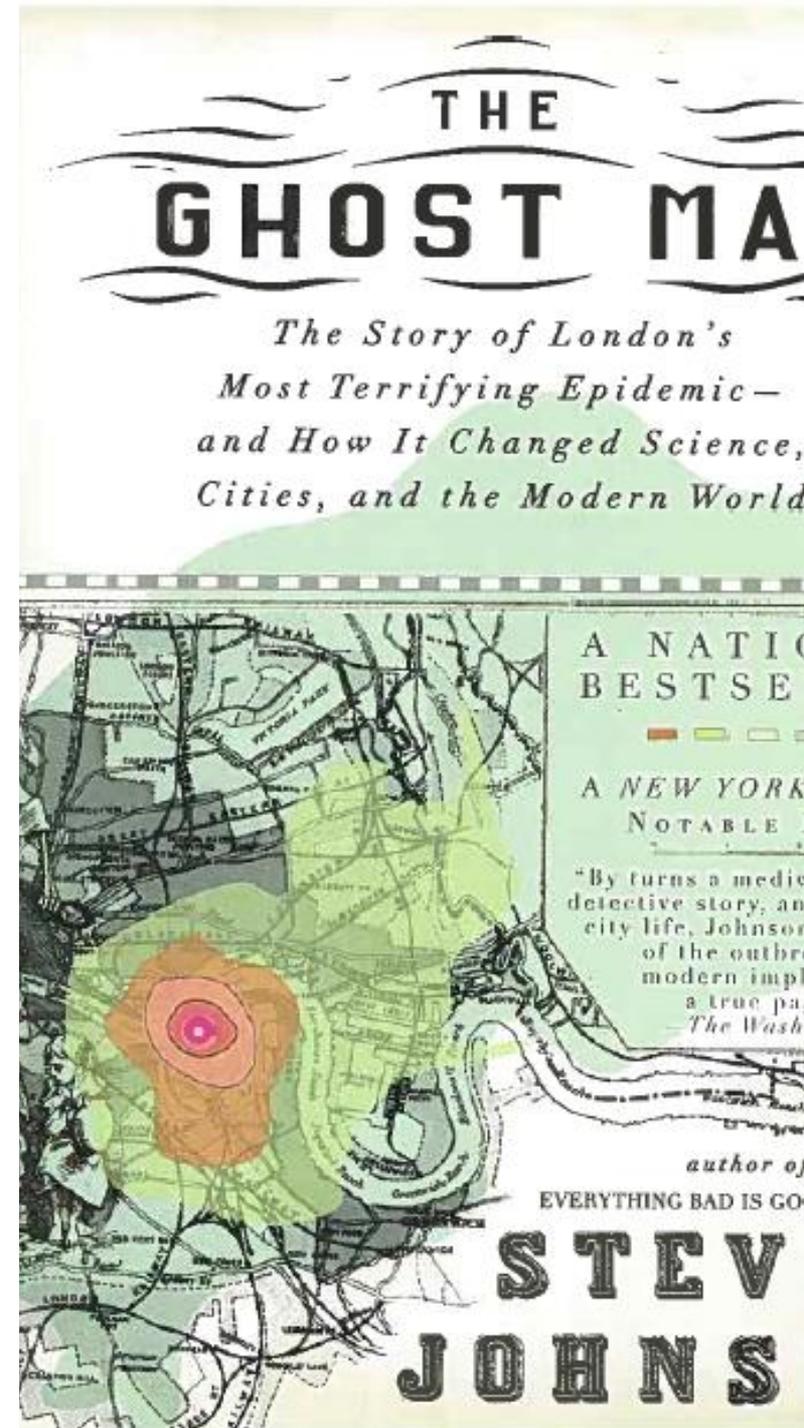
...leading to Slum Areas



estimates: **70 %** of the urban population in sub-Saharan Africa lives in slums

...resembling European History

- ...with disastrous health consequences?
- Cain, L. and S. Hong (2009). Survival in 19th Century Cities: **The Larger the City, the Smaller Your Chances.** *Explorations in Economic History.*



Historical Evidence on Benefits of Sanitation

Fig 2: Driving down child mortality rates⁸

Dramatic improvements in child mortality⁹ that coincided with a peak in sanitation investments in the UK.



Woods, Watterson and Woodward (1988; 1989)

«Contemporary» impact of sanitation on health

Esrey, Potash et al. (1991)

“...water supply and sanitation facilities resulted in substantial reductions in morbidity of diarrhea (26%), ascariasis (29%), guinea worm infection (78%), schistosomiasis (77%), and trachoma (27%).”

Fewtrell, Kaufman et al. (2005)

“...sanitation reduces child diarrhea by 22%-36%”

Human Development Report (2006)

«The toilet and the latrine, which helped revolutionize public health in New York, London and Paris more than a century ago, are among the most underused tools to combat poverty and disease in the developing world.»

Lancet Editorial (2007)

*“Improved sanitation could prevent **1.5 million deaths** from diarrhea illnesses a year...adequate sanitation is the most effective public health intervention the international community has at its disposal”*

Summary of Research Project 1

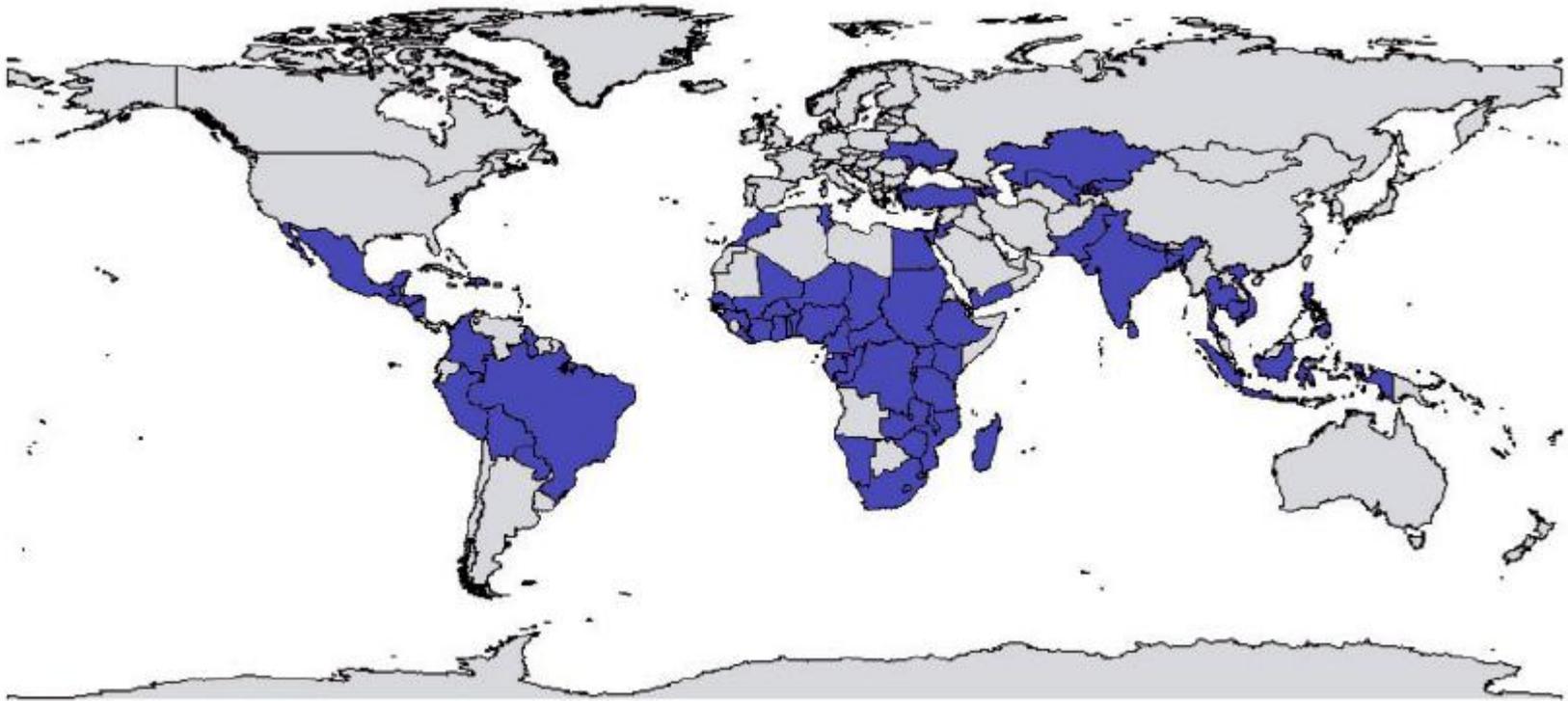
What is the health impact of improved sanitation?

- Fink, Günther, Hill (2014). Slum Residence and Child Health in Developing Countries. *Demography*.
- Günther & Fink (2012). Saving a Life-Year and Reaching MDG 4 with Investments in Water and Sanitation. A Cost-effective Policy? *European Journal of Development Research*.
- Fink, Günther, Hill (2011). The Effect of Water and Sanitation on Child Health: Evidence from the DHS 1986-2007. *International Journal of Epidemiology*.



Data – DHS surveys

70 countries
30 years
796 557 observations
about 500 toilet technologies



Health Impact of Sanitation (odds ratios)

	Mortality	Diarrhea	Stunted
Intermed. quality water	1.04 (0.98–1.11)	0.92 (0.90–0.95)	0.97 (0.95–0.99)
High quality water	0.97 (0.88–1.04)	0.91 (0.88–0.94)	0.92 (0.89–0.94)
Intermed. quality sanitation	0.97 (0.92–1.02)	0.92 (0.90–0.94)	0.88 (0.87–0.90)
High quality sanitation	0.77 (0.68–0.86)	0.87 (0.85–0.90)	0.73 (0.71–0.75)

- Effects are smaller than previous research based on RCTs.
- Technology level matter.
- Sanitation has a higher protective effect than water.
- Protective effects of sanitation similar than moving mothers from no education to primary-secondary education.

Health Impact of Mother's Education

	Neonatal mortality (1)	Mortality 1–12 months (2)	Mortality 13–59 months (3)	Diarrhoea (4)	Stunted (5)
Mother primary	0.92 (0.89–0.96)	0.90 (0.87–0.93)	0.89 (0.84–0.94)	1.02 (1.00–1.04)	0.85 (0.83–0.86)
Mother secondary	0.83 (0.79–0.87)	0.63 (0.50–0.67)	0.58 (0.53–0.64)	0.91 (0.88–0.93)	0.62 (0.61–0.64)
Mother tertiary	0.67 (0.61–0.75)	0.41 (0.35–0.48)	0.39 (0.28–0.40)	0.73 (0.70–0.77)	0.40 (0.38–0.42)
Partner primary	0.99 (0.96–1.03)	0.92 (0.88–0.95)	0.94 (0.89–0.98)	1.00 (0.98–1.03)	0.95 (0.93–0.97)
Partner secondary	0.91 (0.87–0.95)	0.81 (0.77–0.85)	0.80 (0.75–0.85)	0.96 (0.94–0.98)	0.79 (0.77–0.81)
Partner tertiary	0.85 (0.79–0.92)	0.61 (0.55–0.67)	0.64 (0.53–0.75)	0.86 (0.82–0.89)	0.67 (0.64–0.69)
Observations	887 440	671 882	466 782	796 557	567 011

...but little economic research on increasing sanitation coverage.



Summary of Research Project 2

How to increase private investments in sanitation in urban slums?

- U-ACT Policy Brief 2016: [How to increase toilet coverage among the urban poor?](#)
- Günther, I. and A. Horst : [Access to better Toilets – improving the sanitation situation in slum settlements](#). Development and Cooperation, 2014, 55(5)
- U-ACT Policy Brief 2013: [Ventilated Improved Latrine construction in the slum areas of Kampala, Uganda](#).
- U-ACT Policy Brief 2012: [When is shared sanitation improved sanitation?](#)
- U-ACT Policy Brief 2011: [Where do Kampala's poor 'go'?](#)



Sanitation in Urban Slums

- Recommended technology:

Decentralized on-site sanitation systems

Ventilated improved pit latrine (VIP)

Fast growth of cities, governance, lack of water

- Most ongoing policies by development agencies focus on

Social marketing

= increasing information (with varying content) on sanitation benefits

Subsidies for mostly public toilets (but not for private toilets)



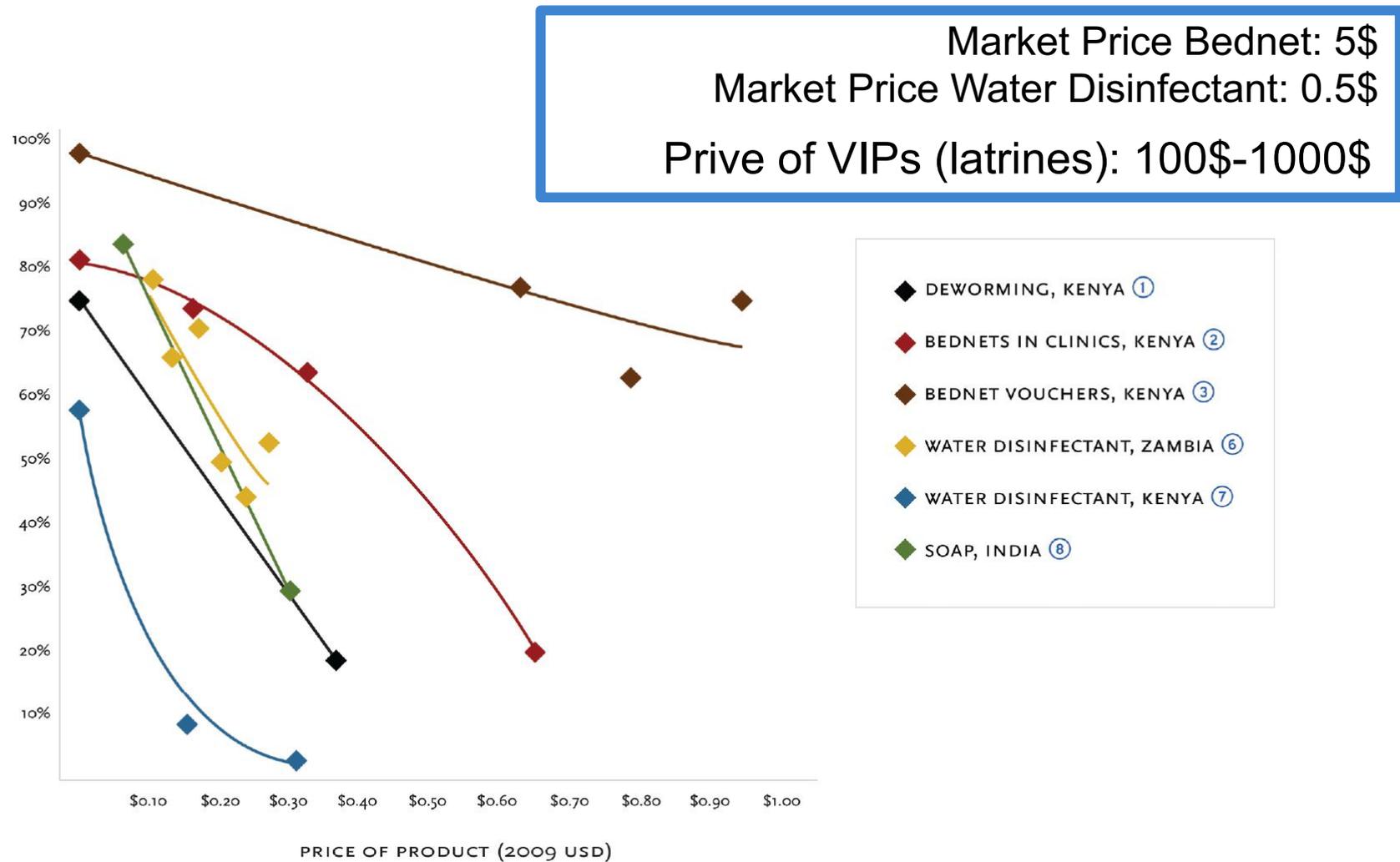
Sanitation Marketing



("A Good Toilet is Possible! We've developed up to a toilet!")

Impact has never been empirically tested

High price elasticity of demand with little difference in use



Impact has never been empirically tested for VIPs

Randomized Controlled Trial (RCT)

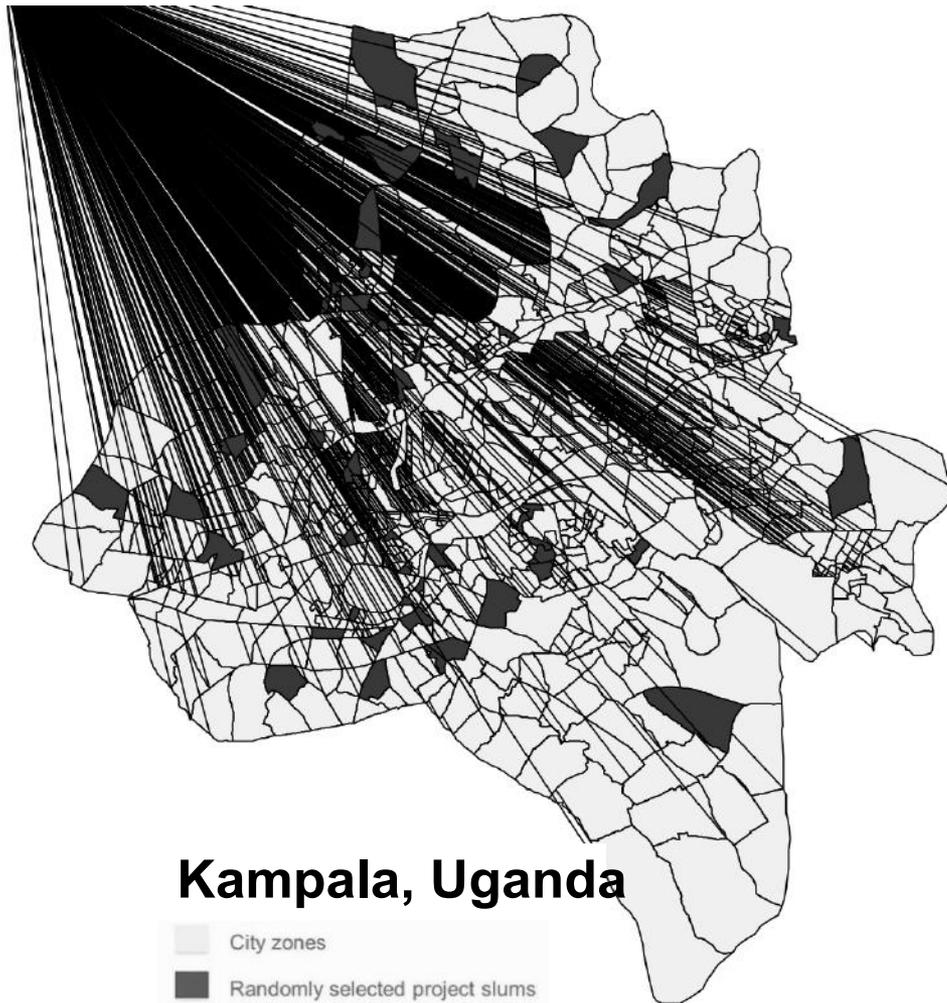
What is the impact of

(1) price

(2) information

on sanitation investments?

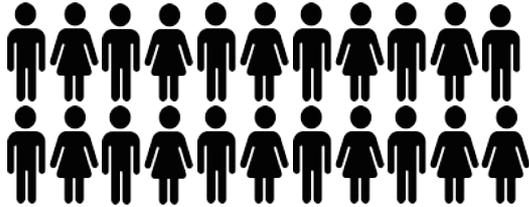
Randomized Controlled Trial on Sanitation Demand



- random selection of 50 slums out of 350 slums
- random selection of 30 households per slum
- 1500 households

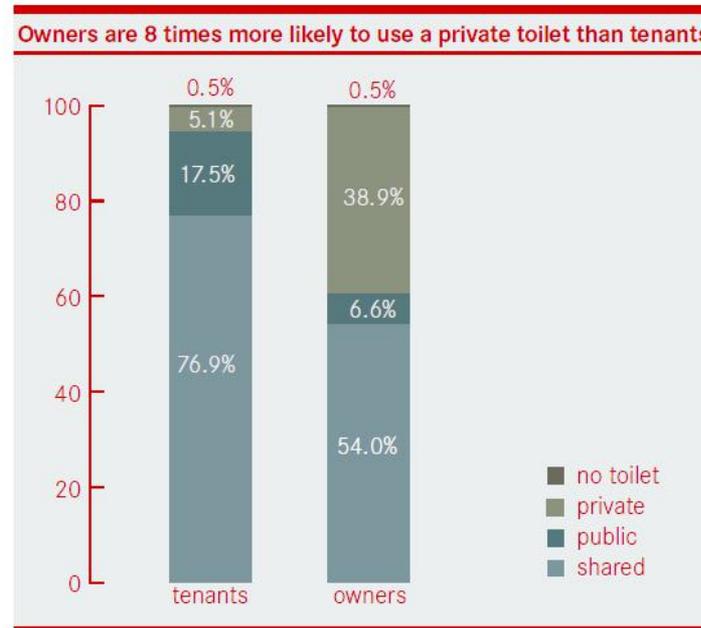
Results and Insights from Baseline Survey

95% use a toilet
but
84% share toilets



On average, 22
people share
one toilet

68% of slum
dwellers are tenants



VIP: ~ \$700



≅ annual mean
p.c. hh income
in urban slums

Is sharing toilets or public toilets a viable option?



Figure 1: Examples of "acceptable" hygienic conditions



Figure 2: Examples of "unacceptable" hygienic conditions

- Coding pictures of 1500 slum toilets
- 2 independent students without access to the survey data
- next time: machine learning

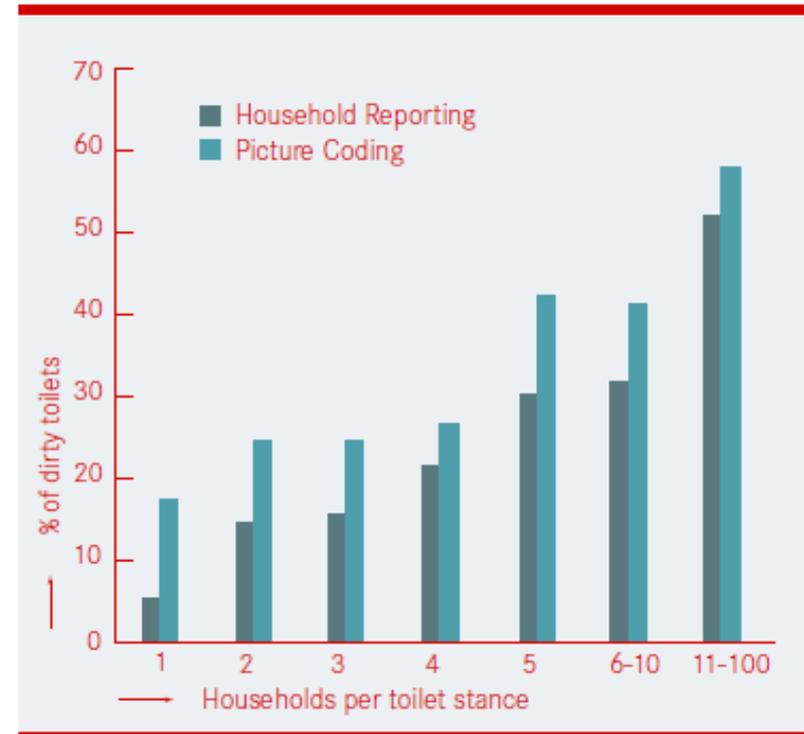


Figure 3: Relation between toilet users and toilet hygiene

Randomized Controlled Trial (RCT)

What is the impact of

Policy:

(1) price (budget constraints)

-> subsidies

(2) information

-> social marketing

(3) liquidity

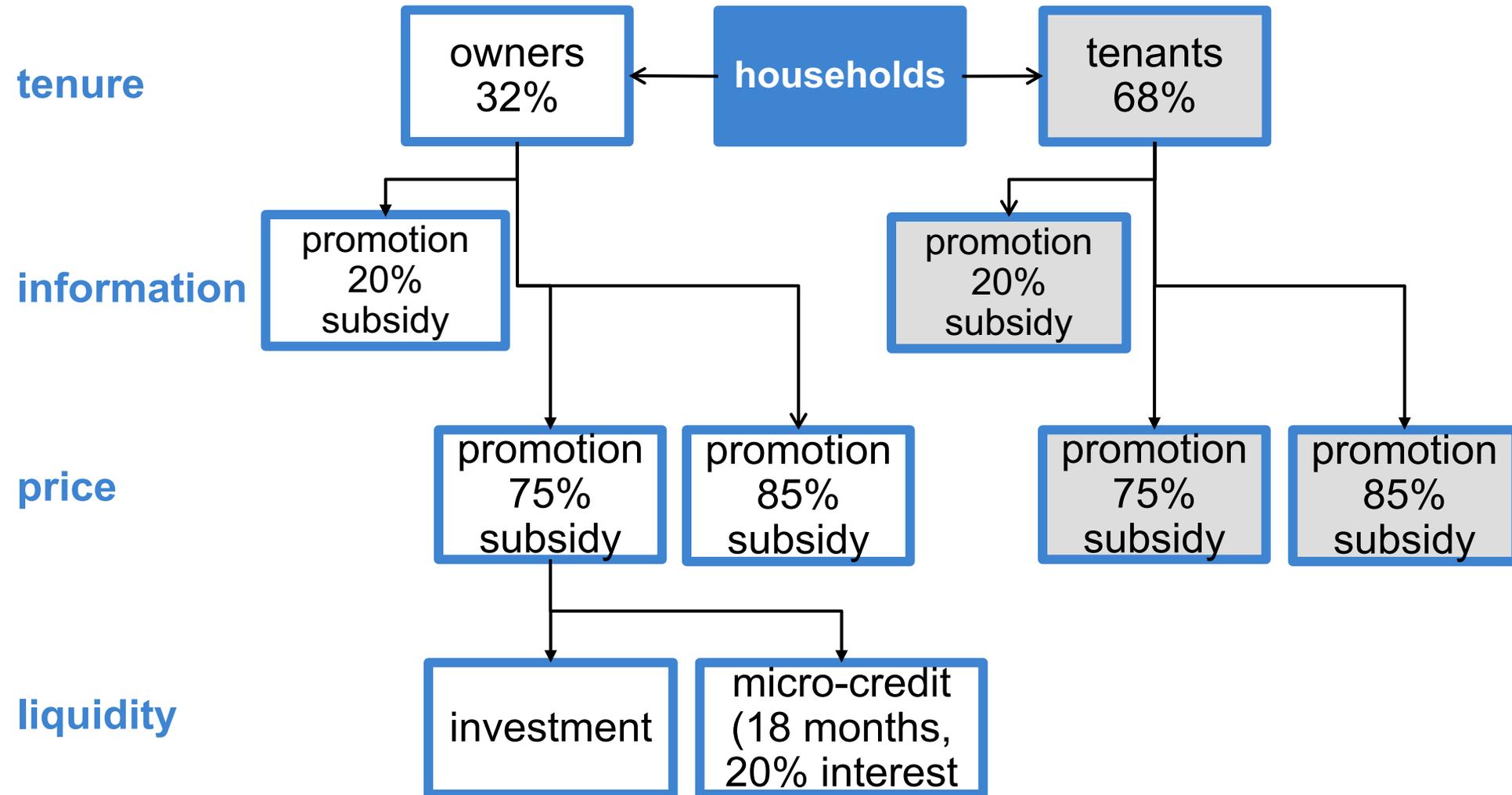
-> micro-credit (18 months, 20% interest rates)

(4) tenure

-> targeting

on latrine investments and hygienic sanitation?

Experimental Set-Up (only to people without private toilet)



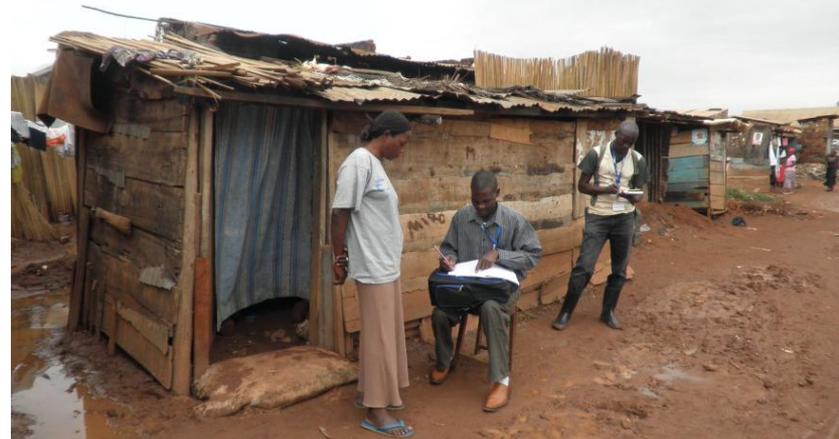
Timeline

2010 – Baseline Survey
50 slums, 1500 households

2011 –
Promotion/Vouchers/Contracts

2012 – VIP Construction

2013 – Follow-Up Survey



U-ACT SSWARS GET YOUR OWN TOILET NOW!
Ffuna kabuyonjo yo kati!

The NGO „Sustainable Sanitation and Water Renewable System“ (SSWARS) offers you a special price for a high-quality toilet for your family or your tenants.

Get your own advanced pit latrine with a plastered superstructure, cement slab and ventilation (VIP) and enjoy the benefits:

- Avoid Diseases and Be More Healthy
- Gain Comfort and Privacy
- Clean and Safe, Reduced Smell
- No Waiting Times
- Increase the Value of your Home

5 easy steps to get your toilet:

1. Contact SSWARS Project Officer (Phone: 077 4 400 389 or 070 3 400 389)
2. Meet with the SSWARS Project Officer
3. Sign the contract with SSWARS
4. Make the 1st payment to SSWARS (50% of total costs)
5. Construction of your toilet starts within 1 week

Contact information SSWARS:
Community Sanitation Centre in Muliaga III, Kileleshwa
Opposite Kamukoko Memorial Primary School
Phone: 077 4 400 389 or 070 3 400 389 or 077 2 335 477

YOUR SPECIAL OFFER FOR HOUSE OWNERS

Division: _____ Zone: _____ No: _____
Name: _____ HH ID: _____

You can choose:

Option 1: 1-stance VIP
Option 2: 2-stances VIP

Special Price: _____
*Prices include a raised superstructure if necessary.

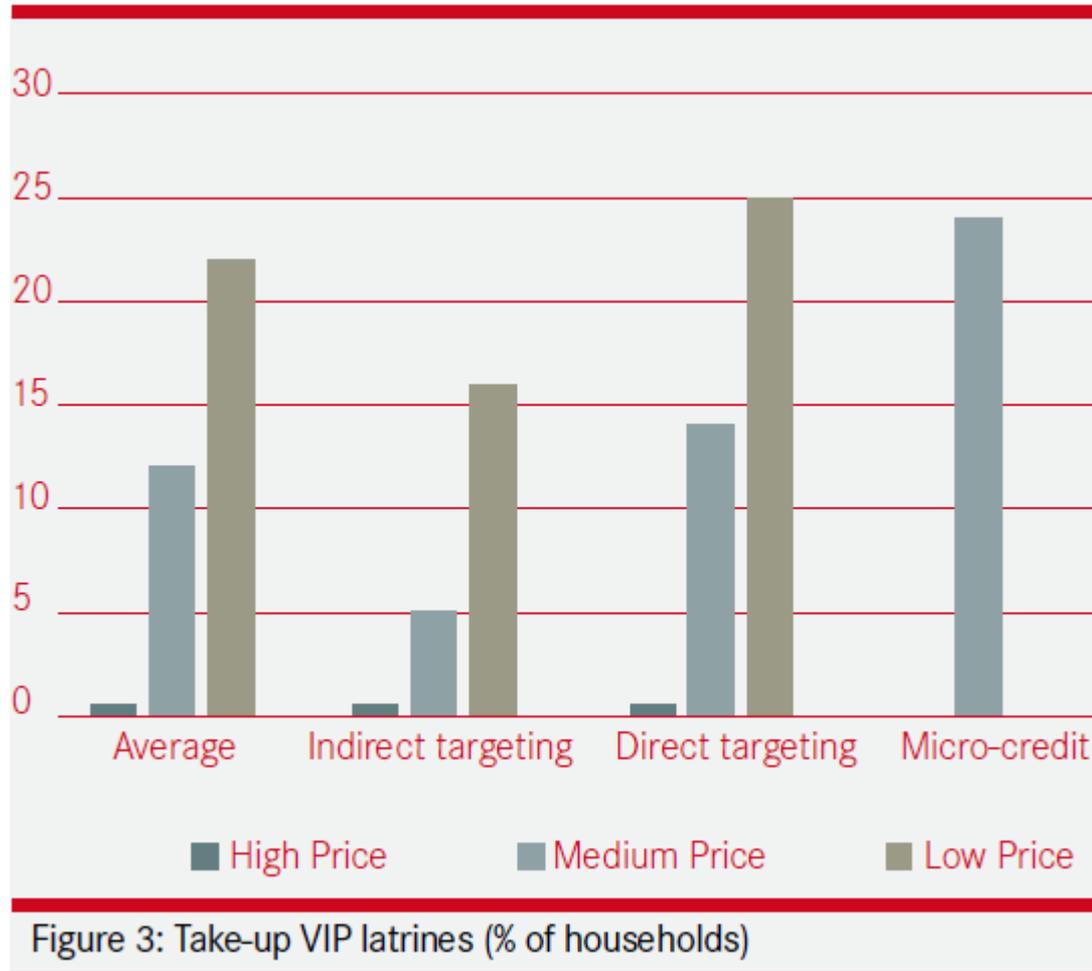
You pay:
1st payment (50% of total costs) on date of your choice
Remaining 50% due latest 2 months after 1st payment

FREE hand washing facility included!

How to get your toilet? Follow the 5 easy steps on the backside
Offer is valid until _____ and can only be redeemed with SSWARS Project Officer



Sanitation Uptake by Intervention



Social marketing (+20% subsidy): no effect

Subsidies: large effects (almost doubling investments) if substantial)

Micro-credit = same as about 50% subsidy

Targeting most important
→ so far rarely taken into account

Sanitation in Slums – an (informal) land property issue

- tenants have on average the same income than house owners
- tenants have about the same average WTP for VIPs than owners

	◦ WTP	Market Price
Owners:	UGX 828,500	UGX 1,500,000
Tenants:	UGX 6,700	UGX 13,000 (22% of rent)
	NPV: UGX 876,000	NPV: UGX1,700,188

(NPV=15 years and 5%.)

- the problem is land: 1 housing unit=3-4 toilets. Alternative investment opportunities for (informal) house owners
- refined regulations needed for tenants
- mobile and smaller on-site technologies needed

New complementary research results (on information and budget constraints)

RESEARCH | REPORTS

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Sciences (NWO/ALW/NPP). The data sets used in this study can be found at <http://pangaea.de>.

SUPPLEMENTARY MATERIALS

www.sciencemag.org/content/348/6237/899/suppl/DC1
Materials and Methods

Figs. S1 to S9
Tables S1 to S4
References (38–78)

26 December 2014; accepted 28 April 2015
10.1126/science.aaa5727

SANITATION SUBSIDIES

Encouraging sanitation investment in the developing world: A cluster-randomized trial

Raymond Guiteras,¹ James Levinsohn,² Ahmed Mushfiq Mobarak^{2*}

Poor sanitation contributes to morbidity and mortality in the developing world, but there is disagreement on what policies can increase sanitation coverage. To measure the effects of alternative policies on investment in hygienic latrines, we assigned 380 communities in rural Bangladesh to different marketing treatments—community motivation and information; subsidies; a supply-side market access intervention; and a control—in a cluster-randomized trial. Community motivation alone did not increase hygienic latrine ownership (+1.6 percentage points, $P = 0.43$), nor did the supply-side intervention (+0.3 percentage points, $P = 0.90$). Subsidies to the majority of the landless poor increased ownership among subsidized households (+22.0 percentage points, $P < 0.001$) and their unsubsidized neighbors (+8.5 percentage points, $P = 0.001$), which suggests that investment decisions are interlinked across neighbors. Subsidies also reduced open defecation by 14 percentage points ($P < 0.001$).

or lack of information about quality or installation methods, may impede adoption (18).

We measured the effects of alternative policies on investment in hygienic latrines using a cluster-randomized trial in 380 rural communities (18,254 households in 107 villages) in the Tanore district of northwest Bangladesh. Although sanitation coverage has increased markedly in rural Bangladesh in recent decades (1), progress in Tanore, located in the poorest region of the country, has been slower. At baseline, 31% of households reported that their primary defecation site was either no latrine (OD) or an unimproved latrine, and only 50% had regular access to a hygienic latrine. The intervention was conducted in 2012, and we collected follow-up data in 2013 (fig. S1).

We randomized communities to different treatments: a community motivation and health information campaign, called the Latrine Promotion Program (LPP); motivation and health information combined with subsidies for the purchase of hygienic latrines; a supply-side market access intervention linking villagers with suppliers and

Summary

- Budget constraints matter for household sanitation investment, information constraints don't.
- Micro-credits have about the same effect as reducing the price by 30%, but program costs of micro-credits were high within the project.
- **Most important for policies: target house owners (30%).**
- Tenants (70% of slums) need strong regulation and enforcement (subsidies and micro-credits only help little) or new technologies.
- Open research question: how to keep public toilets clean?

Additional results

- *Attrition: 37% after a year (urban slum inhabitants stay on average only 3 years in their housing unit – and constantly change their mobile numbers)*
- *Big impact on cleanliness & satisfaction. Small effect on user numbers and waiting times.*
- *Similar to previous research on bednets and mosquito nets: lower costs don't imply lower usage and social benefits.*
- *Housing rents increase for medium price, housing rents remain the same for low price latrines.*

Good policies on toilets are important for policy makers



A screenshot of the BBC News website. The top navigation bar includes the BBC logo, a "Sign in" button, and links for News, Sport, Weather, Shop, Earth, Travel, and More. Below this is a red "NEWS" header with sub-links for Home, Video, World, UK, Business, Tech, Science, Magazine, Entertainment & Arts, Health, In Pictures, and More. The "World" section is active, with sub-links for Africa, Asia, Australia, Europe, Latin America, Middle East, and US & Canada. The main headline is "South Africa toilet protest: Campaigners reveal rears", dated 11 June 2014, with a link to "Africa". A photograph of a protest is partially visible. On the right, a "Top Stories" sidebar lists: "UK goes to polls in general election" (21 minutes ago), "Afghanistan army defends k..." (1 hour ago), and "'Last of US-German Moon te... dies" (7 hours ago).

Thank you!

and thanks to...



Alexandra Horst
World Bank



Liz Tilley
University of Malawi

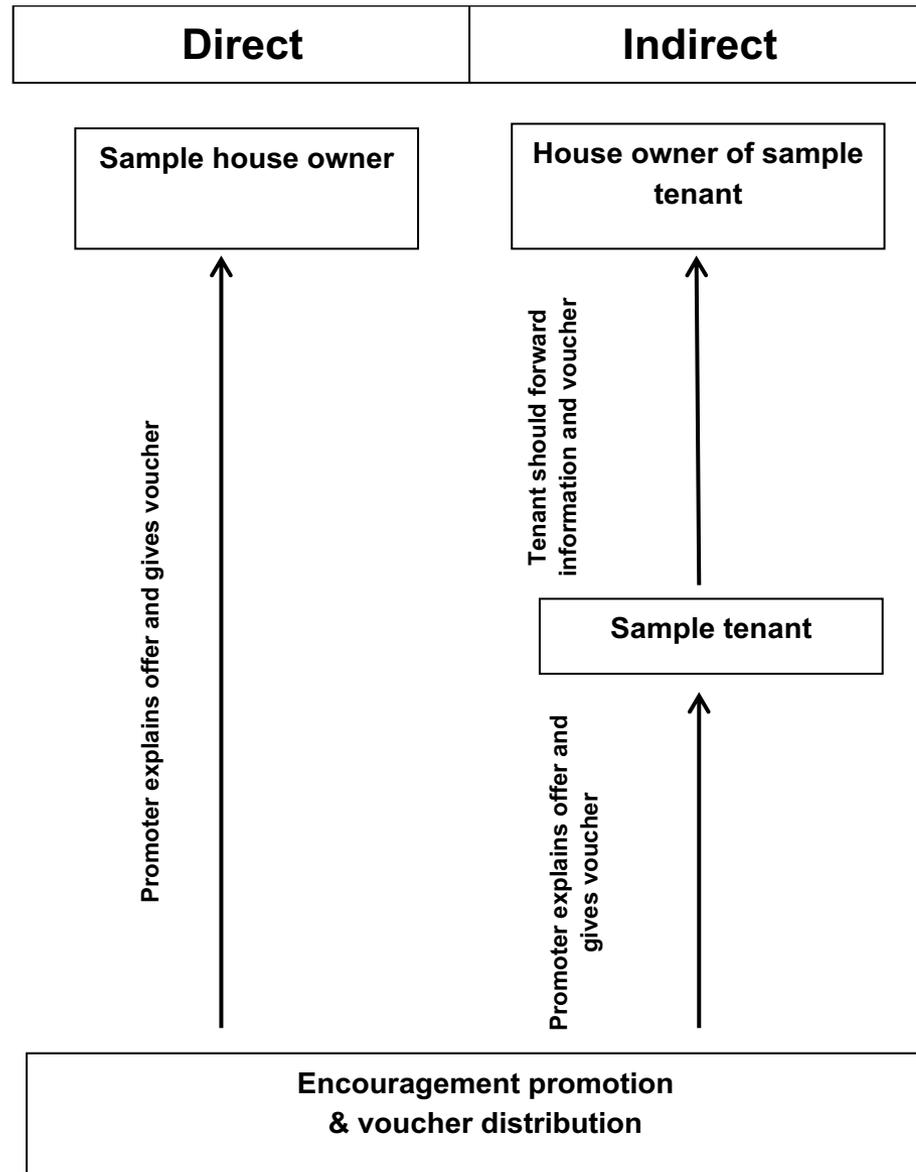


Charles Niwagaba
Makerere University



Chris Luethi
EAWAG

Experimental Set-Up: Targeting



Randomization Verification

Baseline Descriptive Statistics

Variable	Low Price		High Price		Medium Price		Medium with Microcredit		Joint hyp. test of equal means	
	Mean	Obs	Mean	Obs	Mean	Obs	Mean	Obs	F-statistic	P-value
Household is a tenant ¹	0.57	295	0.54	290	0.56	292	0.59	294	0.1	0.96
Household size	4.27	293	4.61	290	4.46	292	4.63	294	1.4	0.24
Household has at least one child below-5	0.62	294	0.63	290	0.63	292	0.67	294	0.85	0.47
Household head age in years	38.7	286	36.2	280	38.7	282	35.4	286	5.14	0.00
Household head has higher education ¹	0.62	294	0.61	290	0.59	292	0.57	294	0.55	0.65
Asset Index (0-100)	0.6	289	0.6	287	0.57	286	0.58	288	1.39	0.24
Monthly income per capita (UGX)	167,059	227	176,920	210	183,124	224	141,631	204	0.25	0.86
Household owns land around house ¹	0.85	114	0.78	127	0.89	123	0.82	109	2.16	0.09
At least one household member has a bank account	0.45	281	0.45	274	0.46	278	0.46	273	0.09	0.96
Household has moving plans ¹	0.19	288	0.2	289	0.16	285	0.2	290	0.58	0.63
Household has a private sanitation facility (improved) ¹	0.20	294	0.19	290	0.17	292	0.15	294	1.14	0.33
Number of user households per stance	5.30	263	3.53	270	4.37	249	3.19	250	4.85	0.00
The sanitation facility is clean ¹	0.44	294	0.54	290	0.46	292	0.47	294	2.41	0.07
Household is suspected to practice OD ¹	0.16	294	0.12	290	0.14	292	0.12	294	1.13	0.34
Household lives in OD environment	0.07	294	0.08	287	0.06	287	0.45	291	1.50	0.21
There would be space for a new sanitation facility ¹	0.65	260	0.64	262	0.62	260	0.69	240	1.03	0.38
Willingness to pay for a private improved sanitation facility (in UGX) ²	849,391	115	847,823	124	951,074	121	816,726	113	0.91	0.43

¹ Dummy variable for which 0 means "no" and 1 "yes".

² This includes respondents who had paid for a private facility.

Effect of Price Differences on Development Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Usage		Conditions Project Sanitation Facility							
	Use project facility	Use project facility	Facility is clean	Facility is clean	Facility user is satisfied	Facility user is satisfied	Number of user households	Number of user households	Need to wait	Need to wait
Low Price	0.042 [0.664]	0.076 [0.508]	-0.031 [0.740]	0.037 [0.812]	0.117* [0.064]	0.037 [0.496]	-1.081* [0.065]	-0.444 [0.491]	-0.133 [0.335]	-0.143 [0.284]
Microcredit Financing	0.010 [0.929]	-0.079 [0.654]	0.109 [0.369]	0.072 [0.716]	0.071 [0.315]	-0.156 [0.169]	-0.705 [0.246]	-0.639 [0.193]	-0.177 [0.279]	-0.234 [0.127]
Mean in Comparison Group (medium Price)	0.861	0.861	0.531	0.531	0.80	0.80	3.50	3.50	0.50	0.50
Household controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Oberservations	129	78	111	68	126	78	125	77	127	78
R-squared	0.004	0.208	0.012	0.337	0.022	0.249	0.039	0.378	0.020	0.284

Health Impact of Living in Slums



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5. Construction of your toilet starts within 1 week

Contact Information SSWARS:

Community Sanitation Centre in Mutaga III, Kifumbira
 Opposite Kamwalya Homestead Primary School
 Phone: 077 4 400 189 or 070 3 400 189 or 077 2 335 477

- Poor: surface water such as rivers, lakes or standing rainwater.
 - Intermediate: primary source was below the surface, such as all springs, boreholes, standpipes, wells and dug wells but not part of a public piped system.
 - High: piped water or bought drinking water from vendors.
-
- Poor: no access to any toilet facilities;
 - Intermediate: access to a basic or latrine;
 - High: flush toilet or VIP