

ONLINE APPENDIX:

Spillovers without Social Interactions in Urban Sanitation*

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A Script Explaining Subsidized Desludging Service in Surveys

The below script is translated from Wolof to English. It appeared on the portable devices used by the enumerators with the different wordings automated by treatment group.

Today, we are going to offer you a subscription to a mechanized desludging service. Mechanized desludging, it's very important, for you, your family, and your neighbors. When you use a truck to desludge your pit, the truck takes all of the filth from the pit, takes it far away from the house, so that you're sure that your house and the area around it is all very clean, and your children and other children in the neighborhood will not play in that filth.

The subscription to the service that we're offering is very useful: it will help you plan for when you will need to desludge your pit, and it is thanks to the subscription that we will be able to subsidize the cost of a desludging over time, and it will enable you to have access to a quality desludging.

If you agree to sign up, when you need a desludging, you will call ZZ, identify yourself as a subscriber, and say that you need a desludging. We'll then find a truck to desludge your pit within about 2 to 3 hours of the call. The desludging service covers one trip by one truck, getting about 8 m³ from the pit, without 'curage'.

Of the twelve houses near you that we chose to participate in the research, ten will be offered a subsidized mechanized desludging. There are small subsidies and large subsidies, and of those 10 households, each household has a 50% chance of being offered a large subsidy. The other two households will not be offered the chance to subscribe to the desludging service.

[For private-price treatment clusters.] We randomly selected each household's subsidy level. We are leaving you with a piece of paper that lists the names of all households near you which were offered a subsidy, but the subsidy level offered to each household will not be told to the other households.

[For public-price treatment clusters.] We randomly selected each household's subsidy level. We are leaving you with a piece of paper that lists the name and subsidy level of each household living near you.

[Enumerator: Pause, give the list to the respondent, and read it aloud with him.]

You can use the subsidy to desludge your pit twice within the next 9 months. *[Note: Later changed to 12 months.]* If you need more than two desludgings within that period, these additional desludgings will not be subsidized. Also, if you do not desludge your pit twice during this period, you will not be able to use the subsidy after those 9 *[Note: Later 12]* months.

In a few weeks, we will come back to the households that decide to sign up for the service to put a sticker on their door signaling that the house signed up.

The undiscounted price of a desludging is 25000 CFA. Your discount is: [discval]. So, you will pay [25000 - discval] for each of your first 2 desludgings over the next 9 months.

[For second five households in public-how-many clusters.] We have already asked [List of First 5 Offered] whether or not they want to sign up, and [Number of Signed Up in First 5] of them have decided to sign up.

[For second five households in public-who clusters.] We have already asked [List of First 5 Offered] whether or not they want to sign up, and [List of Signed Up in First 5] have all

decided to sign up.

[*For deposit treatment households.*] If you would like to sign up for the subsidized mechanized desludging service, you will have to leave a deposit of 3000 CFA. We will take this 3000 CFA from your participation fee, so you will not have to give us any money out of pocket if you sign up. Would you like to sign up?

[*For non-deposit treatment households.*] Would you like to sign up for the subsidized mechanized desludging service? You do not have to pay anything now.

[*Enumerator records whether the respondent signed up. The rest of the script containing details on how they can use the service is only read to people who sign up.*]

B Layout of Randomization

At the cluster level, the 410 clusters are split across 12 types.

- Public-price, Public-how-many, No experiment (39 clusters)
- Public-price, Public-how-many, Experiment (13 clusters)
- Public-price, Public-who, No experiment (38 clusters)
- Public-price, Public-who, Experiment (13 clusters)
- Public-price, Private-signup, No experiment (78 clusters)
- Public-price, Private-signup, Experiment (25 clusters)
- Private-price, Public-how-many, No experiment (40 clusters)
- Private-price, Public-how-many, Experiment (12 clusters)
- Private-price, Public-who, No Experiment (37 clusters)
- Private-price, Public-who, Experiment (13 clusters)
- Private-price, Private-signup, No experiment (77 clusters)
- Private-price, Private-signup, Experiment (25 clusters)

At the household level, we have 4 different types of households:

- High discount, no deposit (255 households).
- Low discount, no deposit (254 households).
- High discount, deposit (1792 households).
- Low discount, deposit (1799 households).

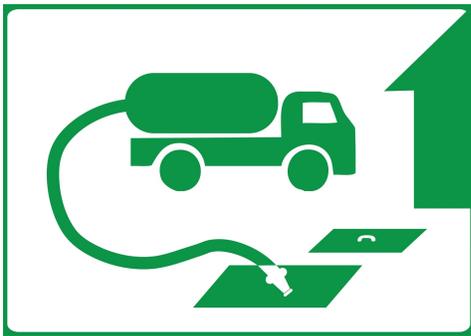
At the cluster level we randomized the number of households, out of ten, which were offered the high subsidy.

- One high subsidy household (8 clusters)
- Two high subsidy households (8 clusters)
- Three high subsidy households (43 clusters)
- Four high subsidy households (98 clusters)
- Five high subsidy households (106 clusters)
- Six high subsidy households (81 clusters)
- Seven high subsidy households (50 clusters)
- Eight high subsidy households (8 clusters)
- Nine high subsidy households (8 clusters)

At the cluster level we randomized the number of households, out of ten, which were required to leave a deposit if they wanted to sign up for the subsidized mechanized desludging service.

- Six households must pay deposit (16 clusters)
- Seven households must pay deposit (41 clusters)
- Eight households must pay deposit (67 clusters)
- Nine households must pay deposit (188 clusters)
- Ten households must pay deposit (98 clusters)

C Sticker Given to Households which Signed Up





D Variables used for post-double-selection LASSO

In this appendix, we describe the variables used for the post-double-selection lasso methods (Belloni et al. 2014) we use throughout the paper. Choosing control variables using post-double-selection lasso reduces error and increases statistical power. The ‘double’ comes from the fact that covariates are included which predict the outcome, and covariates are included which predict the control of interest.

We consider 131 variables measured in the baseline which could potentially be included as controls in the regressions. We list them here in general categories. (These categories are irrelevant for the estimation, but may be helpful when considering the variables.) We replace missing observations with the sample mean and also include indicator variables for observations that are missing a value for each variable. In theory this could imply 131 additional indicator variables though in practice it only leads to 37 additional variables since not all variables have missing observations or the same households have missing observations for multiple variables. All variables are standardized.

- Head and respondent characteristics (7 variables) - head male, head education level, respondent male, respondent education level, respondent married, respondent age, respondent is the head.
- Family characteristics (12 variables) - household size, number of households in compound, anyone outside of compound regularly uses latrine, number of children age 0-5, number of children age 0-14, number of adults, number of female adults, number of household members with jobs, number of household members earning a pension, number of people outside the household providing money, Muslim, primary language is Wolof.

- Residence characteristics (22 variables) - own their residence, years lived in residence, lived in residence more than ten years, expect to move out within five years, expect to stay at least ten more years, don't expect to move out in the future, residence has two stories, number of stories in the residence, number of rooms in the residence, has electricity, courtyard looks clean, road is wide enough for a truck, road is not sandy, number of functioning pits, pit in the compound (as opposed to in the street), animals were seen by the enumerator in the compound, animals were seen by the enumerator outside of the compound, household rents out rooms in the compound to others, courtyard has flooded in last year, floor is made of tile, roof is made of slab, household is only in the second baseline survey (implying they moved in recently).
- Assets (25 variables) - owns a cell phone, owns a radio, owns a television, owns a computer, owns a bicycle, owns a motorcycle, owns a car, owns a fan, owns an air conditioner, owns a refrigerator, owns a gas oven, owns a washing machine, owns a microwave, owns a generator, household asset index, number of animals owned, number of cows owned, number of sheep owned, number of goats owned, number of pigs owned, number of chickens owned, number of other productive animals owned, owns land other than where household lives, has a water meter, wealth index.
- Finance (9 variables) - owns jewelry, value of jewelry owned, household is wealthy, respondent has any account, respondent has a savings account, household in a tontine, total monthly tontine contributions, household expects tontine payout within two months, respondent has heard of Wari mobile money.
- Desludging history (20 variables) - desludge at least once a year, desludging frequency in dry season, desludging frequency in rainy season, desludging frequency if less than once a year, current pit ever desludged, current pit desludged more than once, any pit ever desludged, ever used manual desludging, ever used mechanized desludging, ever used both types of desludging, never desludged, desludged in last year, mechanized desludging in last year, manual desludging in last year, last desludging due to rain, last desludging done within two days of when the need was noticed, months since last desludging, months since last manual desludging done by a family member, months since last manual desludging done by a baay pelle, months since last mechanized desludging.
- Social networks (5 variables) - number of households in the cluster they are aware of, number they drink tea with, number they would pick as a health leader, number they talked about sanitation with, number that are wealthy.
- Preferences (11 variables) - trust people in the neighborhood, people in the neighborhood would take advantage, time preferences today, time preferences in a month, consistent time preferences, hyperbolic time preferences, patient now and impatient later, use savings for big expenses like a desludging, prefer to pay at once with a discount rather than at a higher price in installments, positive reciprocity, negative reciprocity.

- Health (8 variables) - number of household members with diarrhea in the last week, share of household members with diarrhea, number of children 0-14 with diarrhea, number of children 0-5 with diarrhea, number of household members with cough in the last week, share of household members with cough, number of children 0-14 with cough, number of children 0-5 with cough.
- Survey characteristics (7 variables) - enumerator reports no problems with interview, enumerator reports responses seemed reliable, supervisor accompanied enumerator, survey conducted in Wolof language, date of survey, months between baseline and endline survey, household is in endline survey.
- Randomized treatments (6 variables) - high subsidy, deposit required, public-price cluster, second 5 hhd in public-how-many cluster, second 5 hhd in public-who cluster, spillover household.

E Sheets Given to Treatment Households

E.1 Private-Price Clusters

[cluster]



Subsidies for Desludging Subscriptions

Recipients of subsidy:

- [participant 1]
- [participant 2]
- [participant 3]
- [participant 4]
- [participant 5]
- [participant 6]
- [participant 7]
- [participant 8]
- [participant 9]
- [participant 10]

The subsidies for the desludging service were assigned to each household listed above by a random draw. Each household had one chance out of two to be offered a large subsidy, and one chance out of two to be offered a small subsidy.

A household can only access the subsidy if the household signs up for our mechanized desludging service.

E.2 Public-Price Clusters

[cluster]



Subsidies for Desludging Subscriptions

Recipients of a large subsidy

Must pay 17.000 for a desludging:

- [high subsidy participant 1]
- [high subsidy participant 2]
- [high subsidy participant 3]
- [high subsidy participant 4]
- [high subsidy participant 5]
- ...

Recipients of a small subsidy

Must pay 24.000 for a desludging:

- [low subsidy participant 1]
- [low subsidy participant 2]
- [low subsidy participant 3]
- [low subsidy participant 4]
- [low subsidy participant 5]
- ...

A household can only access the subsidy if the household signs up for our mechanized desludging service.

Community Sanitation
2014



F Script Explaining Experiment

The below script is translated from Wolof to English.

Introduction to the game

- Now I am going to explain to you the rules of the game which is part of the study.
- For this game, real money will be used.
- You will make all decisions yourself autonomously during the game.
- We will first review several examples before starting the real game.
- Understand that the money that you take from this game will be entirely given to you at the end.
- In this way, when we have finished the game with your neighbors participating in the study, your winnings will be sent to you by Wari [mobile money].
- Your participation in the game does not require any bets or fees on your part.
- The money used in this game is part of the budget of the study. If you would like to withdraw from the game before the end, any money you have already won will be given to you.

Instructions

- This same game will be reproduced in the other 11 households in your neighborhood participating in the study.
- At the beginning of the game, you will have 1200 CFA.
- Of this amount, you will decide how much you want to distribute to each of your 11 neighbors listed and how much you want to keep for yourself.
- What you distribute to your neighbors can range from 0 to 1200 CFA in steps of 100.
- All that you give to your neighbors will be multiplied by two.
- The amount that you decide to keep for yourself will be given to you, but will not be multiplied by two.

Terms of the game

- Your 11 neighbors participating in the study will play one by one this game and will distribute their 1200 CFA between their 11 neighbors and themselves.
- Nobody will know how you have distributed your 1200 CFA and we will not tell you how your neighbors have used their 1200 CFA.
- You alone will know how much you have given to your neighbors and how much you kept for yourself.

- When all your neighbors have finished distributing their 1200 CFA, the game will end, and we will send you your winnings by Wari. I remind you that what you keep for yourself will not be multiplied by two, but what you give to your neighbors and what they give to you will be multiplied by two.
- We will combine all your winnings and give them to you as one lump sum.

Examples

Before we begin, let us practice with two examples. After these examples, we will ask you to tell us how you want to distribute the 1200 CFA allocated to you between your 11 neighbors and yourself.

Let's talk through this example. You start with 1200 CFA. Let's say you decide to give 100 to each of the other households and keep 100 for yourself. How much will you earn?

[If the person gets the answer wrong the device shows: Enumerator, please work through this example with the respondent.]

Remember, in this example you start with 1200 CFA. You decide to give 100 to each of the other households and keep 100 for yourself. How much will each of the other households earn?

[If the person gets the answer wrong the device shows: Enumerator, please work through this example with the respondent.]

Let's talk through another example. You start with 1200 CFA. Let's say you decide to give 500 to Ahmadou, 500 to Cheikh, keep 200 for yourself, and give nothing to the other nine households. How much will you earn?

[If the person gets the answer wrong the device shows: Enumerator, please work through this example with the respondent.]

Remember, in this example you start with 1200 CFA. You decide to give 500 to Ahmadou, 500 to Cheikh, keep 200 for yourself, and give nothing to the other nine households. How much will Ahmadou earn?

[If the person gets the answer wrong the device shows: Enumerator, please work through this example with the respondent.]

Remember, in this example you start with 1200 CFA. You decide to give 500 to Ahmadou, 500 to Cheikh, keep 200 for yourself, and give nothing to the other nine households. How much will the other households earn?

[If the person gets the answer wrong the device shows: Enumerator, please work through this example with the respondent.]

Now, I am going to show you the list of your neighbors that we selected. I will take note of how much you want to give to each of your neighbors and how much you want to keep for yourself, so that the total of what you give and what you keep comes to 1200.

[The enumerator then listed aloud the name of each eligible household head.]

How much would you like to keep for yourself?

How much would you like to give to [Neighbor X's] household? *[This was asked eleven times, once for each neighboring household.]*

[If the amounts did not sum to 1200.] The respondent must use exactly 1200 CFA, no more and no less. Ask him to readjust his answers so the total comes to 1200.

The game is over, thank you. We will return within the next two weeks to give you your winnings.

G Appendix Tables

Table G-1: Survey Attrition

	Treatments			# of high subsidy hhds in cluster				
	Mean (SD)	Coefficient (SE)		<i>p</i> -value	Mean (SD)	Coefficient (SE)		<i>p</i> -value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Low Subsidy (LS)	High Subsidy (HS)	Spillover (SO)	HS= SO= 0	4-6 High Subsidies (HS46)	1-3 High Subsidies (HS13)	7-9 High Subsidies (HS79)	HS13= HS79= 0
<i>Panel A: Hhds that responded to both baseline surveys</i>								
Responded to endline survey	0.895 (0.306)	0.018 (0.011)	0.019 (0.012)	0.175	0.903 (0.296)	0.004 (0.013)	0.008 (0.013)	0.813
<i>Panel B: Hhds that responded to first baseline survey</i>								
Responded to 2nd baseline survey	0.910 (0.286)	0.010 (0.009)	0.024 (0.011)	0.096	0.917 (0.276)	0.008 (0.015)	0.008 (0.011)	0.697
Responded to endline survey	0.815 (0.388)	0.024 (0.013)	0.035 (0.015)	0.041	0.828 (0.377)	0.011 (0.019)	0.015 (0.017)	0.625

Note: Panel A uses the sample of households that responded to both baseline surveys. Panel B uses the sample of households that responded to the first baseline survey. Columns (1) and (5) show the mean and standard deviation of observations with a low subsidy and observations in a cluster with 4-6 high subsidy hhds, respectively. Columns (2) and (3) show the coefficients on high subsidy and spillover in a regression including grid-point level fixed effects. Columns (6) and (7) show the coefficients on clusters with 1-3 and 7-9 high subsidy hhds in a regression with no fixed effects. Standard errors clustered at the grid-point level in parentheses in columns (2), (3), (6), and (7). Columns (4) and (8) show the *p*-values for tests of whether the coefficients in columns (2)-(3) or columns (6)-(7) equal one another and equal 0. Panel A has 4,521 observations and Panel B has 4,916 observations.

Table G-2: Ex-post Minimum Detectable Effect Sizes (MDEs)

		(1)	(2)	(3)	(4)
		Used Any Mechanized Desludging	Used Manual Desludging	# of hhd members who had diarrhea	Share of hhd members who had diarrhea
<i>Panel A: Reference points</i>					
Baseline data	Mean	0.292	0.376	0.952	0.096
	SD	(0.455)	(0.484)	(1.489)	(0.155)
<i>Panel B: Ex-post power calculations - Minimum detectable effect sizes (MDE)</i>					
Table 2	(treated households) # of high subsidy hhds in cluster	0.013	0.014		
	(spillover households) # of high subsidy hhds in cluster	0.023	0.030		
	(all households) # of high subsidy hhds in cluster	0.012	0.013		
Table 4	# of high subsidy hhds in cluster			0.030	0.003
	# of high subsidy hhds in nearest 4			0.044	0.005
Table 5	# of high subsidy hhds in cluster that you are aware of	0.020	0.021		
	# of high subsidy hhds in cluster that you drink tea with	0.025	0.024		
	# of high subsidy hhds in cluster that you would pick as health leader	0.031	0.034		
	# of high subsidy hhds in cluster that you talked about sanitation with	0.034	0.034		
	# of high subsidy hhds in cluster that are wealthy	0.025	0.025		
	# of high subsidy hhds in cluster that are in nearest 4	0.020	0.022		
Table 6	# signed up in 1st 5 × Public-how-many cluster	0.054	0.056		
	# signed up in 1st 5 × Public-who cluster	0.052	0.056		
Table 7	# signed up in 1st 5 that you are aware of × Public-who cluster	0.102	0.109		
	# signed up in 1st 5 that you drink tea with × Public-who cluster	0.112	0.124		
	# signed up in 1st 5 that you would pick as health leader × Public-who cluster	0.181	0.196		
	# signed up in 1st 5 that you talked about sanitation with × Public-who cluster	0.157	0.161		
	# signed up in 1st 5 that are wealthy × Public-who cluster	0.153	0.146		
	# signed up in 1st 5 that are in nearest 4 × Public-who cluster	0.121	0.125		
Table 8	High subsidy x Public-price cluster	0.072	0.075		

Note: This table shows the ex-post minimum detectable effect sizes (MDE) for main outcomes and main controls. Outcome variables are (1) purchased any mechanized desludging between the baseline and endline, (2) had any manual desludging between the baseline and endline, (3) number of household members who had diarrhea in the past week in endline, and (4) share of household members who had diarrhea in the past week in endline. Panel A shows the mean and standard deviation of outcomes in the baseline. Panel B reports the minimum detectable effect sizes, calculated ex-post using a significance level of 0.05 and power of 80%.

Table G-3: Method of Finding Desludging Provider - Odds Ratios

Alternative-Specific Variable	(1) How Desludger Found
Alternative chosen in bl	1.758 (0.144)
Manual (26%)	
Own high subsidy	0.855 (0.093)
# other high subsidies in cluster	0.918 (0.033)
Mechanized - garage (5%)	
Own high subsidy	0.821 (0.142)
# other high subsidies in cluster	1.006 (0.052)
Mechanized - call, flag, or referral (20%)	
Own high subsidy	0.936 (0.112)
# other high subsidies in cluster	1.104 (0.043)
Mechanized - other (6%)	
Own high subsidy	2.584 (0.402)
# other high subsidies in cluster	1.026 (0.055)
<i>N</i> of Obs.	20455
<i>N</i> of Cases	4091

Note: The sample includes all hhds. Standard errors clustered at the grid-point level in parentheses. Conditional logit estimation presenting odds ratios and testing significance with respect to 1. Odds ratios greater than 1 imply a positive and odds ratios less than 1 a negative relationship. Outcome is the desludging choice between baseline and endline. The base alternative is having no desludging (42% of observations). The other alternatives are (1) having a manual desludging, or having a mechanized desludging and finding the desludger (2) at a garage or parking site, (3) calling trucker (5%), flagging down truck (2%), or referral (13%), and (4) calling the call-in center with or without a subsidy (5%), calling the ministry (0.2%), and don't know (1%). Controls (measured in baseline) selected by post-double-selection LASSO for inclusion in Table ?? (Panel C, columns 3 and 4) and arrondissement fixed effects, all interacted with the different alternatives.

Table G-4: Ability to Remember Neighbors' Subsidy Levels and Decisions

	Baseline		Endline		
	(1) Subsidy	(2) Signed Up	(3) Subsidy	(4) Signed Up	(5) Used Subs Desl
Public-price cluster	0.076 (0.018)	0.010 (0.005)	0.006 (0.002)	-0.002 (0.002)	0.001 (0.001)
Public-who cluster \times 2nd 5 hh	0.039 (0.027)	0.012 (0.010)	-0.004 (0.002)	0.004 (0.005)	0.000 (0.003)
Public-who cluster \times 1st 5 nghbr	0.017 (0.017)	0.004 (0.007)	0.002 (0.003)	-0.004 (0.003)	-0.000 (0.002)
Public-who cluster \times 2nd 5 hh \times 1st 5 nghbr	-0.016 (0.017)	0.004 (0.009)	-0.002 (0.003)	0.005 (0.005)	-0.000 (0.004)
Same respondent in bl intervention and bl payment survey	0.066 (0.018)	0.018 (0.005)			
Weeks between bl intervention and bl payment survey	-0.008 (0.003)	-0.003 (0.001)			
Same respondent in bl intervention and el survey			0.002 (0.002)	0.007 (0.002)	0.003 (0.001)
Weeks between bl intervention and el survey			-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
<i>N</i>	8187	8184	31311	31291	31034
Outcome mean, comparison group	0.002	0.010	0.002	0.017	0.005

Note: The sample in columns (1)-(2) includes dyads for all pairs of treatment households in all clusters participating in the incentivized experiment. The sample in columns (3)-(5) includes dyads for all pairs of treated households in all clusters. Standard errors clustered at the grid-point level in parentheses. Outcome variables in columns (1)-(2) are whether, in the final baseline survey to give out experimental winnings, the respondent correctly knew (1) his neighbor's subsidy level, and (2) whether his neighbor signed up for the subsidized desludging. Outcome variables in columns (3)-(5) are whether, in the endline survey, the respondent correctly knew (3) his neighbor's subsidy level, (4) whether his neighbor signed up for the subsidized desludging, and (5) whether his neighbor purchased a subsidized mechanized desludging. Controls (measured at baseline) are chosen using post-double-selection LASSO. Fixed effects at the arrondissement level. The outcome mean is shown for households that are not in a public price cluster.

Table G-5: Impact of Intervention on Price of Mechanized Desludging

	Mechanized price between bl and el			
	(1) LS + SO	(2) SO	(3) LS + SO	(4) SO
# other high subsidies in cluster	0.459 (0.351)	0.274 (0.654)		
# of high subsidies in nearest 4			0.186 (0.473)	0.728 (0.809)
<i>N</i>	682	213	682	213
Outcome mean, comparison group	45.05	45.17	45.05	45.17

Note: The sample in columns (1) and (3) includes all low subsidy and spillover households that purchased a mechanized desludging between the baseline and endline. The sample in columns (2) and (4) includes only spillover households that purchased a mechanized desludging between the baseline and endline. Standard errors clustered at the grid-point level in parentheses. The outcome is the price paid for a mechanized desludging (in dollars) between the baseline and endline. All regressions include the baseline mechanized desludging price reported, a control for whether the baseline mechanized price is missing, a spillover dummy in columns (1) and (3), and additional controls are selected by post-double-selection LASSO. Fixed effects at the arrondissement level. The outcome mean is shown for all low subsidy and spillover households in columns (1) and (3), and for all spillover households in columns (2) and (4).

References

Belloni, A., Chernozhukov, V. & Hansen, C. (2014), ‘Inference on treatment effects after selection among high-dimensional controls’, *Review of Economic Studies* **81**(2), 608–650.