New technologies for house improvement in rural Gambia: evidence on learning and adoption (challenges) from a malaria RCT

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Study context: the entomology&epidemiology

Roo*Pf*s clustered-randomised controlled trial in the upper river region - The Gambia (Pinder et al, LPH, 2021)

RCT content:

- 800 households (from 90 villages) enrolled received bed nets, and 400, the intervention, received improved housing. Control houses entitled to received the house improvement after the trial

Primary clinical endpoint:

- Incidence of clinical malaria

RooPfs study design

800 houses traditional
mud-walled thatched houses recruited

400 traditional
mud-walled thatched houses

400 ventilated
metal-roofed houses

Study aim and motivation

Aim: to test if there are signals of learning and adoption of house improvement technologies (particularly) among the households not enrolled in the trial but observing the intervention in the villages where the trial was carried out; and whether these signals vary over time (season)

OUR STUDY

- Approx 1 year follow up of a subset of 15 Roo*Pf*s villages (out of 90 total villages)

- 15 villages randomly selected stratifying by:
  - (i) Village size; (ii) North/South bank; (iii) Ethnic group (Jagajari village purposely selected for being Sarahule, while main ethnic groups are Mandinka and Fula)

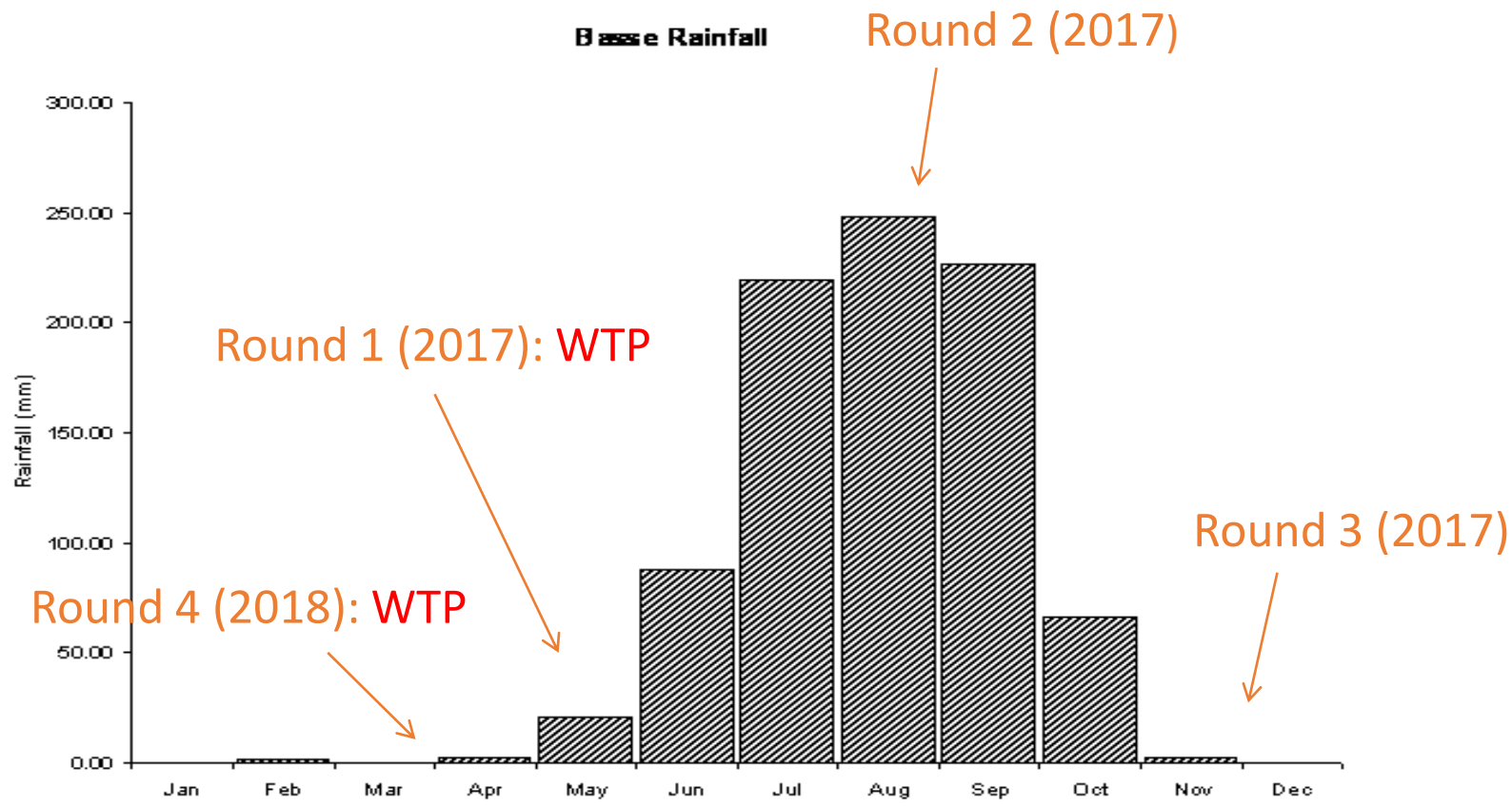
- Intervention and control houses plus non-Roo*Pf*s houses

- 201 households included (67 intervention, 65 control, 69 non-Roo*Pf*s), **191 effective**

- 4 rounds (all after the intervention took place but before knowing the impact on malaria)

Study Rounds and seasonality

Rain distribution over a typical year



Source=NOOA

Different definitions of demand

1. Willingness to pay (WTP) for the intervention (stated preferences)
2. Satisfaction with own house (“utility”)
3. Decision to do house improvement (revealed preferences)

} learning

} adoption

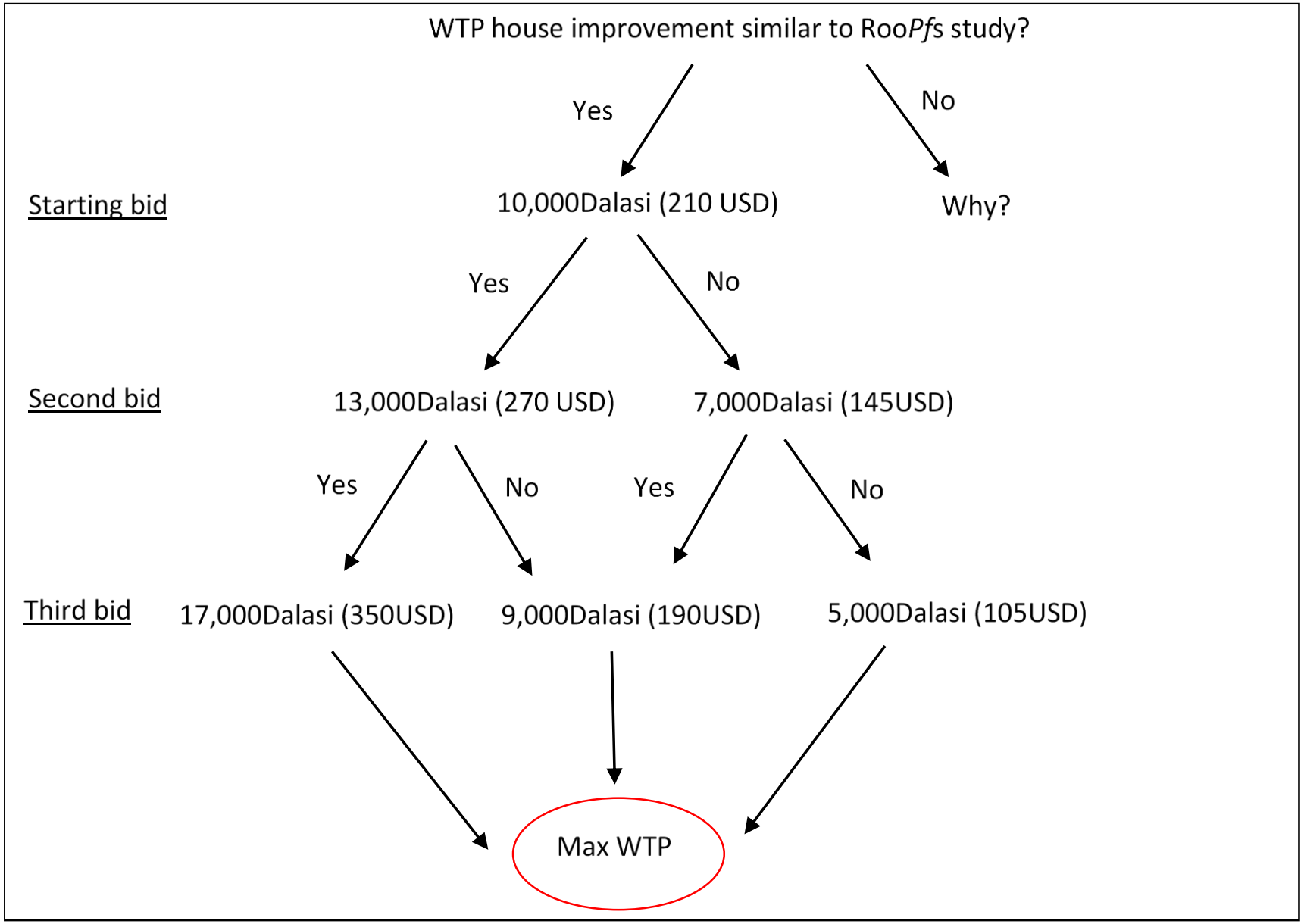
Hypotheses: if there is learning or adoption then…

- The WTP for a Roo*Pf*s-like house in the Control and non-Roo*Pf*s groups should not be lower than the WTP in the Intervention group

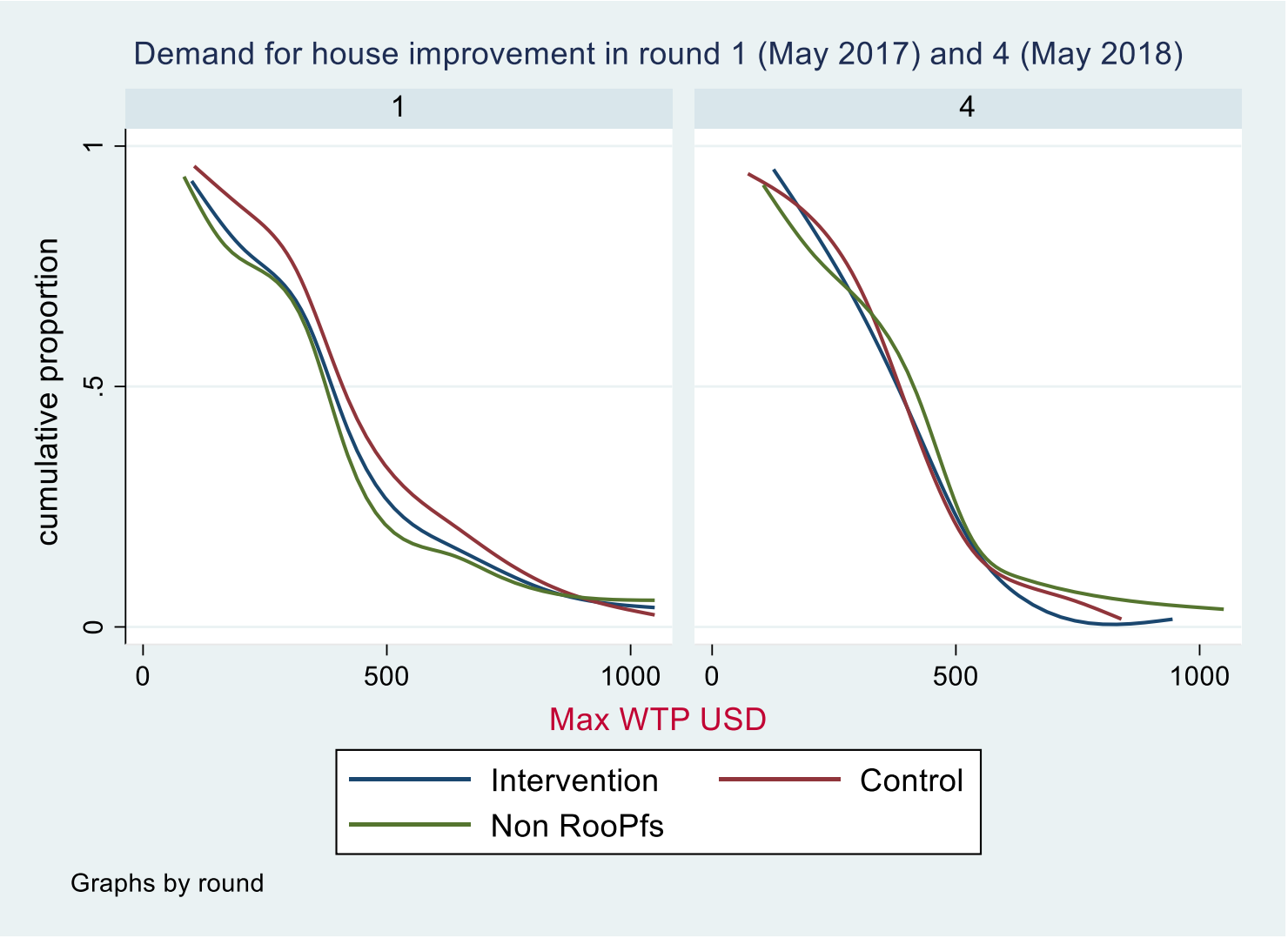
- The satisfaction that individuals in Control and Non-Roo*Pf*s group receive from their *own* houses should decrease in comparison with the Intervention group

- People in Non-Roo*Pf*s houses should increase the amount of interventions done to their houses. Control group may decrease

WTP


WTP house improvement similar to Roo*Pf*s study?
Yes
No
Starting bid
10,000Dalasi (210 USD)
Why?
Yes
No
Second bid
13,000Dalasi (270 USD)
7,000Dalasi (145USD)
Yes
No
Yes
No
Third bid
17,000Dalasi (350USD)
9,000Dalasi (190USD)
5,000Dalasi (105USD)
Max WTP

Demand Max WTP-driven



Mean across groups:

Round 1 = 507.21 USD

Round 4 = 398.97 USD

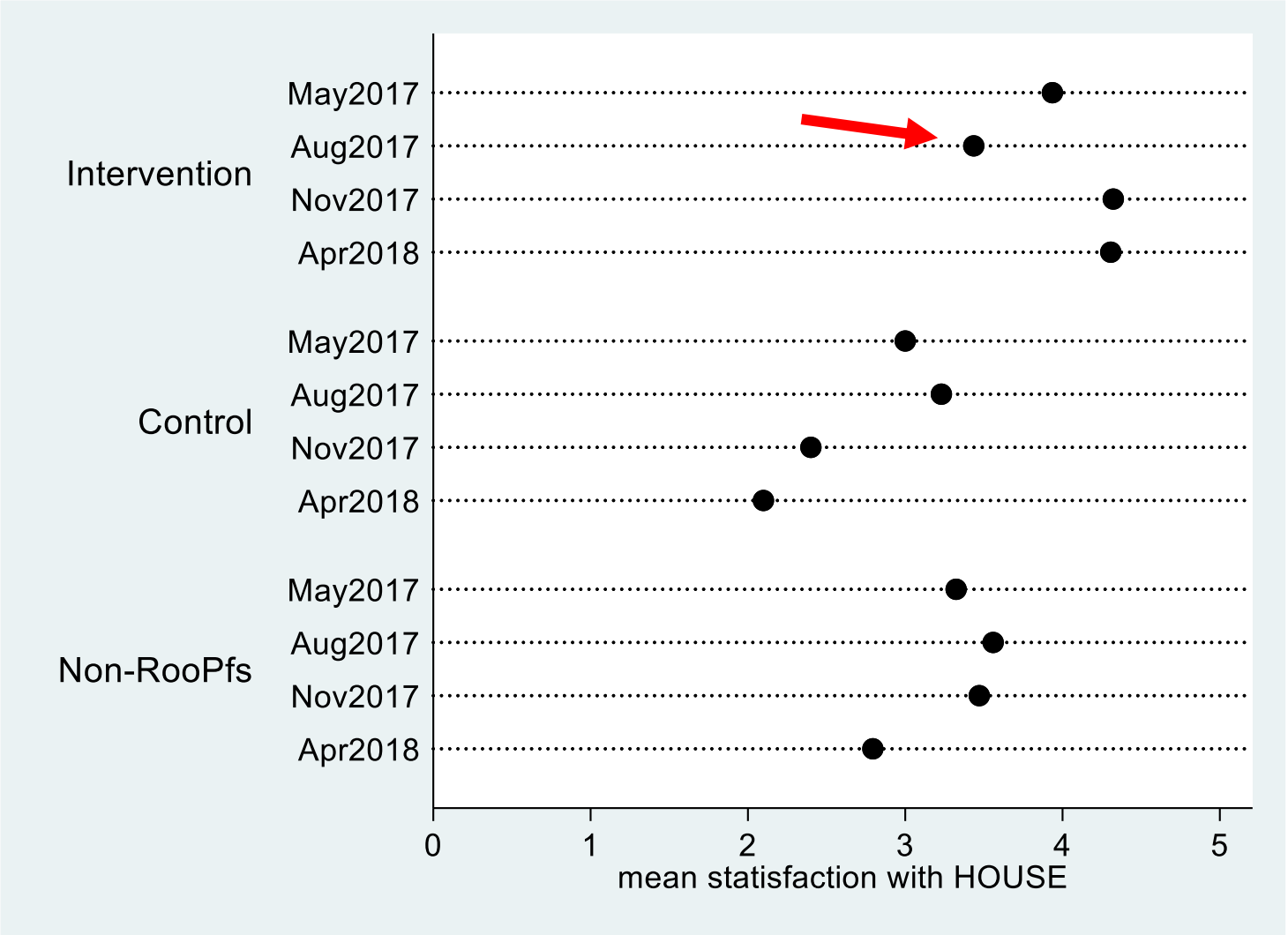
Mean across rounds:

Intervention = 451.96 USD

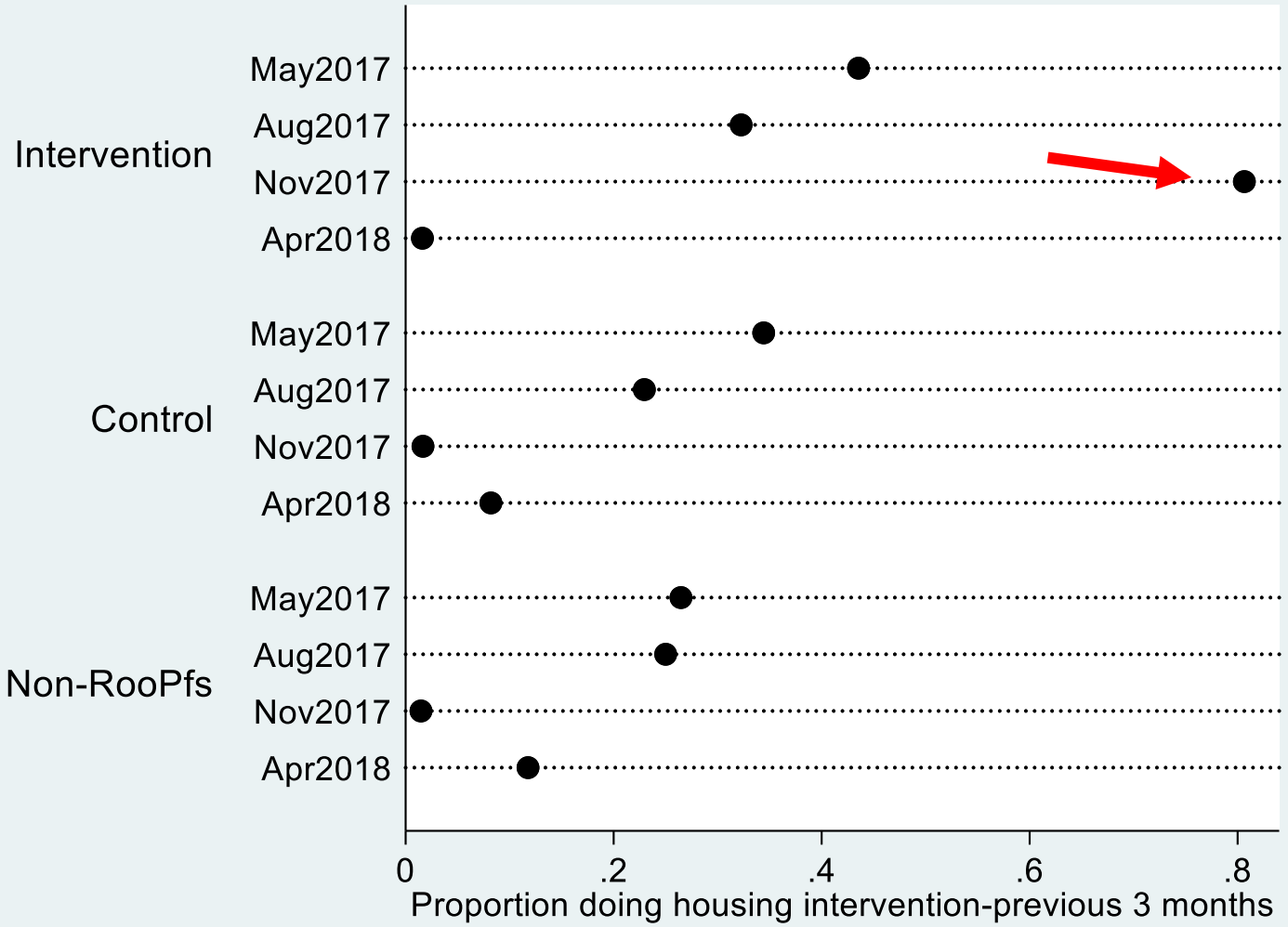
Control = 466.47 USD

Non-Roo*Pfs* = 460.12 USD

Satisfaction with own house



Done anything to your house (over last 3 months)?



Number of households having done something to their house (beyond Roo*Pfs*)			
Round	Intervention	Control	Non-RooPfs
1 - May 2017	27	21	18
2 - Aug 2017	20	14	17
3 – Nov 2017	50	1	1
4 – Apr 2018	1	5	8

Models for satisfaction and house modification

$$Y_{ijt} = \alpha + \beta_{t,j} Round_t * Group_j + \gamma_t + \theta_i + \varepsilon_{ijt} \quad [1]$$

$$Y_{ijt} = \alpha + \beta_{t,j} Round_t * Group_j + \gamma_t + \theta_i + \eta Z_{it} + \varepsilon_{ijt} \quad [2]$$

Y_{ijt} = *Satisfaction; House modifications*
α = *constant term*
$Group_j$ = *trial groups (intervention, control) + Non-RooPfs group*
$\gamma_t = Round_t$ = *time fixed effects*
θ_i = *individual fixed effects*
Z_{it} = *time variant factor (perceived malaria risk)*

Model for the WTP

- Trivariate probit

$y_{im}^{*} = \beta_{m}^{'} X_{im} + \epsilon_{im},\ m = 1, 2, 3$

$y_{im} = 1\ if\ y_{im}^{*} > 0\ and\ 0\ otherwise$

$\epsilon_{im}, m = 1, 2, 3$ are error terms distributed as multivariate normal, each with mean zero and variance-covariance matrix V, where V has values of 1 on the leading diagonal and correlations $\rho_{jk} = \rho_{kj}$ as off-diagonal elements.

Probability to accept each bid:
3 non-independent equations.
Ccovariates:
- Study group
- Values of the bids
- Demographic variables
- Time (round)

Satisfaction with own house		
Control#2 (rain)	**0.680 (0.342)***	**0.661 (0.384)**
Control#3	-0.988 (0.322)***	-1.032 (0.349)***
Control#4	-1.272 (0.172)***	-1.361 (0.233)***
Non-RooPfs#2 (rain)	**0.735 (0.263)*** **	**0.719 (0.219)*** **
Non-RooPfs#3	-0.240 (0.326)	-0.262 (0.267)
Non-RooPfs#4	-0.900 (0.207)***	-0.973 (0.239)***
Time-variant (malaria risk perception)		-0.575 (0.177)***
Constant	3.420 (0.074)***	3.712 (0.104)***
Individual FE	X	X
Round FE	X	X
Observations	762	762
R^2 overall	0.2475	0.3148

Notes: OLS estimates; SE in brackets clustered by village; * p < 0.10, ** p < 0.05, *** p < 0.01

Done anything in the last three months?		
Control#2 (rain)	-0.002 (0.135)	-0.002 (0.137)
Control#3	**-0.702 (0.164)*** **	**-0.704 (0.165)*** **
Control#4	0.157 (0.092)	0.152 (0.094)
Non-RooPfs#2 (rain)	0.098 (0.144)	0.097 (0.145)
Non-RooPfs#3	**-0.620 (0.173)*** **	**-0.622 (0.169)*** **
Non-RooPfs#4	0.272 (0.134)*	0.268 (0.132)*
Time-variant (malaria risk perception)		-0.030 (0.067)
Constant	0.346 (0.050)***	0.361 (0.039)***
Individual FE	X	X
Round FE	X	X
Observations	763	763
R^2	0.2284	0.2287

Notes: OLS estimates; SE in brackets clustered by village; * p < 0.10, ** p < 0.05, *** p < 0.01

Done what?

Type of activity done to house	N
Substituted the roof with a new grass roof	39
Substituted the roof with a new corrugate roof	7
Repaired the Roof (not substitute)	75
Started building a new building	25
Repaired the main door	72
Changed the main door	5
Cover the external side of walls with cement	10
Filled holes	5
Other	15

Accept the first bid			
Control	-0.261 (0.253)	-0.274 (0.260)	-0.255 (0.257)
Non-Roo*Pf*s	**-0.558 (0.236)****	**-0.573 (0.244)****	**-0.527 (0.247)****
Round 4	-0.449 (0.193)**	-0.436 (0.196)**	-0.224 (0.225)
Malaria risk perception			0.364 (0.308)
Sex, Age, Ethnic goup	NO	YES	YES
Constant	1.910 (0.231)***	2.399 (0.698) ***	2.287 (0.743)***
Accept the second bid			
Value second bid	0.016 (0.004)***	0.0173 (0.004)***	0.023 (0.004)***
Control	-0.096 (0.241)	-0.117 (0.24)	-0.088 (0.235)
Non-Roo*Pf*s	0.110 (0.246)	0.096 (0.29)	0.184 (0.240)
Round 4	-0.913 (0.222) ***	-0.907 (0.224)***	-0.895 (0.285)***
Malaria risk perception			-0.154 (0.354)
Sex, Age, Ethnic goup	NO	YES	YES
Constant	-2.243 (1.264)*	-3.155 (1.346)**	-4.588 (1.334)***
Accept the third bid			
Value third bid	-0.0005 (0.003)	0.001 (0.003)	-0.001 (0.003)
Control	-0.031 (0.211)	0.006 (0.216)	-0.002 (0.213)
Non-Roo*Pf*s	-0.224 (0.207)	-0.160 (0.213)	-0.206 (0.209)
Round 4	-0.910 (0.179)***	-0.906 (0.185)***	-0.643 (0.205)***
Malaria risk perception			0.508 (0.298)*
Sex, Age, Ethnic goup	NO	YES	YES
Constant	1.880 (0.902)**	1.963 (1.061)*	2.176 (1.163)*
Observations	377	377	377

The predicted WTP from the model was USD 233.73 (mean), 44.94 (SD), 236.79 (median), 94.64 (min), 270.54 (max).

Conclusion & limitations

- Weak signals of learning in terms of satisfaction not WTP
- No signals of adoption (revealed preferences)
- Households could recognise the limitations of intervention during the rainy season
- Liquidity constraint is a major challenge in adoption: the average cost of house improvement was over 500 USD

- Absence of information before the RCT
- Small sample size (large SE)
- Short follow-up period
- Acquiescence bias in WTP

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