

# Manipulation-Robust Prediction

## Additional Material (not for publication)

Daniel Björkegren      Joshua E. Blumenstock      Samsun Knight

This document includes additional background on the experiment for the curious reader.

### Contents

<b>1</b>	<b>Experimental design</b>	<b>2</b>
1.1	Intake (Detailed Description) . . . . .	2
1.1.1	Calling script . . . . .	2
1.1.2	Intake session . . . . .	3
<b>2</b>	<b>Performance by Outcome</b>	<b>11</b>
<b>3</b>	<b>Expert survey</b>	<b>20</b>
3.1	Recruitment text for expert survey . . . . .	20
3.2	Survey design (details) . . . . .	20
<b>4</b>	<b>Intake survey instrument</b>	<b>21</b>

# 1 Experimental design

## 1.1 Intake (Detailed Description)

The subject population was Kenyans aged 18 or older who own a smartphone and are able to travel to the Busara center in Nairobi. Busara assembled a list of prospective participants from prior experiments and from market centers in Nairobi. The app required Android OS version 5 or above, with at least 50 MB of free space. Participants were asked to commit to the study for at least 18 weeks.

### 1.1.1 Calling script

Prospective participants were invited with a phone call according to the following script:

“Hello, my name is (name).I am calling you from Busara Centre for Behavioral Economics. As explained during recruitment, Busara is a research organization that works on research projects in Kenya and around the world. Our work is focused on the evaluation and implementation of behavioral interventions across different sectors.

I would like to invite you to a study (mention date and time) which will take approximately 4hrs. It will require you to install an app on your phone for 18 weeks to collect anonymous information about how people use their phones. This information is kept confidential and not shared outside the research team. You will also be eligible to receive small weekly rewards for keeping the app on your phone for the full 18 weeks. Are you available to attend?

(If yes)

I would like to ask you a few questions to determine whether you are eligible to participate in this study

- Do you have a smartphone?
- What Android version is it?
- Does your phone have 50mb space and above?
  - (If no) Are you willing to free up 50mb space?
- Are you willing to keep the app running on your phone for 18 weeks in exchange for small weekly incentives?

(If yes, above 5.0, yes or no/yes, and yes) Thank you. Please bring your phone sufficiently charged, as we will need it charged to install the app during the session.

By participating, you will be eligible to receive between 100 Ksh and 300 Ksh every week after you have installed the app, but only if you keep the app installed and upload data on the app

You will additionally receive Ksh 200 for transport and Ksh 50 bonus if you arrive in//on time tomorrow. You will receive an additional 500 Ksh for participation tomorrow

### **1.1.2 Intake session**

Qualified participants were invited to participate in an intake session in the Busara lab. At the lab, participants will be briefed on the project and software, and given a chance to ask any questions. Those who consent will be assisted in installing the app on their phones, and are invited to complete a survey.

The intake session followed the script below:

#### *Introduction*

Thank you for your interest in participating in this research project. The goal of this project is to develop a better understanding of how different types of people use their mobile phones. Mobile phones are everywhere these days, and smartphone apps now play an important role in many people's lives. But different people use their phones in different ways, and one of our main objectives is to learn about these differences. This will make it possible to design products and solutions that are better tailored to the needs of customers.

If you choose to participate in this project, we will ask you to install a new "Sensing" app on your smartphone. This app will run in the background on your phone, and we expect you to leave it running for the next 18 weeks. With the app installed, you may have to charge your phone slightly more, and it will use some data. However, the app is designed to minimize usage of the battery and data, so you can continue to use your phone normally. As part of the study, you will be invited to participate in weekly "challenges" through which you have the opportunity to earn additional rewards.

You can receive up to a maximum of Ksh. 350 in compensation for each week that you participate in this study. We will explain this compensation in more

detail later, but the main things we require are that you:

1. Keep the app running on your phone
2. Accept challenges that you receive in the app (typically at 12pm on Wednesday)
3. Upload your data at the end of the challenge (between Tuesday 1pm and Wednesday 10am)

We will explain the app and the challenges in greater detail now, and then give you an opportunity to ask questions.

*[Probes Details]*

The “Sensing” app is designed to run in the background on your phone and will collect some basic information on how you use your phone. All of this information will be anonymous – in other words, your name and personal information will be removed before it is stored – to ensure that your identity is kept confidential. The anonymous information includes basic information on phone calls, SMS, location, Battery levels, Wifi connections, and the apps you use.

The app will not collect any of content from your SMS or calls, such as the words you write or what you speak into the phone. To help ensure privacy, even the contacts on your phone will be anonymized so we will not know who you are calling. The data collected will only include the date and time of receipt or sending of the message/call, an anonymous label for the contact – such as ‘xcbbn89cv’ – and the duration of the call. So do not worry about the app reading your messages or listening in on your calls. We respect your privacy.

Please see the screenshots of what this data looks - as you can see, it is all anonymous and only shows whether you sent a message or used an app, for example, but no personal details and no content of messages. This data is important because we will use it to determine whether or not you completed the challenges, which we will describe in more detail later.

To reiterate, all this data will be anonymous - your name and contact details are removed and kept in a special file that only the core team can access and that will be kept separate from your app data. We will only use your contact details to call you in case there is some problem related to the app - those who call you will not see details of your phone data.

*[Data Uploading]*

For the “Sensing” app to function properly, it must occasionally send data from your phone to Busara. Please allow the app to run in the background and keep your data on, to allow for this upload to occur more frequently. The more often you upload the less storage space the app will use and it will make it quicker to do the final upload.

[reiterate details about the app running in the background and not interfering with phone functioning].

At the end of each weekly challenge, you will receive Ksh. 100 in compensation if you successfully upload your data. This upload must occur between Tuesday 1 pm and Wednesday 10 am I repeat, there is a short window each week – between Tuesday 1pm and Wednesday 10am, when you must upload your data if you wish to receive this Ksh. 100 reward. We will send you reminders to upload your data, but at the end of the day it is your responsibility to complete this upload. You can check the status of your app at any time during this period to confirm successful upload - we will show you how to do this now.

[Lab Officer to demonstrate] To manually upload your data within this time-frame: when you open your app, if you find the number above the ‘Upload Data’ button is greater than 0, that means that you have data to be uploaded. In that case, ensure your data is on then go ahead and press the ‘Upload Data’ button. Once you see that this has changed to 0, your data is successfully uploaded. Remember you need to do this between Tuesday 1pm (noon) and Wednesday 10am to be eligible for the Ksh100 reward.

*[Challenges description]*

A second way to earn compensation through the app is by accepting and completing weekly Challenges through the Sensing app. These challenges will occur each week starting on Wednesday at noon, and will be delivered on the app through notifications. Challenges will ask you to use your phone in a certain way, and you will be able to earn extra money if you complete these challenges. You will be notified of these challenges at 12pm on Wednesday. To participate in the weekly challenge, you must open your app and click the “Accept” button.

[Lab Officer to show an example alert – but not the challenge itself - this will be shown from their phone and demonstrated to the room] [Lab Phone 1] Here is an example of a notification alerting you to a new challenge. When you see this alert, make sure to open the app and click “Accept” to see your weekly challenge.

There are different types of challenges that you might receive.

One type of challenge, which you will receive for the first few weeks, requires very little action on your part – it is sort of like a “training” challenge. For this challenge, you must open the app and click “accept.” Then no further action is required until the following Tuesday, when you must upload your data between 1pm and 10am the following day. If you complete these steps, you will receive an extra bonus.

Another type of challenge is a little bit more complicated. It will give you money for doing very specific activities on your phone. For instance, an example challenge might say, “You will receive Ksh. 50 for every call you make to a phone number in Uganda, up to a max of 200 Ksh.” If you receive this challenge, you will make more money if you make more calls to Uganda in the next week before Tuesday at 1pm (noon) when the challenge ends - if you make 3 calls to a phone number in Uganda in that week, you will be paid an extra 150 Ksh. at the end of the week for this challenge.

Let’s imagine you make 2 calls to Uganda before Tuesday at 1pm - how much would you earn? [Ksh 100] How about if you make 5 calls to Uganda? [trick question - max of 200]

When would you need to make these calls for them to count towards the challenge? [Between receiving the challenge and Tuesday at 1pm the following week]

[Lab Officer to demonstrate] [Lab Phone 1] Here is an example of what this challenge would look like on your phone.

Another type of challenge will be more complicated. For instance, a different challenge might say, “You can earn up to Ksh. 250 if you use your phone like a person over 50 years old.” This seems a little strange at first, but the idea is that the Sensing app will make a guess, based on how you used your phone that week, of how old you are. This is because older people might use their phone in a different way to younger people, which allows the app to guess a person’s age based on how they use their phones. In this case, your goal is to use your phone like a person who is over 50 years old - if you do this, you will win the challenge.

Sometimes, the challenge will come with a hint. For instance, the hint may say something like “The Sensing app believes old people never use the App WhatsApp Messenger.” This clue is designed to help you understand how the Sensing app

makes a guess - in this case, if you use WhatsApp Messenger a lot that week, the Sensing app will probably guess that you are young, and you would not win the challenge. This is just one example. The hint might instead be, “The sensing app believes old people make many outgoing calls” – in which case, if you make more outgoing calls, the app will think you are older and you are more likely to win the challenge and receive a higher payment. Hints can help you understand how to win the challenge.

[Lab Officer to demonstrate] [Lab Phone 2 - do not scroll down to hints and sliders] Here is an example of what this challenge would look like on your phone.

The app in some instances will also provide you with even more information to help you figure out how to win the challenge. In particular, you may see a screen with ‘sliders’ that help you calculate how much you would earn if you did these behaviors.

Imagine you received the same challenge as before, but this time instead of only a hint, you could use the sliders to help you understand even better how to win the challenge and calculate exactly what you would earn. The challenge is “You can earn up to Ksh. 250 if you use your phone like a person over 50 years old. Hint: The Sensing app guesses how old you are based on your calls and apps. Your base payment will be 150 Ksh, plus 3 Ksh. for every outgoing call you make in the evening, minus 10 Ksh for every day that you use Whatsapp Messenger. You can earn up to Ksh. 250!”.

[Lab Phone 2 - scroll down and demonstrate sliders for challenge] Here is what this challenge would look like on your phone. As you can see, there is a slider for each behavior mentioned in the hint. You can move the sliders accordingly to calculate your earnings. You see here that if you move the WhatsApp slider to the right, that this helps you calculate what would happen if you actually used Whatsapp on this number of days in the following week. If you moved it to “3”, this helps calculate how much you would earn if you used WhatsApp Messenger on “3 days” in the challenge week. You also see the more days you would use WhatsApp, the less your payment would be. This is a little bit like the hint ‘The Sensing app believes old people never use the App [WhatsApp Messenger].’ but instead of only guessing how using WhatsApp affects your earnings, you can determine exactly how much it affects your earnings. Now slide ‘Outgoing calls’ to the right. What happens to the payout?

Can you tell me what this means? [Essentially, they need to indicate that changes in sliders help calculate possible changes in payout BUT that this is only a calculator - they still have to do the behaviors].

What would you need to do in the following week to earn the maximum amount? [phone behaviors]

What is the maximum amount? [250]

[make sure they know i) sliders are hypothetical, that they have to actually do the behaviors and this is simply a calculator, ii) that this tool can help make challenges easier.]

Remember, the sliders help you calculate how much you would earn - it is just a tool to help you calculate. To actually earn these amounts you have to do the behaviors in the upcoming week. The sliders are supposed to be useful for you - they are a tool to help you calculate how to win the challenge - if you do not find them useful, you do not have to use them.

Sometimes, you will not get a hint at all! In these weeks, it is up to you to think about how the Sensing app might make a guess. Sometimes, this might be easy to figure out. Sometimes, it might be difficult. But every time you get a challenge, you can decide for yourself whether you want to try to use your phone in a way that might help you win the challenge.

Some challenges may pay a certain amount only if you pass the challenge: in these challenges, if you succeed you will earn some amount for the challenge, and if you don't succeed you will get Ksh 0. Other challenges will pay you more the better you do in the challenge, like the challenges shown to you above..

The exact details of the challenges will change from week to week, and each person might receive a different challenge. So it is important that when you receive the notification - around 1pm on Wednesday - that you open the app to accept the challenge and see what it says.

Once you accept the challenge, you will have a little less than one week - until the following Tuesday at 1pm - to complete the challenge. After 1pm the following Tuesday, your activity will not count toward the challenge. Make sure to open your app and complete the upload after 1pm on Tuesday - if you don't complete this upload you won't receive any compensation!

Some challenges are more difficult than others, so it may be difficult to earn the full amount. Some weeks you may earn more than you expect and some weeks

you may earn less; if you earn less, try again next week! But remember, you will only earn according to what you have accomplished by Tue 12 pm, and any efforts towards that challenge after this will not count for that challenge. But you will have a chance to earn bonus compensation on the next challenge that will start on Wed at 12 pm!

Are there any questions on this?

[Give respondents handout sheet of best practices]

*[Best Practices]*

- Leave the Sensing app running in the background on your phone.
- Leave your location/GPS turned on throughout the week.
- Keep an eye out for new challenges around 1pm on Wednesdays – and make sure to open the app to accept!
- Make sure that you upload your data between Tue 1 pm and Wed 10 am at the end of each challenge week. You won't receive any compensation if you don't complete this upload!
- Any compensation you have earned will usually be paid to you by the end of the day on the Wednesday after the challenge ends.
- You may check your challenge whenever you want by opening the App. This will help you keep in mind the challenge despite your busy schedules.
- You will receive a reminder message at different points in the week to ensure you 1) you accept the challenge for the week and 2) a final reminder at 1 pm at Tue to upload data before Wed 10 am. We may also call you in case we observe any inconsistencies in your data to check that your internet connection is ok and all permissions are on.
- If you change devices (you get a new one, if it gets lost or anything goes wrong), kindly notify us on the number (phone number) in the consent form.

*[Compensation]*

Because we understand this will cost you a little bit of bundles to ensure all data is uploaded throughout the 6 weeks, we will provide payment via MPESA, but only when you upload your data between Tue 1 pm and Wed 10 am every week. This will be Ksh. 100 per week. The amount of bundles the app uses will be very small, so you will earn more money by uploading every week.

On top of this, you will also receive the payouts for each challenge you receive and complete successfully before Tue 1 pm. This can be up to Ksh 250 per week.

Challenges will finish Tue 1 pm every week. You will receive a notification and an SMS on Wed around noon before receiving the next challenge on the app, letting you know whether you have accomplished the challenge or not and what your earnings are from that challenge. You will receive your earnings via MPESA within 24 hours from receiving this notification.

Over the course of the 18 weeks, you should be able to earn between Ksh 1800 and Ksh 6300 simply for uploading data on the app and responding to challenges. Remember, to do this you need to keep the app on your phone, upload data every week between Tue 1 pm and Wed 10 am and work to complete your challenges before Tue 1 pm.

Please ensure the number that you input on the app is an MPESA number and matches with the number that we sent the invite to. This ensures that we will pay you weekly as we will only make payments to the MPESA number that you registered with us.

[Lab Officer ask the participant]: Just so I am sure you understand, When do you need to upload your data? Between Tue 1 pm and Wed 10 am every week By when do you have to have completed your challenge? Tue 1 pm.

*[Busara Contact]* We want to assure you that your data is strictly confidential and will only be used for purposes of the research. Only Busara and the researchers will have access to your data. If you have any concerns or complaints about the app or the challenges you will receive, please call us on (phone number) during working hours (Mon-Fri, 8-5) and we'll be sure to respond.

What questions do you have at this time, about the app or study? Please decide if you would like to participate in the study and keep the app running for the next 18 weeks.

If you would like to participate, please sign the consent forms in front of you to agree to be part of this study and install the app, upload all data consistently over the next 18 weeks.”

## 2 Performance by Outcome

See following tables for performance on each outcome one by one. The main paper reports performance pooled across all these outcomes.

Table 1: Performance of Decision Rules: Marital Status

Decision Rule	Costs		Marital Status											
	preliminary	final	$\beta_{2019-46}^{LASSO}$ *	$\beta_{2019-47}^{LASSO}$	$\beta_{2019-48}^{LASSO}$	$\beta_{2019-49}^{LASSO}$	$\beta_{2020-02}^{LASSO}$	$\beta_{2019-46}^{SR}$ *	$\beta_{2019-47}^{SR}$	$\beta_{2019-48}^{SR}$	$\beta_{2019-49}^{SR}$	$\beta_{2020-02}^{SR}$	$\beta^{SR_{final}}$	
	$c^{prelim}$ ¢/action <sup>2</sup>	$c_{jj}$ ¢/action <sup>2</sup>	¢/action											
text_count_out	0.035	0.035					-0.135	0.146	-0.196	-0.169				
text_count_incoming	0.038	0.037	0.756	-0.756	-0.756	-0.756		0.177	-0.267	-0.195	-0.207	-0.154		
text_count_evening	0.058	0.057	-0.763	0.763	0.763	0.763	-0.539	0.098		-0.114	-0.437	-0.301	-0.221	
call_count_out	0.591	0.480					0.475		0.548		0.647	0.345	0.309	
max_daily_texts_outgoing	1.920	1.683											-0.902	
avg_duration_outgoing_calls	741.463	3108632.195	-0.00387	0.00387	0.00387	0.00387								
<b>Intercept</b>			646.214	353.786	353.786	353.786	362.554	643.89	338.142	356.82	353.72	354.844	350.060	
$\lambda$			1875.052	1875.052	1875.052	1875.052	2717.86	1875.052	1875.052	1875.052	1875.052	2717.86	2069.664	
<b>Prediction Error</b>														
<b>Baseline Data:</b>														
								RMSE (\$)						
Control			4.603	4.583	4.583	4.583	4.59	4.663	4.612	4.634	4.591	4.613	4.605	
Predicted Transparent (preliminary cost estimates)			4.607	4.584	4.584	4.584	4.591	4.67	4.618	4.634	4.61	4.614	4.605	
Predicted Transparent (final cost estimates)			4.758	4.697	4.697	4.697	4.62	4.67	4.659	4.649	4.686	4.636	4.615	
<b>Implemented:</b>														
Opaque			3.646	4.369	4.545	4.784	4.272	3.607	4.286	4.55	4.83	4.28	-	
Transparent			4.764	4.685	4.701	4.965	4.921	4.409	4.87	4.55	4.753	5.658	-	
N (Control individuals)			1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	1376	
N (Treatment person-weeks, Opaque)			1	53	84	85	92	1	53	84	85	92		
N (Treatment person-weeks, Transparent)			25	55	65	75	72	23	53	70	68	66		

Notes: The first panel reports the decision rule associated with the challenge, and the costs associated with manipulating these behaviors. The below panels report the performance of each decision rule by outcome, root mean squared error (RMSE) at the week-model level. Pooled metrics present the mean RMSE across models. Predicted Transparent represents the average expected performance of models given the theoretical model, behavior incentives, and estimated costs. Implemented Transparent/Opaque represents the average performance of models when assigned with/without transparency hints. Lambda regularization differs slightly between model generations due as we altered the protocol to select penalization closer to the boundary of 3 coefficients. SR model estimated using preliminary costs estimates, while  $SR_{final}$  estimated using final costs estimates. \* models were estimated and evaluated on the outcome corresponding to Single status; all others were estimated and evaluated on the outcome corresponding to Married status.

Table 2: Performance of Decision Rules: Advanced Tech Skills (Self-reported)

	Costs		Advanced Tech Skills (Self-reported)				
	preliminary	final	$\beta_{2019-49}^{LASSO}$	$\beta_{2020-01}^{LASSO}$	$\beta_{2019-49}^{SR}$	$\beta_{2020-01}^{SR}$	$\beta^{SR_{final}}$
	$c^{prelim}$ c/action <sup>2</sup>	$c_{jj}$ c/action <sup>2</sup>					
<b>Decision Rule</b>							
text_count_out	0.035	0.035				-0.121	
text_count_incoming	0.038	0.037	0.261	0.17	0.089	0.288	0.125
text_count_evening	0.058	0.057			0.099		0.025
min_duration_weekend_calls	0.645	0.637		-0.062			
call_count_in	1.328	1.112	-0.008	-0.108		-0.148	-0.098
avg_duration_evening_calls	19.013	19761.4646	-0.532		-0.339		
<b>Intercept</b>			483.853	450.571	486.93	437.600	451.140
$\lambda$			927.854	1127.296	927.854	1127.296	1097.28
<b>Prediction Error</b>							
<b>Baseline Data:</b>							
Control			4.998	4.98	4.991	4.979	4.981
Predicted Transparent (preliminary cost estimates)			5.002	4.979	4.991	4.979	4.981
Predicted Transparent (final cost estimates)			5.011	4.982	4.992	4.999	4.982
<b>Implemented:</b>							
Opaque			4.988	5.174	4.97	5.345	-
Transparent			4.926	4.991	4.96	4.917	-
N (Control individuals)			1391	1391	1391	1391	1391
N (Treatment person-weeks, Opaque)			88	132	88	132	
N (Treatment person-weeks, Transparent)			85	106	81	124	

*Notes:* The first panel reports the decision rule associated with the challenge, and the costs associated with manipulating these behaviors. The below panels report the performance of each decision rule by outcome, root mean squared error (RMSE) at the week-model level. Pooled metrics present the mean RMSE across models. Predicted Transparent represents the average expected performance of models given the theoretical model, behavior incentives, and estimated costs. Implemented Transparent/Opaque represents the average performance of models when assigned with/without transparency hints. SR model estimated using preliminary costs estimates, while  $SR_{final}$  estimated using final costs estimates.

Table 3: Performance of Decision Rules: Num Friends PCA

	Costs		Num Friends PCA						
	preliminary	final	$\beta_{2019-46}^{LASSO}$	$\beta_{2019-48}^{LASSO}$	$\beta_{2020-02}^{LASSO}$	$\beta_{2019-46}^{SR}$	$\beta_{2019-48}^{SR}$	$\beta_{2020-02}^{SR}$	$\beta^{SR_{final}}$
	$c^{prelim}$ ¢/action <sup>2</sup>	$c_{jj}$ ¢/action <sup>2</sup>							
<b>Decision Rule</b>									
text_count_incoming	0.038	0.037	0.651	0.651	0.625	0.181	0.225	0.272	
call_count_out	0.591	0.480	3.416	3.416	2.093	1.773	1.25	1.346	1.013
call_count_in	1.328	1.112	2.171	2.171	1.495	2.738	4.28	1.647	1.284
max_daily_texts_incoming	2.299	3.471							1.467
<b>Intercept</b>			0.528	0.528	17.904	77.223	51.388	75.391	83.824
$\lambda$			1913.298	1913.298	2310.08	1913.298	1913.298	2310.08	2271.559
<b>Prediction Error</b>									
<b>Baseline Data:</b>						RMSE (\$)			
Control			2.768	2.768	2.589	2.676	2.88	2.746	2.824
Predicted Transparent (preliminary cost estimates)			4.556	4.556	3.242	2.947	3.273	2.824	2.844
Predicted Transparent (final cost estimates)			7.448	7.448	4.482	3.639	4.543	3.06	2.905
<b>Implemented:</b>									
Opaque			3.114	4.317	3.625	3.172	3.816	3.565	-
Transparent			3.958	4.963	3.597	3.261	3.804	5.155	-
N (Control individuals)			1391	1391	1391	1391	1391	1391	1391
N (Treatment person-weeks, Opaque)			11	74	80	11	74	80	
N (Treatment person-weeks, Transparent)			22	40	80	19	54	75	

*Notes:* The first panel reports the decision rule associated with the challenge, and the costs associated with manipulating these behaviors. The below panels report the performance of each decision rule by outcome, root mean squared error (RMSE) at the week-model level. Pooled metrics present the mean RMSE across models. Predicted Transparent represents the average expected performance of models given the theoretical model, behavior incentives, and estimated costs. Implemented Transparent/Opaque represents the average performance of models when assigned with/without transparency hints. Lambda regularization differs slightly between model generations due as we altered the protocol to select penalization closer to the boundary of 3 coefficients. SR model estimated using preliminary costs estimates, while  $SR_{final}$  estimated using final costs estimates.

Table 4: Performance of Decision Rules: Activity PCA

	Costs		Activity PCA						
	preliminary	final	$\beta_{2019-48}^{LASSO}$	$\beta_{2019-49}^{LASSO}$	$\beta_{2020-02}^{LASSO}$	$\beta_{2019-48}^{SR}$	$\beta_{2019-49}^{SR}$	$\beta_{2020-02}^{SR}$	$\beta^{SR_{final}}$
	$c_{prelim}$ ¢/action <sup>2</sup>	$c_{jj}$ ¢/action <sup>2</sup>							
<b>Decision Rule</b>									
text_count_incoming	0.038	0.037	1.357	1.357	1.154	0.393	0.466	0.324	0.217
text_count_evening	0.058	0.057			0.036		0.502	0.37	
call_count_out	0.591	0.480	2.894	2.894	1.978	0.929	1.901	1.321	0.980
call_count_in	1.328	1.112	0.042	0.042		3.041			
max_daily_texts_incoming	2.299	3.471							1.797
<b>Intercept</b>			-39.249	-39.249	-28.101	34.139	43.835	55.906	51.504
$\lambda$			4229.6	4229.6	5562.44	4229.6	4229.6	5562.44	5641.534
<b>Prediction Error</b>									
<b>Baseline Data:</b>						RMSE (\$)			
Control			2.57	2.57	2.131	2.337	2.24	2.506	2.577
Predicted Transparent (preliminary cost estimates)			6.872	6.872	4.785	2.69	2.818	2.633	2.592
Predicted Transparent (final cost estimates)			11.658	11.658	7.746	3.402	3.809	2.902	2.646
<b>Implemented:</b>									
Opaque			2.812	2.167	2.131	2.862	2.651	2.965	-
Transparent			4.58	6.154	4.629	3.565	3.452	4.03	-
N (Control individuals)			1391	1391	1391	1391	1391	1391	1391
N (Treatment person-weeks, Opaque)			74	85	80	74	85	80	
N (Treatment person-weeks, Transparent)			87	75	85	76	76	79	

*Notes:* The first panel reports the decision rule associated with the challenge, and the costs associated with manipulating these behaviors. The below panels report the performance of each decision rule by outcome, root mean squared error (RMSE) at the week-model level. Pooled metrics present the mean RMSE across models. Predicted Transparent represents the average expected performance of models given the theoretical model, behavior incentives, and estimated costs. Implemented Transparent/Opaque represents the average performance of models when assigned with/without transparency hints. Lambda regularization differs slightly between model generations due as we altered the protocol to select penalization closer to the boundary of 3 coefficients. SR model estimated using preliminary costs estimates, while  $SR_{final}$  estimated using final costs estimates.

Table 5: Performance of Decision Rules: Last Week Texts Received (Self-reported)

	Costs		Last Week Texts Received (Self-reported)				
	preliminary	final	$\beta_{2019-47}^{LASSO}$	$\beta_{2020-01}^{LASSO}$	$\beta_{2019-47}^{SR}$	$\beta_{2020-01}^{SR}$	$\beta^{SR_{final}}$
	$c^{prelim}$ ¢/action <sup>2</sup>	$c_{jj}$ ¢/action <sup>2</sup>					
<b>Decision Rule</b>							
text_count_out	0.035	0.035	0.521	0.298	0.241	0.117	0.128
text_count_incoming	0.038	0.037	0.463	0.108	0.275	0.148	0.157
text_count_evening	0.058	0.057		0.393	0.149	0.225	0.240
call_count_out	0.591	0.480	-0.399				
<b>Intercept</b>			180.965	181.212	163.37	192.802	188.689
$\lambda$			1239.342	3750.88	1239.342	3750.88	3738.023
<b>Prediction Error</b>							
<b>Baseline Data:</b>					RMSE (\$)		
Control			3.007	3.023	3.043	3.068	3.061
Predicted Transparent (preliminary cost estimates)			3.246	3.081	3.072	3.075	3.07
Predicted Transparent (final cost estimates)			3.586	3.154	3.101	3.078	3.074
<b>Implemented:</b>							
Opaque			1.85	3.669	1.818	3.641	-
Transparent			3.078	3.522	3.126	3.861	-
N (Control individuals)			1391	1391	1391	1391	1391
N (Treatment person-weeks, Opaque)			45	135	45	135	
N (Treatment person-weeks, Transparent)			57	121	54	124	

*Notes:* The first panel reports the decision rule associated with the challenge, and the costs associated with manipulating these behaviors. The below panels report the performance of each decision rule by outcome, root mean squared error (RMSE) at the week-model level. Pooled metrics present the mean RMSE across models. Predicted Transparent represents the average expected performance of models given the theoretical model, behavior incentives, and estimated costs. Implemented Transparent/Opaque represents the average performance of models when assigned with/without transparency hints. Lambda regularization differs slightly between model generations due as we altered the protocol to select penalization closer to the boundary of 3 coefficients. SR model estimated using preliminary costs estimates, while  $SR_{final}$  estimated using final costs estimates.

Table 6: Performance of Decision Rules: Texts Sent in First Control Week

	Costs		Texts Sent in First Control Week				
	preliminary	final	$\beta_{2019-46}^{LASSO}$	$\beta_{2019-47}^{LASSO}$	$\beta_{2019-46}^{SR}$	$\beta_{2019-47}^{SR}$	$\beta^{SR_{final}}$
	$c^{prelim}$	$c_{jj}$					
	$c/action^2$	$c/action^2$					
<b>Decision Rule</b>							
text_degree	1.011	1.018	12.425	12.425			
call_count_in	1.328	1.112	0.874	0.874	1.771	2.427	1.158
text_degree_outgoing	5.432	5.448					1.580
text_degree_incoming	6.006	6.041			6.203	1.645	2.780
avg_duration_evening_calls	19.013	19761.4646	0.272	0.272	0.482	0.576	
<b>Intercept</b>			50.126	50.126	486.93	437.600	188.537
$\lambda$			1266.198	1266.198	1266.198	1266.198	1362.531
<b>Prediction Error</b>							
<b>Baseline Data:</b>			RMSE (\$)				
Control			2.348	2.348	2.769	2.585	2.708
Predicted Transparent (preliminary cost estimates)			16.042	16.042	2.82	2.744	2.72
Predicted Transparent (final cost estimates)			26.029	26.029	2.944	3.022	2.745
<b>Implemented:</b>							
Opaque			3.225	2.832	2.934	2.772	-
Transparent			7.509	3.53	2.667	3.023	-
N (Control individuals)			1391	1391	1391	1391	1391
N (Treatment person-weeks, Opaque)			8	50	8	50	
N (Treatment person-weeks, Transparent)			19	60	21	41	

Notes: The first panel reports the decision rule associated with the challenge, and the costs associated with manipulating these behaviors. The below panels report the performance of each decision rule by outcome, root mean squared error (RMSE) at the week-model level. Pooled metrics present the mean RMSE across models. Predicted Transparent represents the average expected performance of models given the theoretical model, behavior incentives, and estimated costs. Implemented Transparent/Opaque represents the average performance of models when assigned with/without transparency hints. Lambda regularization differs slightly between model generations due as we altered the protocol to select penalization closer to the boundary of 3 coefficients. SR model estimated using preliminary costs estimates, while  $SR_{final}$  estimated using final costs estimates.

Table 7: Performance of Decision Rules: Intelligence (Above-Median Ravens)

Decision Rule	Costs		Intelligence (Above-Median Ravens)		
	preliminary	final	$\beta_{2020-04}^{LASSO} *$	$\beta_{2020-04}^{SR} *$	$\beta^{SR_{final}}$
	¢/action	¢/action		¢/action	
text_count_incoming	0.038	0.037	0.278	0.145	0.115
call_count_outgoing_missed	4.64	1.91	-0.208		
calls_noncontacts	2.24	1.929	-0.606	-0.575	-0.518
max_daily_texts_incoming	2.30	3.47		0.324	0.420
Intercept			490.727	488.441	487.033
$\lambda$			997.576	997.576	1032.365
<b>Prediction Error</b>					
Baseline Data:				RMSE (\$)	
Control			4.971	4.973	4.973
Predicted Transparent (prelim costs)			4.98	4.975	4.974
Predicted Transparent (final costs)			4.989	4.975	4.975
Implemented:					
Opaque			4.898	4.906	-
Transparent			5.037	4.894	-
N (Control individuals)			1391	1391	1391
N (Treat person-weeks, Opaque)			81	81	
N (Treat person-weeks, Transparent)			76	80	

*Notes:* The first panel reports the decision rule associated with the challenge, and the costs associated with manipulating these behaviors. The below panels report the performance of each decision rule by outcome, root mean squared error (RMSE) at the week-model level. Pooled metrics present the mean RMSE across models. Predicted Transparent represents the average expected performance of models given the theoretical model, behavior incentives, and estimated costs. Implemented Transparent/Opaque represents the average performance of models when assigned with/without transparency hints. SR model estimated using preliminary costs estimates, while  $SR_{final}$  estimated using final costs estimates.

Table 8: Performance of Decision Rules: Monthly Income

	<i>Costs</i>		<b>Income</b>		
	Preliminary	Final	$\beta^{LASSO}$	$\beta^{SR}$	$\beta^{SR_{final}}$
	$c^{prelim}$	$c_{jj}$			
	¢/action <sup>2</sup>	¢/action <sup>2</sup>		¢/action	
<i>Panel A: Decision Rule</i>					
text_count_out	0.035	0.035	-0.395	-0.107	-0.101
text_count_incoming	0.038	0.037	0.065		
text_count_evening	0.058	0.057		-0.121	-0.120
call_count_out	0.591	0.480	0.625	0.542	0.531
Intercept			301.071	304.622	302.472
$\lambda$			1087.036	1087.036	759.296
<i>Panel B: Prediction Error</i>					
<b>Baseline Data:</b>			RMSE (\$)		
Control			3.574 (0.058)	3.583 (0.052)	3.584 (0.059)
Predicted Transparent (prelim costs)			3.620 (0.045)	3.582 (0.019)	3.586 (0.047)
Predicted Transparent (final costs)			3.702 (0.058)	3.591 (0.056)	3.591 (0.057)
<b>Implemented:</b>					
Opaque			3.549 (0.249)	3.525 (0.218)	-
Transparent			3.675 (0.179)	3.484 (0.2)	-
N (Control individuals)			1376	1376	
N (Treat person-weeks, Opaque)			75	75	
N (Treat person-weeks, Transparent)			90	74	

*Notes:* The first panel reports the decision rule associated with the challenge, and the costs associated with manipulating these behaviors. The below panels report the performance of each decision rule by outcome, root mean squared error (RMSE) at the week-model level. Pooled metrics present the mean RMSE across models. Predicted Transparent represents the average expected performance of models given the theoretical model, behavior incentives, and estimated costs. Implemented Transparent/Opaque represents the average performance of models when assigned with/without transparency hints. Lambda regularization differs slightly between model generations due as we altered the protocol to select penalization closer to the boundary of 3 coefficients.  $SR$  model estimated using preliminary costs estimates, while  $SR_{final}$  is estimated using final costs estimates. RMSE for “Control” and “Predicted Transparent” conditions for pooled models based on randomly stratified sample across assigned models for each outcome.

## 3 Expert survey

### 3.1 Recruitment text for expert survey

“Josh Blumenstock (UC Berkeley) and I are working on a research study on machine learning models for digital credit. As part of this, we are measuring how Kenyans use smartphones, and testing whether that behavior can be used to draw inferences about people. And that is where you come in. We are asking a small number of experts (including you!) to give us your best guess of which behaviors are easy or hard to change. This will help us understand how well experts can predict these types of behaviors. If you’re willing to participate, we would be delighted if you completed a 15 minute survey. Your responses will only be reported when aggregated with the responses of other experts. If your answers are closest to the behavior we measure in our experiment this summer, you will be eligible for a bonus of \$50, as well as the honorary title of ‘Best Expert Predictor for Björkegren and Blumenstock (2019)’, which you are welcome to boast about widely, or not at all, or one day tell your grandchildren. There is, of course, no obligation to participate.”

### 3.2 Survey design (details)

In the survey, after obtaining consent and an initial information screen, we provided the following instructional text:

“In this survey we are asking you to predict how a group of people would use their smartphones under different conditions. The group of people is smartphone owners in informal settlements in Nairobi, Kenya.

These individuals use their phones for common things (calls, text messages, Facebook, Instagram, and web searches, for example). But these individuals are relatively poor (Kenya’s GDP is \$125 per person per month, 1/40th that of the U.S.). Typical costs to place a call are \$0.04 per minute and to send a text message \$0.01. Receiving a call or text message is free.

In a field experiment we are running, each week, one behavior from the list below will be incentivized at random. We are asking you to predict how the average Kenyan smartphone owner’s behavior would change.

For example: In a typical week, Paul usually makes 3 calls to a phone number in Uganda. In one week when Paul is participating in the study, Paul is paid \$0.02 for every call made to a phone number in Uganda. If you think, in the week of the experiment, Paul would make 10 calls to Ugandan phone numbers, you should write the number ‘10’.”

We then asked respondents to predict the behavior of a typical person when incentivized, with questions of the form:

‘A typical person in a typical week *sends 55 text messages*. One week during the study, people were paid *\$0.02 for every text message sent*. During the week they are getting paid, how many of this action would the typical person take?’<sup>1</sup>

## 4 Intake survey instrument

The following is the survey given to Busara participants in the main study.

---

<sup>1</sup>A small number of respondents were shown pilot versions of the survey that asked for differences rather than levels, or that omitted baseline levels. All responses were converted into differences from baseline for analysis.

## 1. WELCOME SCRIPT

## 2. CONSENT

## 3. COMPREHENSION CHECKS

## 4. Demographics

- What is your first name?
- What is your middle name?
- What is your last name?
- What is your year of birth?
- Gender
- Ethnicity
- What is the highest level of education you have completed?
  - None, or pre-school
  - Primary standards 1 to 6
  - Primary standard 7
  - Primary standard 8 or secondary forms 1 to 3
  - Secondary form 4
  - Some college
  - Completed college
  - Some graduate
  - Completed graduate
- Can you read a letter or newspaper? [Easily / With Difficulty / Not at all]
- Can you write a letter? [Easily / With Difficulty / Not at all]
- What is your marital status?
- How many children are there in your household?
- How many close friends do you have?
- How many acquaintances do you have?
- How many people rely on you?
- How frequently do you gamble? [Daily / Weekly / Monthly / Rarely / Never]
- Are you the primary breadwinner in your household?
  - If not, what is your relation to the primary breadwinner?
- What is your mother tongue?
- How many biological children do you have? Biological children are directly related to you, not step children or adopted children.

## 5. Socioeconomic status

- What sector do you work in?
- Do you receive a regular salary each week?
- In the last week, how many days of work did you do?
- In the last month, how much income did you earn from economic activity?
- PPI questions (<https://www.povertyindex.org/country/kenya>)
  - How many members does the household have?
  - What is the highest school grade that the female head/spouse has completed?
  - What kind of business (type of industry) is the main occupation of the male head/spouse connected with?

- A. Does not work
- B. No male head/spouse
- C. Agriculture, hunting, forestry, fishing, mining, or quarrying
- D. Any other
- How many habitable rooms does this household occupy in its main dwelling (do not count bathrooms, toilets, storerooms, or garage)?
- What material is the floor of the main dwelling predominantly made of?
  - Wood, earth, or other
  - Cement or tiles
- What is the main source of lighting fuel for the household?
  - A. Collected firewood, purchased firewood, grass, or dry cell (torch)
  - B. Paraffin, candles, biogas, or other
  - C. Electricity, solar, or gas
- Does your household own any irons (charcoal or electric)?
- How many mosquito nets does your household own?
- How many towels does your household own?
- How many frying pans does your household own?
- Do you have electricity / an electric socket at home?
- Can you tell me approximately how much money was used for each of the following?
  - Own consumption (food, entertainment, etc.)
  - Provided as a loan or gift to a family member
  - Provided as a loan or gift to someone else in your community
  - Saved for the future
- During the last seven days, how many times did one or more people in your household not receive a regular daily meal?
- Please tell me the material that your FLOOR is made out of.
- Please tell me the material that your WALLS are made out of.
- Please tell me the material that your ROOF are made out of.
- What toilet facilities do you PRIMARILY use?
- Do you currently receive any government benefits?
  - If so, which program?
  - How much per month?
- What type of lighting do you use in your house?

6. Mobile Phone use

- Complete the following table:

Complete the Operator	How many SIM cards do you own that use this network?	What is your primary phone number on this network?	How frequently do you use this SIM card?	Do you consider this to be your main number?
Safaricom			A-E (see below)	Yes/No
Airtel			A-E (see below)	Yes/No
Telkom			A-E (see below)	Yes/No
Other			A-E (see below)	Yes/No

- A: Multiple times per day
  - B: Roughly once per day
  - C: Multiple times per week, but not every day
  - D: Roughly once per week
  - E: Less than once per week
- How many years have you had a smartphone?
- Does your current phone typically have more than one SIM card in it?
- If you had a technical problem with your cell phone, who would you mainly ask for help? (for example if your phone would not turn on or allow you to make calls)
  - Self
  - Relative
  - Friend or neighbor
  - Repair shop
- Do you share your current mobile phone with others?
  - Typically one or more times each day
  - Not every day, but several days each week
  - Just once or twice each week
  - Very rarely (no more than once or twice each month)
  - Never
- On a scale of 1-5, with 1 being a total beginner, and 5 being an expert, what would you say your level of skill and familiarity is with digital technology (such as computers and phones)?
- Without looking at your phone, can you estimate how many different contacts you have stored in your contact list?
- Roughly how many different people do you estimate you spoke to in person in the last week?
- Without looking at your phone, can you tell me approximately...
  - How many phone calls you made in the last week?
  - How many phone calls you received in the last week?
  - How many text messages you sent in the last week?
  - How many text messages you received in the last week?
  - How many different people you spoke with on the phone last week?
  - How much money you spent on airtime in the last week?
  - How much money you spent on cellular data in the last week?
  - Do you have Facebook?
    - If so, how many Facebook friends do you have?
  - How many times you sent money using mobile money?
  - How many times you received money using mobile money?
- Subjective rating:
  - On a scale from 1-5, how easy is would it be for you to:
    - Send 10 more text messages next week than you did last week?
    - Send 10 fewer text messages next week than you did last week?
    - Make 10 more phone calls next week than you did last week?
    - Make 10 fewer phone calls next week than you did last week?

- Call 10 people next week that you didn't call last week?
- The number of people you call?
- The amount of data you use?
- The time of day that you use data?
- The time of day that you call?

Next, imagine a company were to provide you with a bonus for using your mobile phone differently.

- If you were paid a bonus 0.5 Ksh per SMS you send next week, how many SMS would you send?
- If you were paid a bonus of 50 Ksh but from that was deducted 0.5 Ksh per SMS you send next week, how many SMS would you send?
  
- If you were paid a bonus 0.5 Ksh per call you make next week, how many calls would you make?
- If you were paid a bonus 50 Ksh but from that was deducted 0.5 Ksh per call you make next week, how many calls would you make?
  
- If you were paid a bonus 0.5 Ksh per person you called next week, how many people would you call?
- If you were paid a bonus 50 Ksh minus 0.5 Ksh per person you called next week, how many people would you call?
  
- If you were paid a bonus 0.05 Ksh per MB of data you used next week, how much data would you use?
- If you were paid a bonus 50 Ksh minus 0.05 Ksh per MB of data you used next week, how much data would you use?
  
- How many mobile phones do you own?
  - How many are smartphones?
- Do you have a mobile money account (M-PESA, etc)?
  - Which M-PESA services do you use (check all that apply)?
- Where do you charge your mobile phone battery mostly? [ home, shop, work/school, other ]
  - How many times per week do you charge your mobile phone?
  
- How regularly do you use the following services?
  - E-mail
  - WhatsApp
  - Tuko
  - Facebook
  - YouTube
  - SportPesa or other betting service
  - Other internet sites
  - A laptop or computer (not a phone)

- Baselines
  - How many SMS do you plan to send next week?
  - How many calls do you plan to make next week?
    - How many in the morning from 5am-8am
    - How many between 8am-7pm?
    - How many in the evening from 7pm-11pm?
    - How many overnight (11pm-5am)?
  - How many different people do you plan to call next week?
  - How much data do you plan to use next week (in MB)?

7. Financial Inclusion

- Do you currently keep an account at any of the following institutions?
  - Commercial Bank
  - Microfinance institution (such as XX)
  - ROSCA (such as XX)
  - Other
- In an average month, roughly how much money do you personally earn?
- In an average month, roughly how much do you spend?
- Have you ever received a loan from any of the following sources?

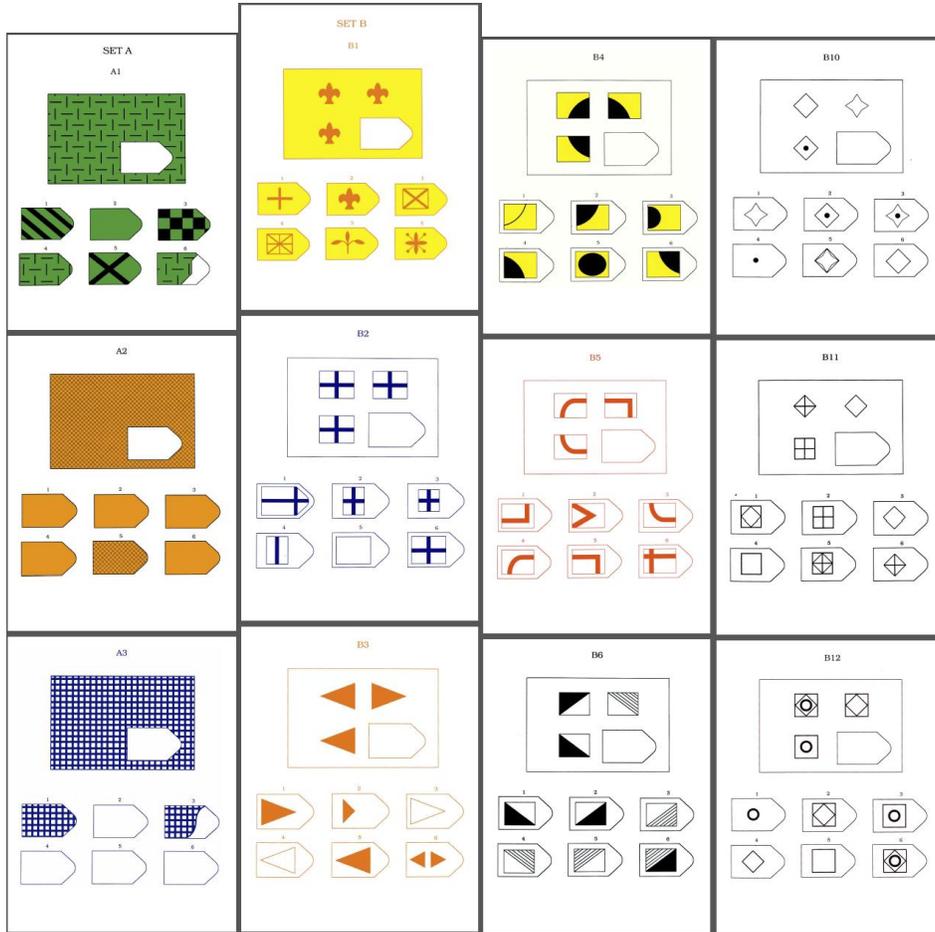
Source	If yes, roughly how many loans?	What was the largest loan you received from this lender?	Were your repayments on time or late?
Commercial bank			A-E (see below)
Local moneylender			A-E (see below)
M-Shwari			A-E (see below)
Branch			A-E (see below)
Tala			
Other (list)			

- A: Always on time
- B: Usually on time, but occasionally late
- C: Frequently late
- D: Not fully repaid by end of loan term

8. Numeracy and Raven's scores

- Suppose Joseph earns a salary of 1000 Shillings a week. He obtains a ten percent raise. How much exactly will his income be after the raise?
- In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 10 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?
- If it takes five machines five minutes to make five widgets, how long does it take 100 machines to make 100 widgets?
- Raven's matrix: Here is a pattern with a piece missing. Below are six pieces, choose the one that completes the pattern.

- A1 – example (doesn't count)
- A2 – example (doesn't count)
- A3
- B1 – B12 [ see attached PDF for enlargement]



## 9. Present Bias and Risk Aversion

We are interested in understanding how Kenyans make decisions involving uncertain outcomes and some normal risks that people face every day. We would like to ask you some hypothetical questions that will help us understand these decisions. There is no real money involved and you will not receive any money for answering these questions. Are you willing to answer these questions? [ Yes (Proceed with survey)) / No (Conclude Surevy) ]

- Suppose someone was going to pay you 4000 Shillings 13 months from now. He/she offers to pay you a lower amount in 12 months time. What amount in 12 months would make you just as happy as receiving 4000 Shillings in 13 months?
  - [ Comparison ladder ]
- Suppose someone was going to pay you 4000 Shillings 6 months from now. He/she offers to pay you a lower amount in 5 months time. What amount in 5 months would make you just as happy as receiving 4000 Shillings in 6 months?
  - [ Comparison ladder ]
- Suppose someone was going to pay you 4000 Shillings 1 month from now. He/she offers to pay you a lower amount today. What amount today would make you just as happy as receiving 4000 Shillings in 1 month?
  - [ Comparison ladder ]
- [Show Card] First we will ask you a hypothetical question over an amount for certain, or an amount that will be awarded depending on which of ten numbers you draw from a bag. We have deposited 10 cards numbered 1 through 10 into a bag. You have an even chance of drawing any of the 10 numbers. The numbers in parentheses indicate the winning number. For each Option No., please indicate whether you would prefer Choice 1 or Choice 2. For each option No. there will be 10 numbers in the bag and you are only able to draw one. This is not for real money and we are not asking you to make a gamble, we just want to understand how you would respond to naturally occurring risk.
  - [ Comparison ladder ]
- Now we will ask you which of two lotteries you would prefer. We will place 10 even sized cards numbered 1 through 10 into a bag and ask you to draw one. You have an even chance of drawing any of the cards. The numbers in parentheses indicate the winning numbers.
  - [ Comparison ladder ]

10. Mental Health

**Patient Health Questionnaire-9 (PHQ-9)**

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The Phq-9. Journal of general internal medicine, 16(9), 606-613.

ENUMERATOR: Over the last two weeks, how often have you been bothered by any of the following problems?

TRANSLATION: Kwa juma viwili zilizopita mara ngapi umesumbuliwa na matatizo haya?

Code	Question	Values
	Little interest or pleasure in doing things	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day
	Mwelekeo mdogo au kukosa raha wa kufanya vitu	1 Hapana kabisa 2 Siku kadhaa 3 zaidi ya nusu ya siku hizi 4 Karibu kila siku
	Feeling down, depressed or hopeless	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day
	Kujisikia kama huwezi kuchangamka, kusikia, huzuni au kukosa tumaini	1 Hapana kabisa 2 Siku kadhaa 3 zaidi ya nusu ya siku hizi 4 Karibu kila siku
	Trouble falling or staying asleep, or sleeping too much	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day
	Tatizo kupata usingizi au tatizo kuendelea kulala baada ya usingizi, ama kulala kupita kiasi	1 Hapana kabisa 2 Siku kadhaa 3 Zaidi ya nusu ya siku hizi 4 Karibu kila siku
	Feeling tired or having little energy	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day

	Kujisikia kuchoka au kuwa na nguvu kidogo	1 Hapana kabisa 2 Siku kadhaa 3 zaidi ya nusu ya siku hizi 4 Karibu kila siku
	Poor appetite or overeating	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day
	Hama ya kula ni mbaya, au kula kupita kiasi	1 Hapana kabisa 2 Siku kadhaa 3 zaidi ya nusu ya siku hizi 4 Karibu kila siku
	Feeling bad about yourself -- or that you are a failure or have let yourself or your family down	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day
	Kusikia vibaya kuhusu binafsi, au kusia kama umeshindwa, Au umejishusha, ama umeshusha chini familia yako	1 Hapana kabisa 2 Siku kadhaa 3 zaidi ya nusu ya siku hizi 4 Karibu kila siku
	Trouble concentrating on things, such as reading the newspaper or watching television	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day
	Tatizo kutuliza akili kwenye vitu kama kusoma gazeti au kusilikiliza radio	1 Hapana kabisa 2 Siku kadhaa 3 zaidi ya nusu ya siku hizi 4 Karibu kila siku
	Moving or speaking so slowly that other people could have noticed? Or the opposite -- being so fidgety or restless that you have been moving around a lot more than usual.	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day
	Kutembea au kuzungumza pole polesana hata ingeweza kuonekana kwa watu wengine. Ama kinyume-kuwa namashaka/wasiwasi au kutotulia kiasi hata umekuwa ukitembea tembea sana kuliko kawaida	1 Hapana kabisa 2 Siku kadhaa 3 zaidi ya nusu ya siku hizi 4 Karibu kila siku
	Thoughts that you would be better off dead or of hurting yourself in some way	1 Not at all 2 Several Days 3 More than half the days 4 Nearly every day

	Fikira kwamba ni heri ukifa, au fikira za kujiumiza kwa njia fulaniFulani	1 Hapana kabisa 2 Siku kadhaa 3 zaidi ya nusu ya siku hizi 4 Karibu kila siku
	If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	1 Not difficult at all 2 Somewhat difficult 3 Very difficult 4 Extremely difficult
	Ikiwa umejibu kuhusu shida yoyote, ni kwa kiasi gani haya mashida yamefanya iwe vigumu kwako kufanya kazi yako, kutunza vitu nyumbani au kuelewana na watu wengine?	1 Sio vigumu hata kidogo 2 Vigumu kiasi 3 Vigumu sana 4 vigumu kupita zaidi