Pre-Analysis Plan

This paper estimates the willingness to pay (WTP) for the infection and treatment (ITM) vaccine against east coast fever (ECF) using a field experiment in Kenya. It uses the Becker-DeGroot-Marshack (BDM) method to estimate the WTP for the ITM vaccine for young calves.

Using random variation in timing, we also seek to assess the impact of exogenous liquidity constraints on WTP elicitation. If WTP represents a stable valuation, independent of constraints, then recent shocks and other constraints should not affect measured WTP. If they do, that would suggest that what we capture as willingness-to-pay truly represents some combination of willingness and ability to pay.

Sample

The experiment's sample consists of households engaging in livestock management activities in Narok County, Kenya. Households that refuse to participate will be excluded from the experiment. We target 774 households.

Experiment overview

This study will take place in Narok County, Kenya, from January 2025 to May 2025. Participants will be surveyed by enumerators, including detailed data on recent expenses. The survey will be programmed via Commcare and conducted on a tablet. The BDM exercise will take place after the survey; during it, participants will be able to purchase the ITM vaccine at a (potentially) subsidized rate.

For the exercise, participants will first state the number of calves they want to vaccinate. Participants will then state their maximum WTP for vaccinating the chosen number of calves. A random price will then be drawn from a predefined distribution. If this random price is less than or equal to the participant's WTP, they will purchase the vaccine at the drawn price. If the random price is higher, they cannot buy the product through the survey.

The data collection process will involve randomizing the order in which participants will be surveyed. Specifically, each participant will be randomized to receive the survey and WTP elicitation in a pre-specified week during the survey period (January 2025 to May 2025). This randomization is expected to introduce exogenous variation in liquidity constraints based on seasonality and the randomness of recent events.

Participants who successfully purchase the vaccine through the WTP exercise will have 48 hours to gather/raise funds. They will be notified of the potential vaccination opportunity one week in advance of their randomly assigned survey week. This notification is to enable households to gather funds before the visit, mimicking the typical purchase environment for the vaccine.

To identify randomization-induced variation in liquidity constraints, we are considering the following:

- Crop-agriculture seasonality: The sample includes households that routinely farm different crops, including green maize, dry maize, and beans. These different crops face different lean seasons, inducing variation in liquidity. The majority of the households grow maize every six months. The harvesting season for maize differs based on the type of maize the farmer wants. Farmers typically sell green maize from April to June. The peak sale of dry maize takes place from July to September.
- Schooling expenditure: Changes in the liquidity constraints due to payment of school fees. A year in Kenya School education system has three terms.The first term starts in January - end of March. The second term starts at May - end of July, while the third term starts in early September - end of November. Schooling fees are usually paid in the beginning of each term. Considering the timeline of the study, we plan to focus on the exogenous variation created by the school fees that are due at the beginning of first semester that is in January.
- Random shocks such as health shocks, expenses due to ceremonies.

Key variables:

Variable	**Definition**
Quantity	Number of calves chosen to vaccinate
WTP	Maximum willingness to pay for the number of calves chosen to vaccinate
school_fee_amount	Total cost (in Ksh) incurred by the household school fees in the last month
hosp_cost	Total cost (in Ksh) incurred by the household from unexpected illness or injury in the last month
fest_cost	Total cost (in Ksh) incurred by the household in festivals and ceremonies in the last month
hhincome_off_farm	Income (in Ksh.) earned by the household from off-farm activities in the last month
hhincome_farm	Income (in Ksh.) earned by the household from farm activities in the last month
hhincome_crop_amount	Income (in Ksh.) earned by the household from selling crops in the last month
hhincome_off_farm_avg	Income (in Ksh.) earned by the household from off-farm activities in an average month
hhincome_farm_avg	Income (in Ksh.) earned by the household from farm activities in an average month

hhincome_crop_amount_avg	Income (in Ksh.) earned by the household from selling crops in an average month
exp	Expenditure (in Ksh.) by the household in the last month
exp_avg	Expenditure (in Ksh.) by the household in an average month

Primary Analysis

Approach 1:

Our first approach involves a straightforward regression of willingness to pay, conditional on quantity, on a number of plausibly exogenous recent shocks to income or expenditure. The direction and significance of each coefficient will tell us whether these external factors affect self-reported willingness to pay.

$$WTP_{ij} = \beta_0 + \beta_1 Quantity_{ij} + \beta_2 school\_fee\_amount_i + \beta_3 hosp\_cost_i + \beta_4 fest\_cost_i + \beta_5 hhincome\_off\_farm_i + \beta_6 hhincome\_farm_i + \beta_7 hhincome\_crop\_amount_i + \beta_8 X_i + \gamma_t + e_i$$

where:

- WTP_{ij}: The dependent variable representing the willingness to pay for the j^{th}unit of vaccine purchased by participant *i*.
- X_i: vector of survey unit-level characteristics. We will also estimate the above equations with and without the following control variables:
  - Total number of people in the household (household size).
  - Number of children in the household attending primary school.
  - Number of children in the household attending secondary school.
- γ_t : A vector of month fixed effects where 't' is the month when the participant was interviewed.
- e_i: Individual error term. Since random assignment is at the survey level, we use robust standard errors.

We test the following hypotheses:

H_a: 1.a: $\beta_1 < 0$. As the number of vaccines purchased increases, the WTP per unit decreases

H_a: 1.b: $\beta_2 < 0$. As the amount spent on school fees increases, the WTP per unit decreases
H_a: 1.c: $\beta_3 < 0$. As hospital costs increase, the WTP per unit decreases
H_a: 1.d: $\beta_4 < 0$. As festival or ceremony costs increase, the WTP per unit decreases
H_a: 1.e: $\beta_5 > 0$. As household income from off-farm activities increases, the WTP per unit increases
H_a: 1.f: $\beta_6 > 0$. As household income from farm activities increases, the WTP per unit increases
H_a: 1.g: $\beta_7 > 0$. As household income from selling crops increases, the WTP per unit increases

Approach 2:

As a second approach, we will implement a two-stage process where we first leverage randomized variation in survey timing to identify plausibly-exogenous constraints in liquidity, then regress our measure of WTP on predicted constraints.

For the first stage, we will use a single omnibus measure of constraints (or, rather, non-constraints), where we focus on the respondent's excess income in the last month, normalized against the respondent's average excess income.

Stage 1:
$$LiquidityConstraint_i = \alpha_0 + \alpha_1 Timing_i + \alpha_2 AverageLiquidity_i + X_i + \epsilon_i$$

Our endogenous regressor will be constructed as follows:
Liquidity Constraint = hhincome_off_farm + hh_income_farm - exp

We will control for AverageLiquidity, which is constructed as follows:
AverageLiquidity = hhincome_off_farm_avg + hh_income_farm_avg - exp_avg

The $Timing_i$ variable indicates the period in which the household was surveyed. X_i are defined as in Approach 1.

Stage 2:
$$WTP_i = \beta_0 + \beta_1 \hat{LiquidityConstraint}_i + X_i + \epsilon_i$$

The key coefficient will be β_1 in stage 2. We are particularly interested in the hypothesis that higher constraints may reduce liquidity (e.g., $\beta_1 < 0$), but any rejection of the null hypothesis that $\beta_1 = 0$ is inconsistent with the view that WTP represents a stable

willingness to pay. In particular, $\beta_1 < 0$ is consistent with a view that WTP represents some combination of willingness and ability to pay.

Balance Checks:

We will perform balance checks on the following variables, which should not be substantially affected by survey timing:

1. Number of people in total currently living in the household
2. Primary occupation of the household head.
3. Whether any household member maintains a savings account.
4. Whether any household member maintains a mobile money account.
5. The ownership status of the dwelling in which the family lives.
6. The ownership status of the land in which the dwelling sits.
7. Whether any member of the household own any land.
8. Acres of land (altogether) owned by the members of the household.
9. Asset index, constructed based on the following:
    - clock/watch
    - radio
    - television
    - mobile telephone
    - fixed telephone
    - refrigerator
    - solar panel
    - bicycle
    - motorcycle/scooter
    - animal-drawn cart
    - vehicle/car/truck
    - boat with motor
    - tractor
    - ox plough
    - computer