

Supplementary material for

Machine learning for maternal health: predicting delivery location in a community health worker program in Zanzibar

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Conflict of interest

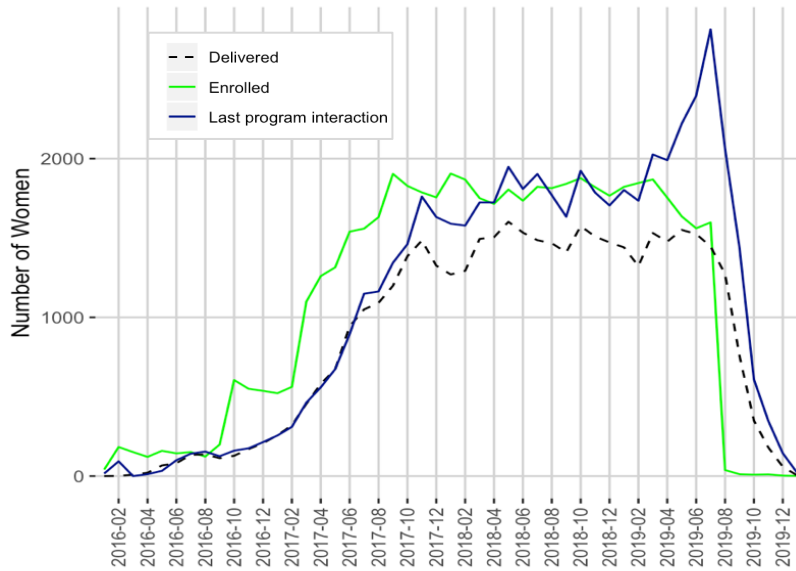
The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

CONTENT

- 1. Further details regarding the Uzazi Salama program**
- 2. Further details regarding the socioeconomic predictors**
- 3. Further details regarding chi-square test to identify key predictors**
- 4. Further model performance metrics**

1. Further details regarding the Uzazi Salama program

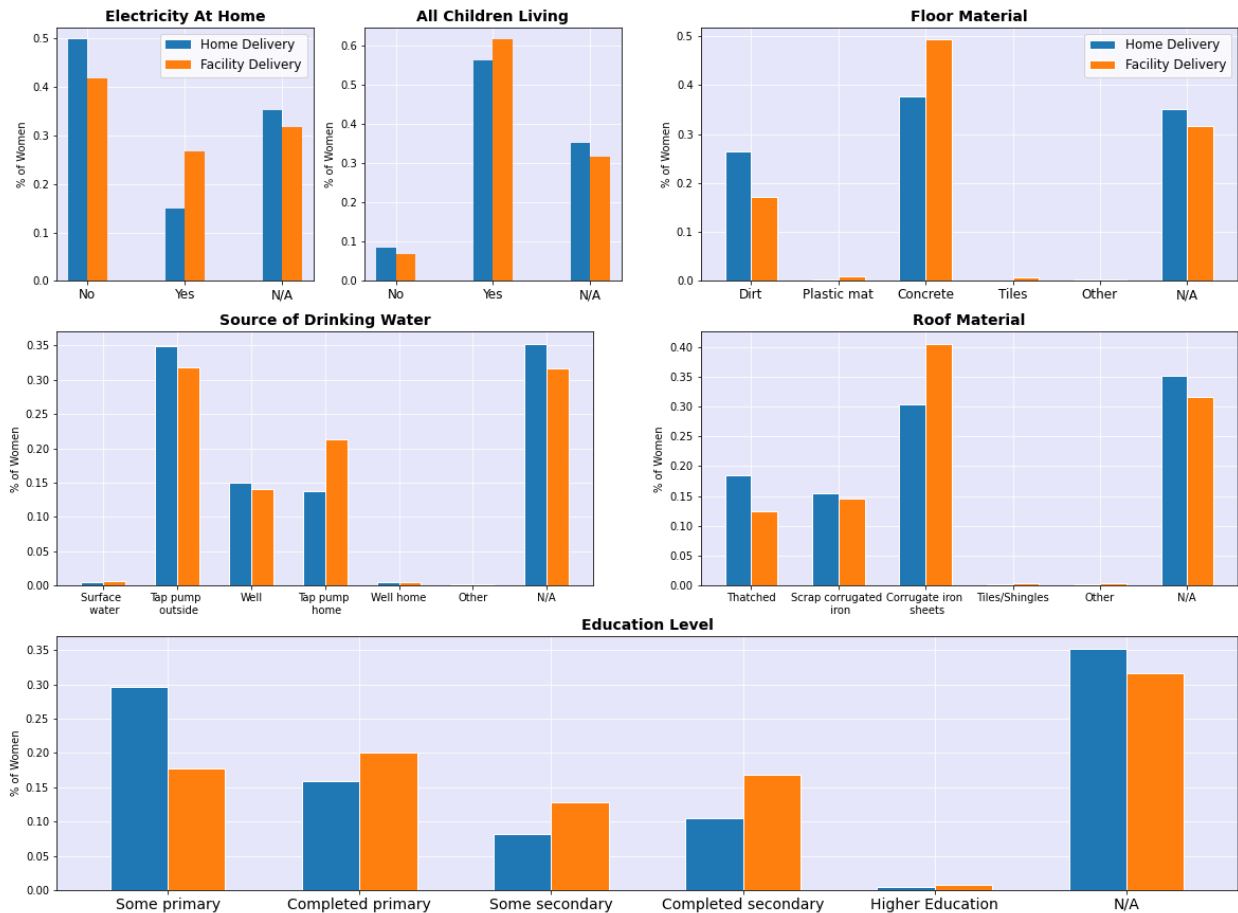
Further detail regarding the distribution of new monthly enrollments, deliveries and program exits in the Uzazi Salama in Zanzibar is illustrated in *Supplementary Fig. 1*.



Supplementary Figure 1. *Distribution of new monthly enrollments, deliveries and program exits in the Uzazi Salama in Zanzibar.*

2. Further details regarding socioeconomic predictors

The analysis of each predictor's ability to individually discriminate between women who deliver in a health facility and women who deliver at home, presented in the *Results* section, suggests that socioeconomic indicators are important factors. *Supplementary Fig. 2* below illustrates the difference in socioeconomic distribution between women who deliver in a health facility and women who deliver at home.



Supplementary Figure 2. Distribution of facility and non-facility deliveries across socioeconomic indicators

3. Further details regarding chi-square test to identify key predictors

Further detail regarding the outcome distribution across key predictors and their corresponding χ^2 -statistic is provided in *Supp. Table 1*.

Supplementary Table 1. Demographic and programmatic characteristics by delivery location (N=38,787)

VARIABLE	HEALTH FACILITY DELIVERY N (PROPORTION OF TOTAL WOMEN IN CATEGORY)	χ^2 STATISTIC	P-VALUE
Overall	29679 (76.5%)		
Previous delivery location		4580.1	<0.001
At home/in community	3841 (48.3%)		
On the way to health facility	202 (59.8%)		
Health facility	17853 (83.0%)		
No previous delivery	7730 (86.7%)		
Rate of facility delivery among women with same CHW		4407.7	<0.001
Q1 (2 - 58.1%]	4796 (54.1%)		
Q2 (58.1 – 77.6%]	6729 (75.9%)		
Q3 (77.6 - 91.3%]	7726 (86.8%)		
Q4 (91.3 - 100%]	8201 (92.7%)		
Rate of facility delivery among women in same shehia		4265.1	<0.001
Q1 (7.2 - 58.3%]	4918 (54.1%)		
Q2 (58.3 – 77.8%]	6922 (76.3%)		
Q3 (77.8 - 88.7%]	7742 (85.7%)		
Q4 (88.7 - 100%]	8350 (92.2%)		
Name of Delivery Facility List of specific facilities omitted due to length.		2370.6	<0.001
District		2298.4	<0.001
Kaskazini A	4333 (74.7%)		
Kaskazini B	2458 (86.8%)		
Kati	2874 (81.4%)		
Magharibi	4291 (88.4%)		
Kusini	1791 (96.2%)		
Mkoani	3686 (60.1%)		
Wete	3015 (77.0%)		
Micheweni	2910 (65.1%)		
Chake Chake	4321 (80.2%)		
Parity		954.9	<0.001
0	7730 (86.7%)		
1	5183 (78.0%)		
2-4	11241 (75.0%)		
5+	5470 (67.0%)		
Education level		867.9	<0.001
Some primary	5291 (66.2%)		
Completed primary	5939 (80.6%)		
Some secondary	3806 (83.5%)		
Completed secondary	4982 (83.9%)		
Higher education	245 (85.1%)		
Floor material		623.3	<0.001

Dirt	5093 (67.6%)		
Plastic mat	259 (91.8%)		
Concrete	14640 (81.2%)		
Tiles	198 (91.2%)		
Other	73 (79.3%)		
Electricity in home		508.6	<0.001
Yes	7908 (85.4%)		
No	12355 (73.2%)		
Fee at first ANC visit (shilling)		414.8	<0.001
Q1 (0 – 1,000]	2917 (67.6%)		
Q2 (1,000 – 2,000]	1206 (82.3%)		
Q3 (2,000 – 3,000]	3241 (80.9%)		
Q4 (3,000 – 10,000]	4833 (83.5%)		

4. Further model performance metrics

Table 3 presents the true positive rate, true negative rate, overall accuracy and AUC of each of the trained models. *Supplementary Table 3* provides additional detail on the false positive rate, women predicted to deliver at home who actually delivered in a health facility, and false negative rate, women who were predicted to deliver at a health facility, but delivered at home.

Supplementary Table 3. Additional metrics for model performance on test set by training set type.

TRAINING SET	CLASSIFIER	FALSE POSITIVE RATE	FALSE NEGATIVE RATE
Undersampled N=14,572	Logistic	28.3%	26.0%
	Regularized Logistic	29.0%	25.5%
	Random Forest	25.6%	28.2%
	Neural Network	44.9%	19.7%
Oversampled N = 47,486	Logistic	28.9%	25.5%
	Regularized Logistic	29.0%	25.4%
	Random Forest	28.9%	26.2%
	Neural Network	24.9%	34.1%
SMOTE with minor undersampling N = 30,000	Logistic	28.2%	26.0%
	Regularized Logistic	28.9%	25.5%
	Random Forest	31.4%	23.5%
	Neural Network	41.1%	19.2%