

Keheala Pilot Study Metrics and KPIs



Figure 1: Keheala Impact

Contact:
Jon Rathouser, CEO & Founder, Keheala
JonR@Keheala.com
+972-58-798-2058

	All Individuals (n=1104)			Bacteriologically Confirmed Individuals (n=585)		
	Intervention (n=569)	Control (n=535)	p-value	Intervention (n=313)	Control (n=272)	p-value
<i>Poor Outcome (Failed Treatment, Died, Loss to Follow Up)</i>						
Count	24	70		17	32	
Rate (%)	4.22	13.08	<0.001	5.43	11.76	0.006
(Std. Error)	0.84	1.46		1.28	1.95	
<i>Loss to Follow Up</i>						
Count	10	53		9	27	
Rate (%)	1.76	9.91	<0.001	2.88	9.93	<0.001
(Std. Error)	0.55	1.29		0.95	1.81	

Figure 2: Treatment outcomes.

Treatment outcomes as recorded from clinic registers are presented in Figure 2. In the intervention, 6.6% (40) were misdiagnosed or transferred out, compared with 7.8% (45) in the control (NS). There remained 569 and 535 individuals in the intervention and control, respectively. Of these, 4.2% (24) had poor treatment outcomes in the intervention, compared with 13.1% (70) in the control ($p < .001$). When adjusted for individual characteristics (including language preference, age, employment, and education) and clinic fixed effects, the marginal effect of the intervention on poor treatment outcomes is 8.7 percentage points (CI = [4.9, 12.5], $p < .001$), and 9.5 percentage points on LTFU (CI = [5.6, 13.4], $p < .001$).

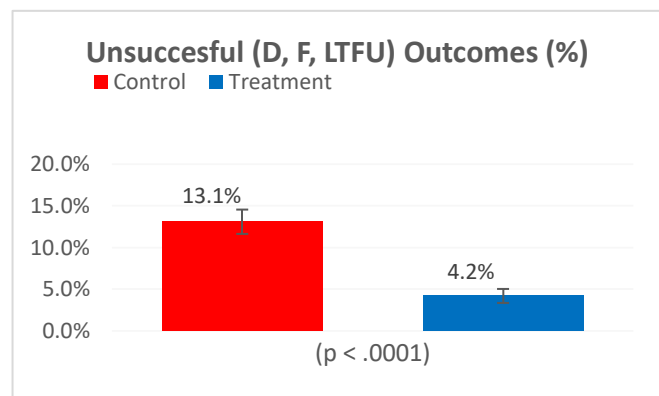


Figure 3: Percentage of unsuccessful outcomes by intervention.

The intervention was particularly effective for individuals who were likely to fail: We fitted a logistic regression of treatment success on individual demographics for the control, and used the results to predict likelihood of treatment success for all individuals (Figure 4). We assigned individuals into quintiles according to this variable, and displayed treatment success by intervention group and quintile. Whereas in the control, unsuccessful outcomes grow dramatically across quintiles, in the intervention, they remain roughly constant: no more than 6% of individuals had poor treatment outcomes, regardless of quintile. We interpret this result to mean the intervention is better helping those who need it most.

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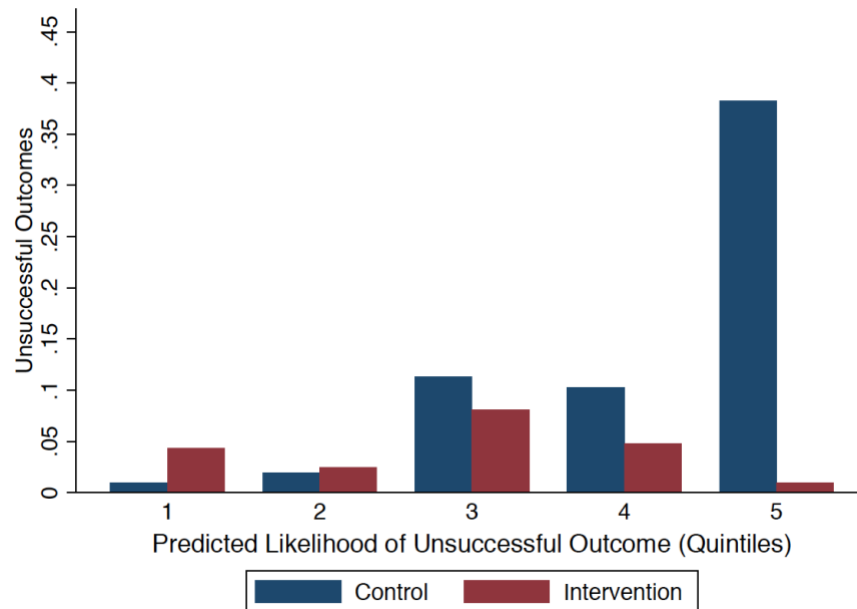


Figure 4: Unsuccessful outcomes by predicted likelihood of unsuccessful outcomes (quintiles).

56,543 daily treatments were successfully verified across the Keheala platform, or 93 successful verifications per patient on average. Patients, were enrolled on Keheala for an average period of 152 days, or just over 5 months. The verification rate then suggests that patients verified their adherence 61% of the expected time.

15% of patients verified their medication at least 90% of the time

34% of patients verified their medication at least 80% of the time.

60% of patients verified their treatment at least 60% of the time. Removing patients who never interacted with the system, 66% of patients verified their treatment at least 60% of the time.

The compliance score ranking was accessed 4,802 (beyond being directed to this function immediately after daily verification), or eight times per patient on average.

The TB info section was accessed 1411 times for 2.3 views per patient.

8508 interactions sent by support sponsors (14 per patient, 1,701 per support sponsor)

999 messages received from patients (1.65 per patient)

353 medical questions forwarded from patients to clinicians (less than 1 per patient)

482 instances of individuals being non-adherent for a period of three days or longer. In these instances, patient information was shared with the local clinical site for on-the-ground follow up.

Of Keheala's best patients, 60 individuals expressed an interest to work with and support Keheala in the future and could be engaged as potential support sponsors.

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Kenya Health System Impact (TB)	
Estimated Cost-Savings to Ministry of Health from Pilot:	\$92,880
Estimated Cost-Savings to Ministry of Health at Scale (annually):	\$24,400,000
Estimated Lives Saved in Kenya at Scale (annually):	1,553
Estimates Drug-Resistant Cases Averted at Scale (annually):	329

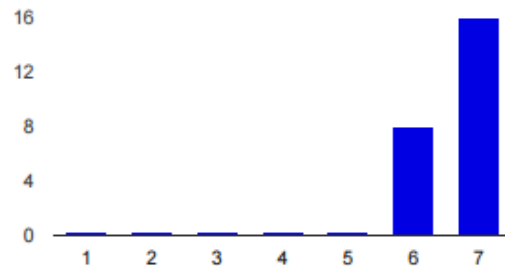
Figure 5: Kenya Health System Financial Impact (TB). Extrapolated from work of Collins and Njuguna (2016) for 138,105 annual patients.

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User Feedback on Keheala

Upon completion of the proof of concept trial in Kenya, a clinician survey was conducted to obtain insights on the benefit of Keheala for healthcare providers. Survey questions, clinicians feedback and comments are detailed below:

What is your impression of how this program impacted your patients' compliance with their tuberculosis treatment?



No impact: 1	0	0%
2	0	0%
3	0	0%
4	0	0%
5	0	0%
6	8	33.3%
Extremely positive impact: 7	16	66.7%

Clinician Comments:

- “Patients come for their treatment on time and tell me were it not for the reminders and constant calls they could have left taking treatment because they felt better”
- “The emails made me get to the patient’s soon as opposed to having to wait for them not to come to the clinic for a month or so to know that they are not taking their pills well”
- “The reminders were key in helping non-compliant patients not to miss treatment even after missing one day.”
- “Most patients finished their TB medication and they do not default unlike before”

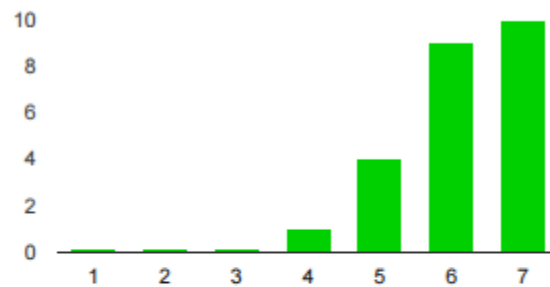
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To what degree did this program make your job easier?



Not at all: 1	0	0%
2	0	0%
3	0	0%
4	1	4.2%
5	4	16.7%
6	9	37.5%
Extremely: 7	10	41.7%

Clinician Comments:

- “Information about TB was shared through Keheala which lessened my job. The patients were asking questions via the platform and they would get informed through Keheala”
- “Very little explanation now required and hence less time per patient helping ease the congestion problem”
- “Patients took medication on time and were more responsible for their treatment”
- “It made my work very easy because I didn't spend a lot of time educating the patients, because I no longer have to call patients to remind them to come to the clinic”
- “It gave me an easy time to follow up on patients, reduced the workload”
- “It really helped because of the constant interaction with them, they gained trust more and I feel strongly that the program should go on”
- “The emails made me get to the patient's soon as opposed to having to wait for them not to come to the clinic for a month or so to know that they are not taking their pills well”

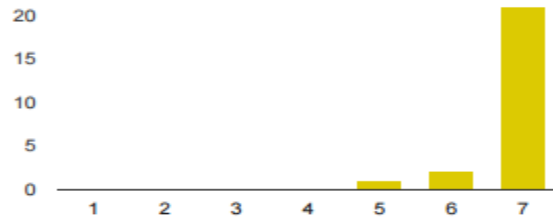
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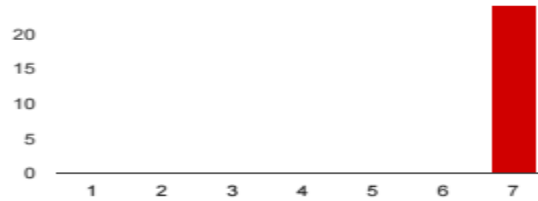
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Would you prefer to work with patients using this program?



Definitely not: 1	0	0%
2	0	0%
3	0	0%
4	0	0%
5	1	4.2%
6	2	8.3%
Definitely yes: 7	21	87.5%

If a family member of yours had tuberculosis, would you want them to be enrolled in this program?



Definitely not: 1	0	0%
2	0	0%
3	0	0%
4	0	0%
5	0	0%
6	0	0%
Definitely yes: 7	24	100%

Clinician Comments:

- “I would prefer to use this program because patients can ask questions without having to come to the hospital which saves time and money, the support sponsors are in constant communication with patients hence they feel that someone cares about them hence they become more open with me unlike before”
- “Makes work efficient and to the patient, they are kept on track especially those who are taking treatment for a lengthy period. We would love to have such a program for the HIV patients and Maternal and Child Health.”
- “Keheala has been supportive to our patients and it is a bridge communication between the community and the clinics.”

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Patient Feedback

Platforms like Keheala are expected to provide the following benefits: increased knowledge about TB and other infectious diseases, improved health, increased prosociality, improved attitudes towards medical professionals, improved economic outcomes, and increased empowerment. Keheala has the potential to generate large and diverse welfare gains directly through reduction of TB - currently the deadliest infectious disease in the world - as well as other diseases like HIV. Decreased rates of medical remission have been tied to positive changes in educational attainment, health care costs, and economic outcomes.

Patients using the platform had the opportunity to initiate and submit unsolicited feedback. The following feedback was received:

- "I have taken my medicine to avoid infecting other people."
- "i finishd trtment thnks 2 u"
- "i need a remindr on arvs"
- "THANKS 4 UR SUPPORT 4 TB TREATMENT"
- "thank you for your concern about my health."
- "THANK YOU"

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