



MACRO-EYES HEALTH

ESPECIALISTA

Human-In-The-Loop Frontline Experts-As-A-Network

AUGUST 2020 - I/01-4

INTELLIGENCE

Human-in-the-Loop: Frontline Experts-As-A-Network

#XAAN

Frontline health workers: Activating the most powerful network in the world for ultra real-time, hyper-local insight.

Frontline health workers are the world's foremost experts on the communities they serve: supply constraints, changes in demand, environment, rumors, staffing. Today, health workers are treated as mechanisms for data entry: "measure x," "record y." None of these data entry tasks take advantage of their unique insight or knowledge. Our approach to health worker-in-the-loop ML aims to change how health systems learn from health workers.

macro-eyes launched five Telegram group chats at health facilities in Mozambique in partnership with VillageReach in November

2019. We rarely asked health workers direct questions and did not tell them what to share. We asked that they describe change in their environment that they deem important.

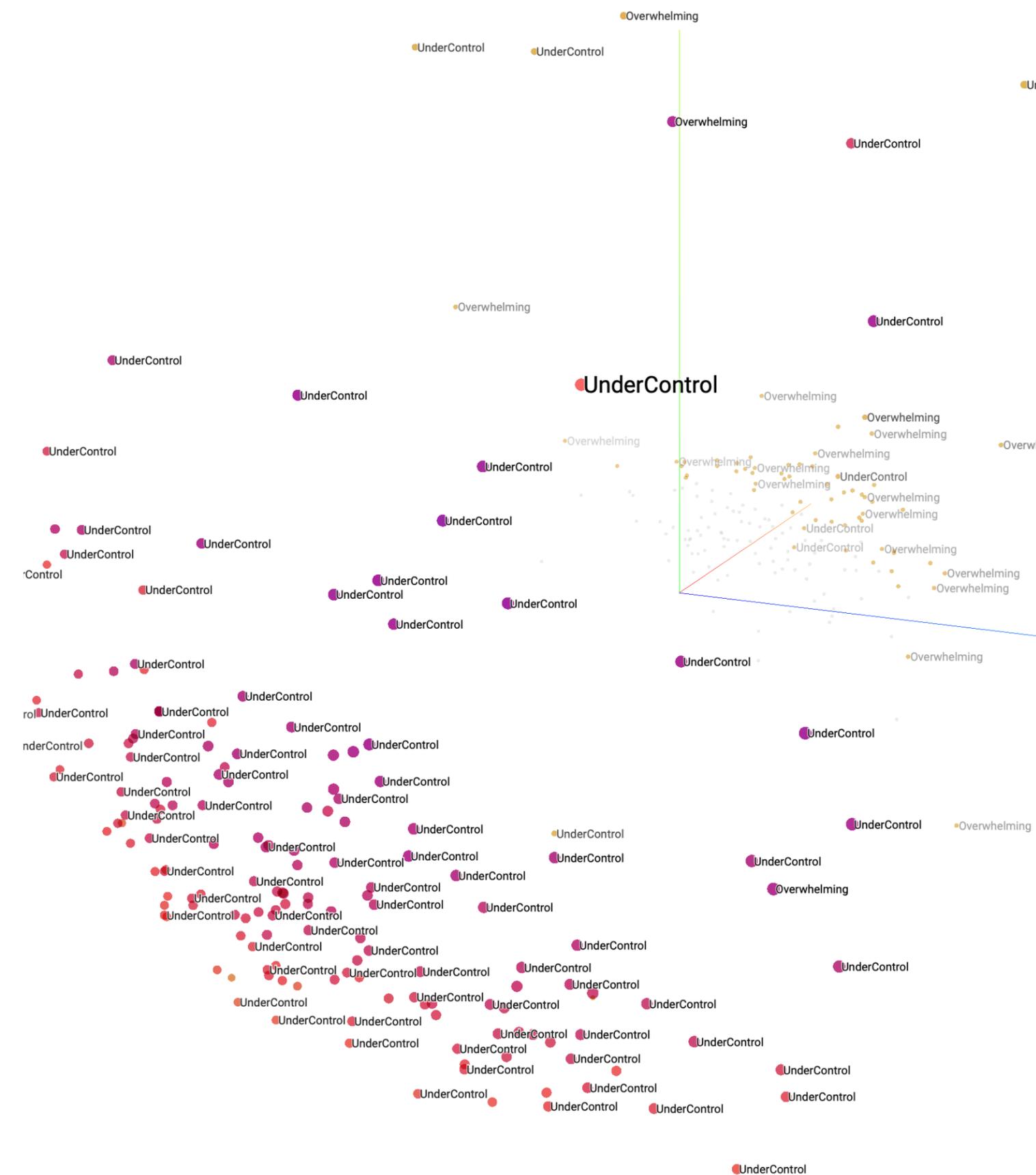
On average, users shared about 46 messages, averaging 15 words per message. macro-eyes technology machine-learned insight into environmental conditions, supply constraints, the spread of rumors, COVID and catchment population adherence to social distancing and hand-washing. We demonstrated the ability to correctly gauge the capacity for care, machine learned only from natural language.

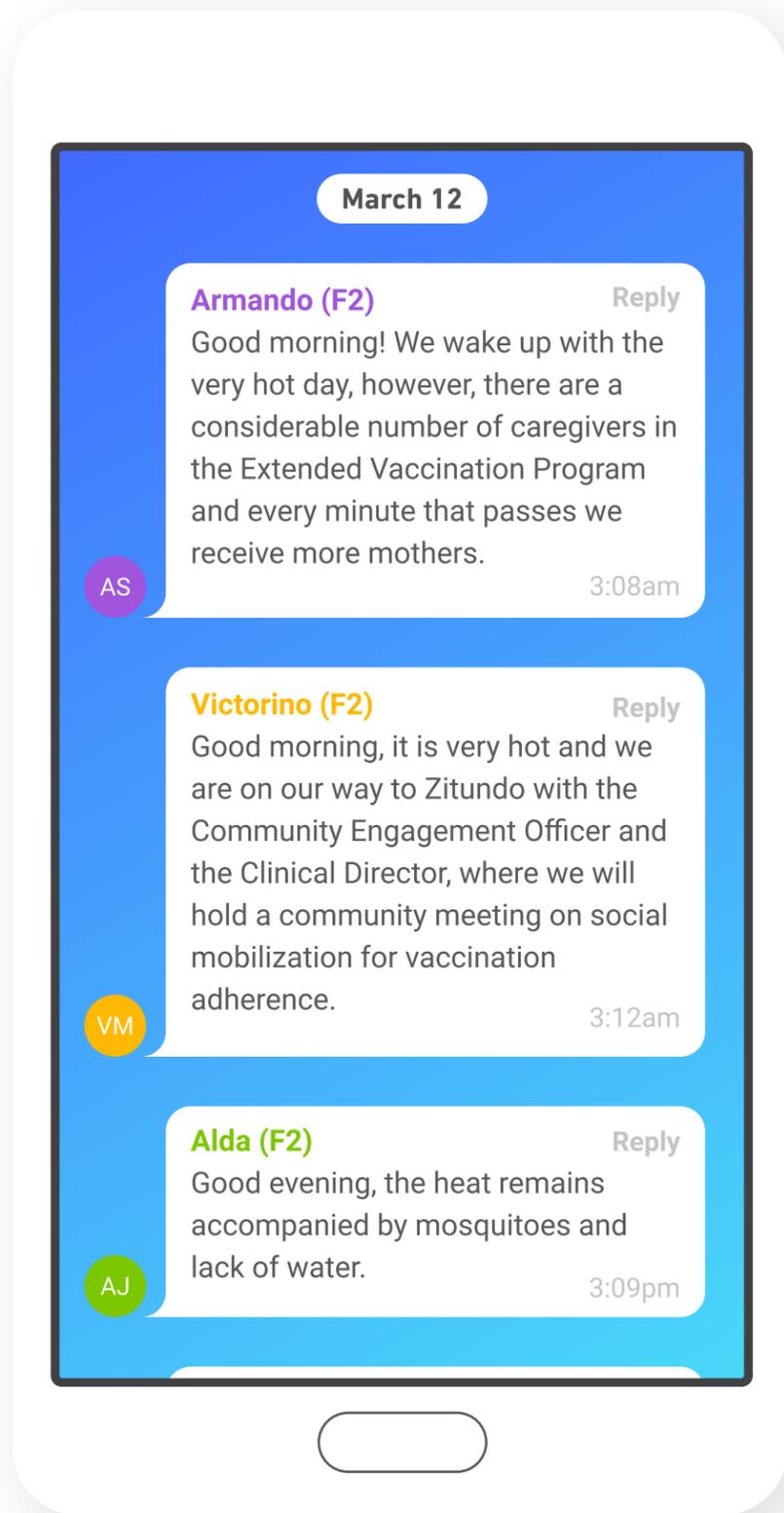
What we've learned:

Frontline health workers are eager to share their insights and observations.

The state of a facility / capacity for care is more than the sum of equipment + staff on hand. Insight into capacity is nearly impossible to measure without direct and indirect insights from frontline health workers.

We tested a series of behavioral incentives. We experienced overwhelming engagement from the start; participants shared messages prior to receiving paid data – the technical "go-live". Incentives seemed to have little effect on the levels of engagement, arguably indicating the underlying incentive – treating them as the experts – was the most powerful incentive of all.





Learning from the Experts: Frontline Health Workers as Network

Real-time intelligence from the point of care

Frontline health workers are the world's foremost experts on communities.

They comprise the most valuable network of unused health system insight and data on the planet – they are a network hiding in plain sight. Frontline health workers

are willing to share daily insights about the changes they notice in their environment – they've been waiting for a seat at the table.

“Thank you for this training and for coming to our facility. We are so thankful for the opportunity to share what we are seeing everyday. No one has ever provided a way for us to do this before. We do notice things daily and thank you for giving us a way to express ourselves.”

-HEALTH FACILITY DIRECTOR, MAPUTO PROVINCE, MOZAMBIQUE

By engaging them as experts, health workers are empowered to share what they see – to share what they know is most important at their facility, in their community.

users share approximately 55 messages, averaging 15 words per message. Participants were given phone credit monthly to cover the cost of sharing messages daily.

As of May 2020, we've received over 3,000 messages connecting directly to ~40 frontline health workers. We derisked our greatest concern – would health workers engage with us at all? Share anything? The answer is a resounding yes.

More impressive than the volume of messages, was the breadth of messages. Content includes messages across routine topics of data collection and expanded into to complex network relationships between facilities, health workers, and regions.

macro-eyes launched five Telegram group chats at five different health facilities across Mozambique in partnership with VillageReach in November, 2019. On average,

Long sought after real time insights into community and health rumour were raised regularly – increasingly so during the novel COVID-19 outbreak.

Human *Experts* In-The-Loop ML: Engaging with frontline health workers

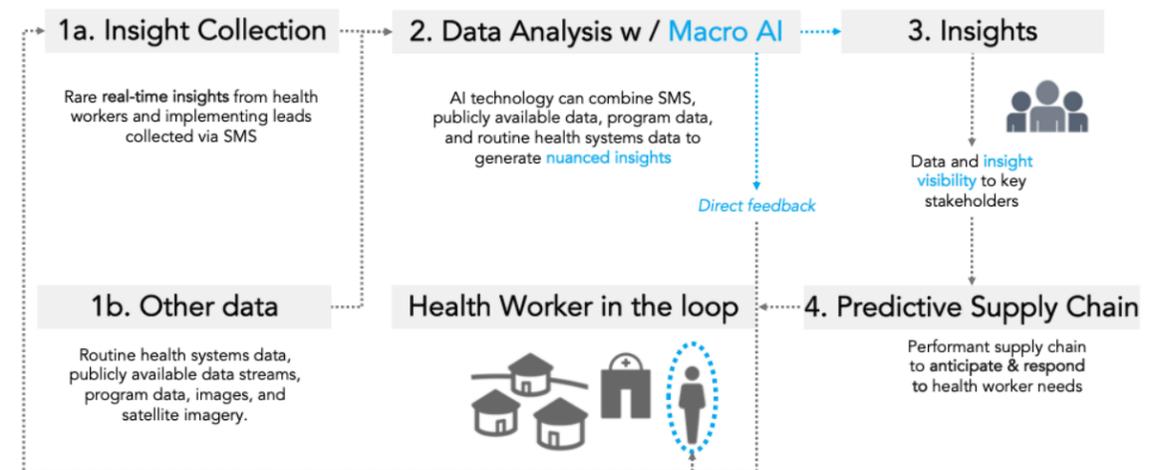


Fig. 1 Experts In-The-Loop: From Insight to Predictive Supply Chain

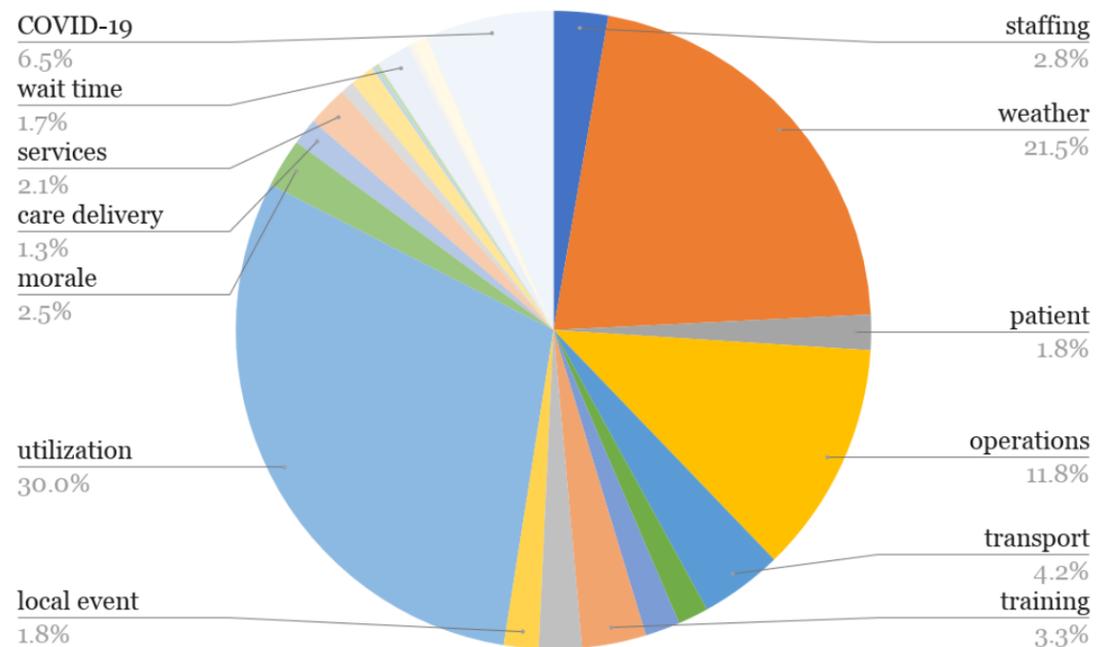


Fig. 2 Most Common Labels of Types of Messages Received from Telegram Groups of Health Facilities in Mozambique

The preliminary deployment strategy sought to improve engagement by testing a set of incentives for the participants.

Six incentives were tested at the health facilities:

1. “(your) context is king” - confers authority
2. recognition
3. peer to peer competition
4. data for knowledge (reward=cellular data)
5. positive reinforcement
6. authoritative (annex 4: incentive protocols)¹

Somewhat unexpectedly, we saw overwhelming engagement from the start; participants shared messages prior to receiving paid data – the technical “go-live”.

Incentives seemed to have little effect on the levels of engagement. The intrinsic incentive that underpinned each experiment was to visibly treat each health worker as an expert with a voice worthy of respect and point of view that demands attention.

The greatest indicator of level of engagement was the social culture established at the facility prior to arrival. It could be hypothesized that engaging in activities that increase normal social interaction and trust/collaboration between health workers at the facility would positively impact the engagement in social platforms like the initiative to test the macro-eyes human in the loop framework. Providing the platform – and a framework of respect – for health workers to communicate easily and daily, proved overwhelmingly successful.

macro-eyes technology can machine-learn from natural language (messages and images shared by frontline health workers) health facility capacity on a daily basis. The machine learning system discerns if health workers are overwhelmed or feel the day is under control.

The technology can home in on the elusive, critical measure of health system resiliency: when and where are health workers overwhelmed; what levels and type of care overwhelm them; which facilities can care for more patients and which facilities cannot effectively manage the patient load they currently face. Today, no government in the world can see true capacity at the health facility level. We developed this in direct response to key stakeholder feedback.

The Maputo Province Deputy Director expressed a need to better understand where staff should be deployed according to demand. He has limited visibility into which facilities were feeling overwhelmed and which felt under control.

It’s not a simple calculation of staff and patients. Complexity of care, efficiency of staff, sentiment, and configuration of the facility all play a part in how efficiently care is delivered. Insight into capacity is nearly impossible to measure without direct and directed insights from frontline health workers.

Additional queries were tested with the platform to understand hyper-local differences in infrastructure and environment between health facilities – even in countries with limited EIR data. Examples of environmental characteristics that can be observed through the platform include: frequency of power outages (figure 17), transport issues, flooding, and refrigeration issues. During the onset of the

novel corona virus, macro-eyes also saw an increase in messages with the topic of COVID-19. Early messages indicating rumor of the virus in local migrant patients were shared on the platform two weeks prior to the first nationally recognized case of COVID-19.

25% of messages in April were related to COVID-19. The HIL platform identified washing stations at all included facilities, social distancing was being done, but masks and adherence to stay at home orders were being followed with varying rigor from site to site. These insights contributed to a broader understanding of how diseases move and how existing (and potential similar) treatments may or may not be effective.

Understanding individual level facility resilience to environmental factors is crucial to accurately predicting both supply, demand and estimating the ability of a facility to meet required levels of capacity in real time.

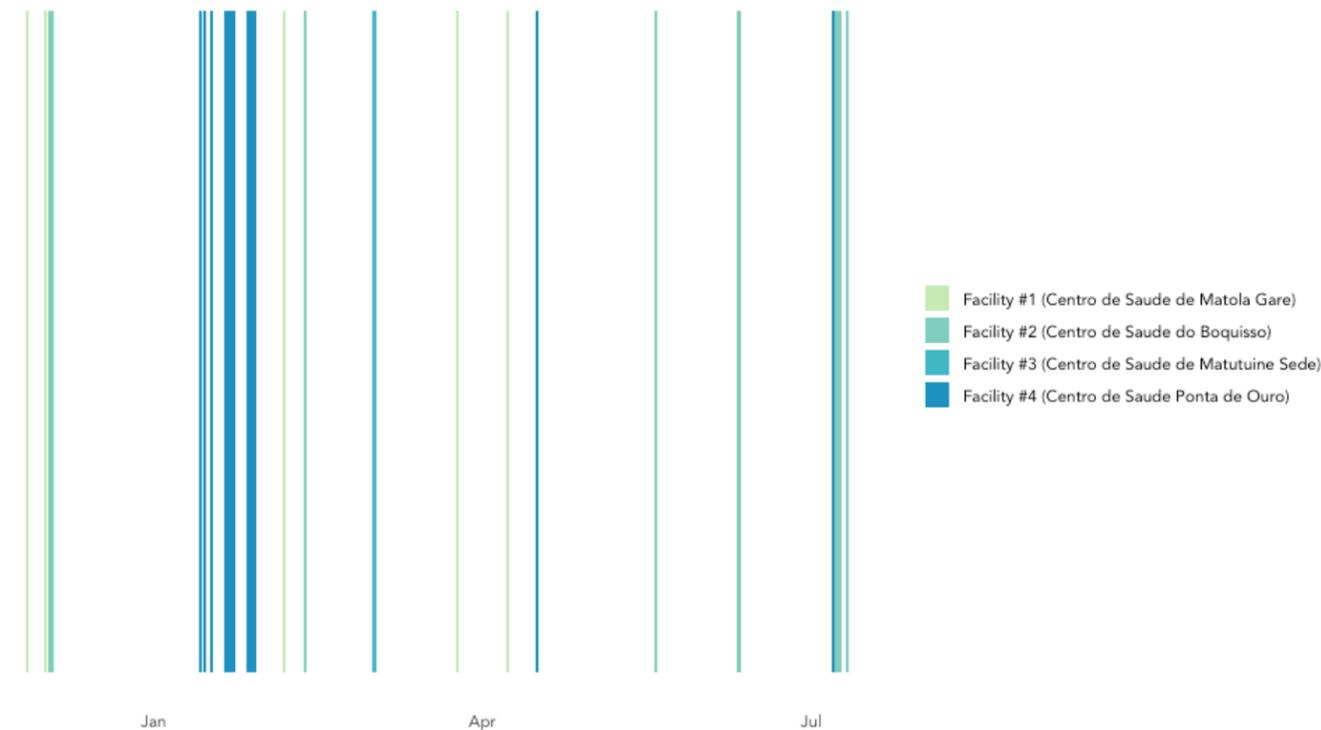


Fig. 3 Days of Reported Power Outages by Facility

¹An educational incentive was also identified as participants were informed about the human-in-the-loop approach and linked activity to overall impact for improved supply chains for vaccines.

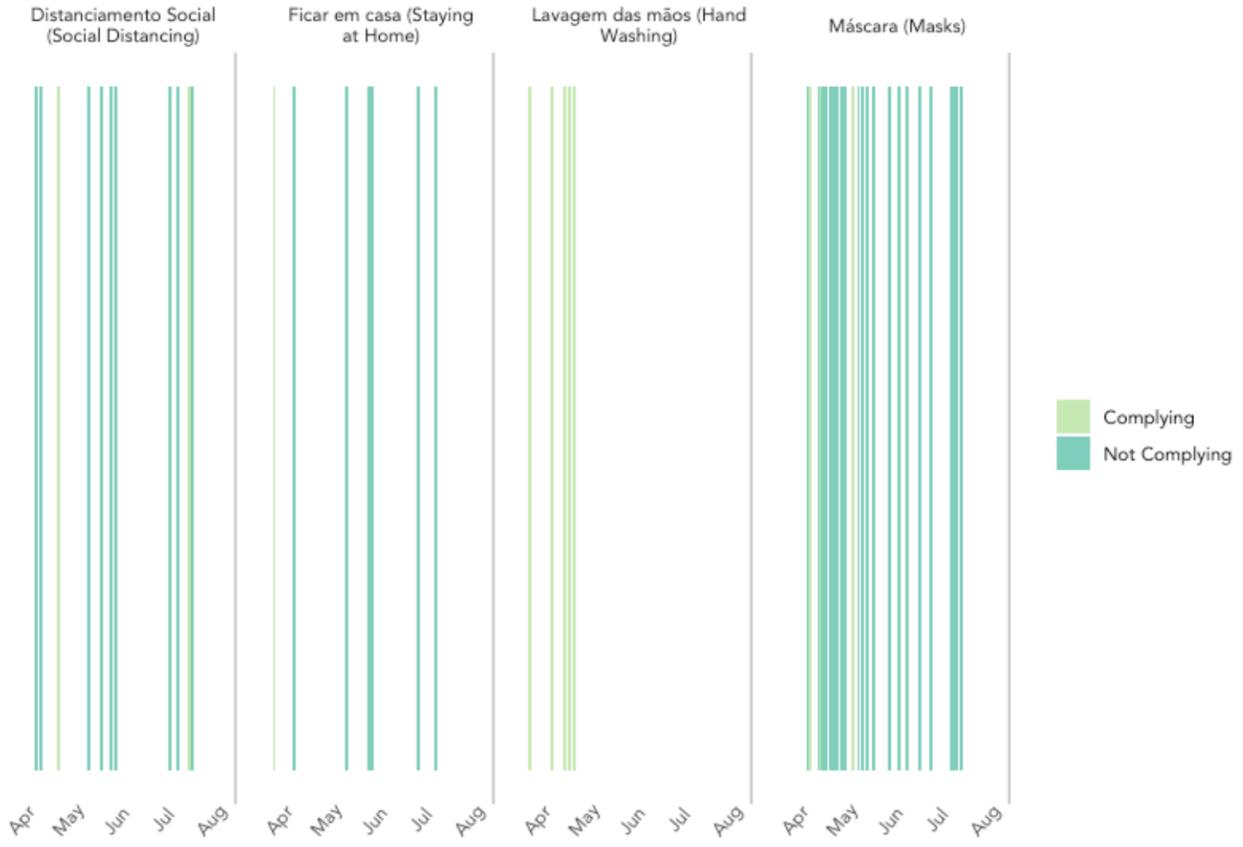


Fig. 4 Frequency of compliance reports by week by preventative method

Unexpected operational benefits of the social platform.

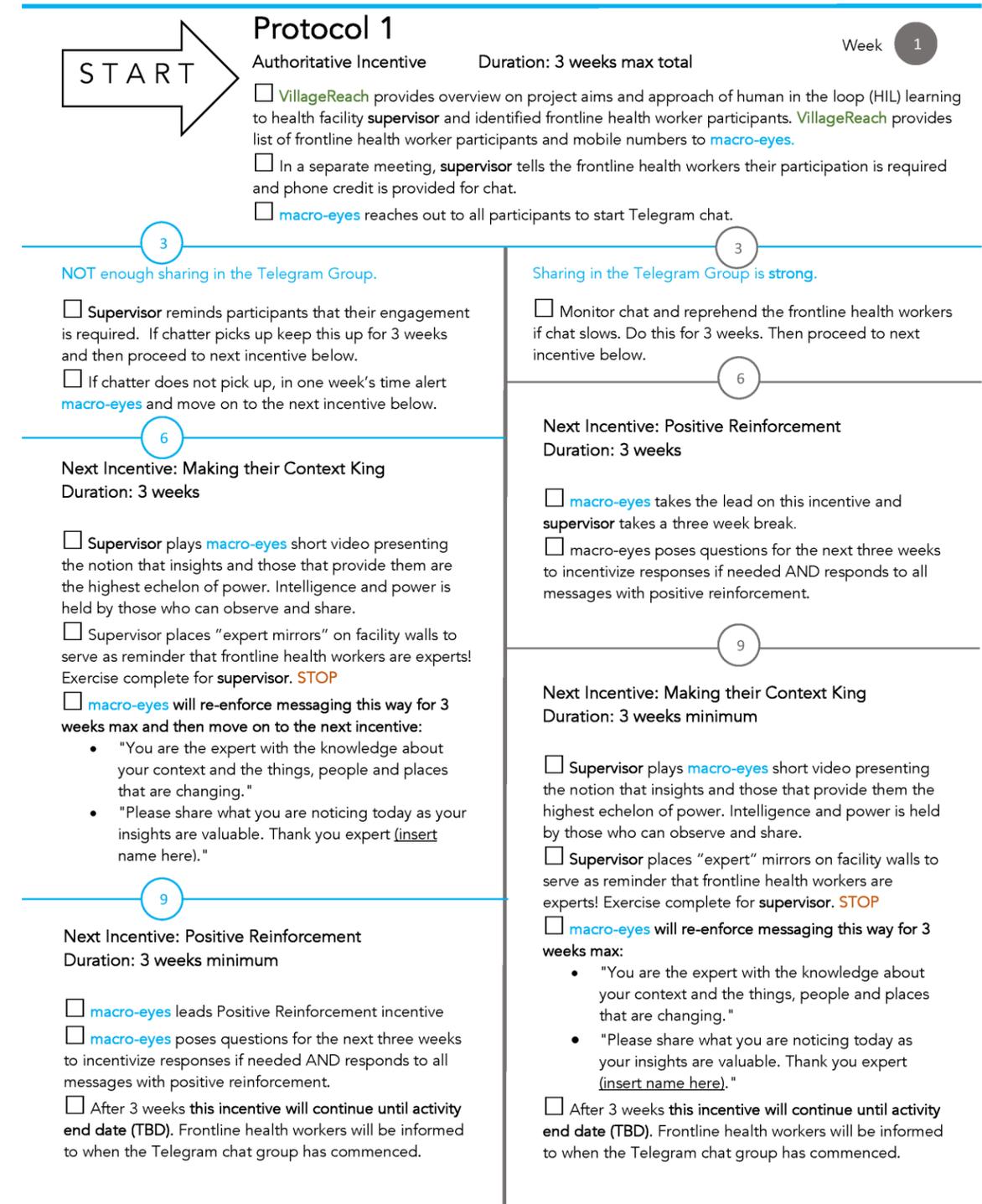
Focus group discussions with the Telegram chat group participants revealed improved coordination of daily activities within the health facility themselves. Many of the health facility directors noticed an improvement in general services. In one case, frontline health workers were able to better prepare for a day at their ward for child health consultations because they were informed early of long lines via the chat groups. Facility directors noticed staff were more "alert and online" as a consequence of their engagement with the platform.

Frontline health workers are untapped domain experts with a wealth of information that can provide rare and real-time insights to power predictive intelligence. By meaningfully engaging health workers, macro-eyes can translate expert - timely insights into data and generate predictive intelligence about the health system. This technology can generate information to fill gaps in health system visibility and provide contextual insights never before visible.



Fig. 5 Frontline health worker and participant in the Telegram chat group in front of the "Especialista" ("Expert") mirror given to health facilities by macro-eyes to remind them that they are the experts on a daily basis.

Annex: Incentive Protocols



Need Support? Contact macro-eyes directly via the Telegram chat group or contact Mamiza 84 079 1519 MACRO-EYES HEALTH



Protocol 2

Context is King
Duration: 3 weeks max total

Week 1

- VillageReach provides overview on project aims and approach of human in the loop learning to health facility supervisor and identified frontline health worker participants. Provides list of frontline health worker participants and mobile numbers to macro-eyes.
- VillageReach plays macro-eyes short video for health workers participants presenting the notion that insights and those that provide them are the highest echelon of power. Intelligence and power is held by those who can observe and share.
- Supervisor places "expert" mirrors on facility walls to serve as reminder that frontline health workers are experts!
- Supervisor provides phone credit to frontline health workers for chat exercise.
- macro-eyes reaches out to all participants to start Telegram chat. macro-eyes will re-enforce "expert" messaging targeted at the frontline health workers:
 - "You are the expert with the knowledge about your context and the things, people and places that are changing."
 - "Please share what you are noticing today as your insights are valuable. Thank you expert insert name here."

3

NOT enough sharing in the Telegram Group.

- macro-eyes will continue to encourage the frontline health workers and if nothing changes in one week's time will alert VillageReach and the supervisor and move on to the next incentive below.

7

Next Incentive: Comparative competition
Duration: 4 weeks minimum

- Supervisor leads a meeting with frontline health workers to inform them that after one week's time macro-eyes will share a list with all participants that ranks them among their peers (other participants). Those who end up at the bottom of this ranking have provided the least amount of information to the chat. Supervisor will thank frontline health workers for participation so far and provide more data for frontline health workers to continue chat in Telegram. Exercise complete for supervisor. **STOP**

- macro-eyes provides ranked list week 1
- macro-eyes provides ranked list week 2
- macro-eyes provides ranked list week 3
- macro-eyes provides ranked list week 4
- macro-eyes continues to provide ranked list for each week until activity end date (TBD)...

- If there are issues with low engagement on Telegram, macro-eyes will send a reminder to the Telegram group that the rankings will be provided to the group based on level of participation at end of week.
- After 4 weeks this incentive will continue until activity end date (TBD). Frontline health workers will be informed to when the Telegram chat group has commenced.

Need Support? Contact macro-eyes directly via the Telegram chat group or contact Mamiza 84 079 1519



Protocol 3

Data for Knowledge (Reward) Incentive
Time: 6 weeks max total

Week 1

- VillageReach provides overview on project aims and approach of human in the loop learning to facility supervisor and identified frontline health worker participants. Provides list of frontline health worker participants and mobile numbers to macro-eyes. Provides initial credit for chat to begin.
- Supervisor informs frontline health workers that the higher the level of participation (with a max of 2 insights per day) the more cell data provided to the participant.
- macro-eyes reaches out to all participants to start Telegram chat.

6

NOT enough sharing in the Telegram Group.

- macro-eyes sends a reminder to the Telegram Group that the higher the level of participation the more cell data provided. Wait 1 week and if not much movement, then move to the next incentive. If chatter increases wait total of 6 weeks before moving on to next incentive.

9

Next Incentive: Recognition
Duration: 3 weeks

- Supervisor holds meeting for frontline healthcare workers at facility to kick-off new incentive. Informs participants that after 1 week a "winner" will be crowned based on highest number of valuable insights provided in the Telegram chat. "Winner" will receive recognition in front of the group after each week by supervisor.
 - Supervisor recognizes week 1 winner
 - Supervisor recognizes week 2 winner
 - Supervisor recognizes week 3 winner
- If there are issues with little to no Telegram chatter, macro-eyes will send a reminder to the Telegram group that the higher the level of participation the more likely their chance of "winning" recognition.
- After 3 weeks move on to the next incentive.

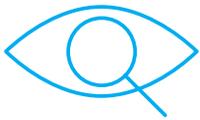
12

Next Incentive: Positive Reinforcement
Duration: 3 weeks minimum until end

- macro-eyes takes the lead on this incentive.
- macro-eyes poses questions for the next three weeks to incentivize responses if needed AND responds to all messages with positive reinforcement.
- After 3 weeks this incentive will continue until activity end date (TBD). Frontline health workers will be informed to when the Telegram chat group has commenced.

Need Support? Contact macro-eyes directly via the Telegram chat group or contact Mamiza 84 079 1519





MACRO-EYES HEALTH

Learn more at macro-eyes.com