

*Peer Review Framework for Predictive Analytics
in Humanitarian Response*

MODEL REPORT:
**Cooper/Smith population
mobility model**

November 2021

OCHA CENTRE FOR HUMANITARIAN DATA



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1. Background

In 2020 the technical assistance firm [Cooper/Smith](#) developed a population mobility model in Malawi with the support of the [Digital Impact Alliance](#) (DIAL) and the Malawi Ministry of Health (MoH). The mobility model provides insight on population localization and movement patterns. It enables the MoH and local stakeholders to have a near real-time view on where the population is, providing a much-needed complement to the census.

Between November 2020 and January 2021, the OCHA Centre for Humanitarian Data (the Centre) engaged with technical and ethical experts¹ to conduct an independent review of Cooper/Smith's model in Malawi, according to the Centre's [Peer Review Framework for Predictive Analytics in Humanitarian Response](#). Between February and November 2021 The Centre worked with Cooper/Smith and our reviewers to finalise the recommendations presented below.

2. Main Findings and Recommendations

The population mobility model provides insight on population localization and movement patterns, enabling the Ministry of Health (MoH) of Malawi and local stakeholders to have an almost real-time view on where the population is. It signals when there is a large gathering that is two standard deviations from the mean number of subscribers in that location (traditional authority or district level) over the last 30-days.

The primary user of this model is the Government of Malawi's Public Health Emergency Operations Center (PHEOC). The model has an automated signal that will send emails to PHEOC members and the PHEOC's Incident Management System, which logs, triages, and actions reported incidents.

¹ For this project we collaborated with technical experts from UN Global Pulse and ethics experts from the Centre for Humanitarian Data.

You can find all the documentation regarding the model, its application and the review process at the following links:

- The [Model Card](#) describes version 2 of the model developed in Q2 2020.
- The [Model Evaluation Matrix](#) was completed in November 2020 by experts from the OCHA Centre for Humanitarian Data and UN Global Pulse.
- The [Implementation Plan](#) was completed in November 2020. It summarizes the concrete actions that the model will trigger or inform.
- The [Ethical Matrix](#) aims to identify all stakeholders and potential issues regarding the intended use of the model. The Ethical Matrix was completed In January 2021.

A summary of the main findings and recommendations is provided below.

2.1 Technical Review

Model development and documentation

- The Centre recommended clearly distinguishing the three modeling tasks and clarifying which methods are being used to perform each of the three tasks when presenting the model to potential stakeholders and end users.
 - This recommendation has been considered and met by Cooper/Smith, as detailed in the [Model Evaluation Matrix](#) and the [Model Documentation](#).

Model Evaluation

- Depending on data availability, we recommend performing a quantitative analysis of model performance.
- Additional datasets used to independently validate the model (Google Mobility; observed events counts; case counts) all have limitations. We recommend that Cooper/Smith should continue seeking alternative sources to compare estimates and understand correlation/discrepancies between them.
- Cooper/Smith should continue to operate a feedback process from model end users and health care workers on the ground, and we recommend enlarging it to community members and leaders. Validating findings from the model with a larger group of actors (e.g. community health workers, community leaders) would ensure greater accuracy and usefulness.

2.2 Ethical Review

False Positives and Negatives

When the model produces a false alarm this is considered a 'false positive'. When the model misses an event this is considered a 'false negative'. False positives and negatives can cause costly interventions or lack thereof, for example sending personnel or resources to an area where they were not urgently needed.

- Cooper/Smith has identified a risk mitigation strategy that includes an ongoing feedback loop with primary stakeholders about how to handle false alarms, helping decrease the level of concern. The Centre recommends continuing to follow this strategy closely to prevent any potential issues from materializing.

Overreaction

Overreaction is a decision informed by the model output that leads to action that is too impactful compared to the need that should be addressed.

- Cooper/Smith has already established a decision process and protocol for the use of the model to mitigate risk related to Overreaction. In future applications of the model, we suggest creating a limited list of decisions that may be informed by the model output, in order to ensure the output is not used to inform decisions leading to action that is incompatible with applicable guidance and ethical principles, including the Humanitarian Principles.

Inaction

When no action is taken based on the model output this is considered 'inaction'.

- The Centre recommends that the risk reduction strategy identified in the [Model card](#) be followed closely and its implementation be monitored. In future model deployments, the Centre recommends the model only be deployed when there is an established plan for action based on its outputs.

Privacy / Rights Infringement

When data or information is managed or exposed in ways that infringe upon human rights, this is considered a 'privacy / rights infringement'.

- The data currently used in the model is anonymized and aggregated. Should the model use personal or otherwise sensitive data in future applications, we suggest its management to be checked by legal / data protection experts.

Gaming

When stakeholders can act according to the algorithm's rules to achieve an intended outcome, this is considered 'gaming'.

- The Centre recommends that any significant changes in model behavior be monitored closely in order to assess whether they might be caused by gaming. Sudden changes that affect the outcome of the model could indicate that the target population is adjusting its behavior to avoid gatherings from being detected.