

A PEER REVIEW FRAMEWORK FOR PREDICTIVE ANALYTICS IN HUMANITARIAN RESPONSE

DRAFT FOR CONSULTATION AS OF SEPTEMBER 2019

THE CENTRE FOR
HUMANITARIAN DATA



OCHA

centre for humdata

1. Introduction

Humanitarian decision-makers have called for the increased use of predictive analytics to inform anticipatory action. However, translating the outputs of predictive models into timely and appropriate responses remains a challenge for several reasons:

- First, there is no common standard or mechanism for assessing the **technical rigor** of predictive models in the sector.
- Second, the development of predictive models is often led by technical specialists who may not consider important **ethical concerns**, such as the consequences of a false positive (a model output that predicts a crisis when one does not manifest) or a false negative (a model output that fails to predict a crisis that occurs).
- Third, model outputs may not be **actionable or relevant** for humanitarian decision-making due to mandate, policy, resource, or other constraints.

The Centre for Humanitarian Data ('the Centre') has been working with our partners to understand the current state of model development and use in humanitarian operations. We have noted a clear desire for quality assurance of models by partners, with the Centre identified as having a unique role to facilitate a peer review process.

Initially developed as part of the Centre's 2019 Data Fellows Programme, the following Peer Review Framework for Predictive Analytics in Humanitarian Response is our first attempt to create standards and processes for the use of models in our sector. It is based on research with experts and stakeholders across a range of organizations that design and use predictive analytics. The Framework draws on best practices from academia and the private sector.

Peer review is one of three areas of focus for the Centre's predictive analytics workstream. We also work on developing new models and supporting existing partner models for use in humanitarian operations, and on community and capacity building. Learn more about our work on predictive analytics [here](#).

2. Peer Review Framework

The Framework consists of three steps: 1) Readiness Assessment; 2) Model Review; and 3) Assessment and Results. The duration for review will depend on the completeness and quality of the submission by the partner organization. We estimate that the review may take anywhere from one to two months.



In the first step, the Centre will assess the readiness of a model for peer review. We will work with the partner to understand the model objectives, the crisis setting, and the action that the model output will inform.

In the second step, the model will be assessed against three criteria: technical, ethical, and humanitarian relevance. For this, the Centre will invite experts to engage in the review process.

In the third step, the Centre will convene the reviewers to discuss the findings. A results package will be developed that includes findings across each domain and the final assessment of the model. This package is shared with the partner privately. The partner may decide to revise their submission based on the findings and would have the ultimate say in whether the results are shared publicly.

3. Roles in the Peer Review Process

The Centre will lead the process and will work with experts to complete the review. The partner organization will be asked to identify a single focal point for the process although different colleagues may need to be involved for each step.

The roles include:

- The Client: an organization submitting a model for peer review.
- Ethical Reviewer: an individual with demonstrated expertise in practical and humanitarian ethics.
- Humanitarian Relevance Reviewer: an individual with demonstrated sectoral expertise in the relevant context.

- **Technical Reviewer:** an individual with demonstrated expertise in data science and statistics.
- **Moderator:** a member of the Centre’s Predictive Analytics team designated by the Predictive Analytics Team Lead on a case-by-case basis.

3.1 The Client

The client initiates the process through a direct request to the Centre’s Predictive Analytics Lead. Models may be submitted for peer review by organizations developing a model, or by organizations planning to use model outputs for decisions.

3.2 Reviewers

The Centre will invite experts to submit a brief application to become a reviewer in one of the domains -- ethical, humanitarian relevance, or technical. Once accepted, the reviewer will become part of a reviewer pool which will be managed by the Centre. The moderator will select reviewers based on availability and a match of skills for the model in reference. Reviewers will not be assigned to review models submitted by their own organization. The reviewer role is unpaid.

3.3 The Moderator

The Centre’s Predictive Analytics Lead appoints a member of the Centre’s team to act as moderator to each review. Following the initial request for model review, the moderator is the point-of-contact for the client and the reviewers.

4. Readiness Assessment

In the first step, the Centre assesses the readiness of a model for peer review by conducting a viability call at the request of the client within 7 days of receiving the submission. During this call, a member of the Centre’s Predictive Analytics team will guide the Client through the Readiness Assessment (see Annex A).

The objectives of the viability call are to:

- a) Determine whether the model aligns with the Centre’s work and objectives; and
- b) Assess the feasibility of reviewing the model.

Using the Readiness Assessment, the moderator will collect information needed to continue with the review, including an overview of the model and the availability of supporting materials. The client is asked to provide information about the model, describe how the outputs are expected to inform action, and confirm whether the

development code, methodology documentation and data will be made available for review.

Should the Readiness Assessment criteria not be met, the moderator will inform the client of the decision and share the report highlighting steps that need to be taken for the model to be reviewed. Should the model meet the Readiness Assessment criteria, the Client will be informed that the model will be reviewed and will be provided with a timeline.

5. Peer Review

The model is assessed against the criteria for ethical, humanitarian relevance and technical domains by the reviewers. To initiate this step, the client submits supporting materials (e.g. development code, methods documentation) to the moderator. The client may request supporting materials be treated confidentially.

The moderator sends invitations to ethical, humanitarian relevance and technical reviewers based on their domain expertise. Reviewers are asked to accept the invitation to review within 3 business days. Additional reviewers are contacted until each position is filled. Up to 7 days are allocated to identify reviewers. The moderator provides the reviewers with templates addressing criteria across the ethical, humanitarian relevance and technical domains.

5.1 Ethical Review

The ethical considerations of the model will be assessed using the Ethical Matrix (Annex B) which has been adopted from the work of Cathy O’Neil.¹ The ethical reviewer will identify all stakeholders and concerns regarding how the model could be used. For instance, a model may need to be adjusted in a scenario in which a false negative is unacceptable for affected populations or a false positive is unacceptable for a donor. The matrix will be filled in in collaboration with the client.

5.2 Humanitarian Relevance Review

The actionability of the model output will be assessed using the Humanitarian Relevance Checklist (Annex C). The Humanitarian Relevance reviewer will assess the model output in consideration of the crisis context, output reliability and interpretation, and stakeholder engagement.

¹ O’Neil, C. Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. Crown Publishing Group New York, NY, USA, 2016.

5.3 Technical Review

The Technical Checklist (Annex D) is designed to assess the scope and methodology of the model. The technical reviewer will assess the code and technical documentation of the model to identify and evaluate the theoretical foundations, data sources, parameters, analysis methods, limitations, and interpretations. If applicable, the technical reviewer will reproduce the results using the code and technical documentation.

6. Assessment and Recommendations

Reviewers will complete the templates (Ethical Matrix, Humanitarian Relevance Checklist and Technical Checklist) with their assessment within an agreed amount of time. Reviewers may request additional information or clarification from the client via the moderator during this time. Reviewers will be asked to sign their review at submission.

The moderator convenes all reviewers to discuss the findings. The moderator prepares the Assessment and Results report (Annex E), detailing how the model output may be interpreted and its reliability, as well as the key components of each review.

The moderator shares the recommendation package with the client privately. The client may decide to revise their submission based on the findings and would have the ultimate say in whether some or all the results are shared publicly.

Feedback

The Centre invites relevant individuals and organizations working in the humanitarian, academic, research and private sector to engage with us on the peer review process. Please send feedback on the framework to centrehumdata@un.org.

Acknowledgements

The draft Framework was initially developed by Dani Poole who worked as a Data Fellow with the Centre during the 2019 Data Fellows Programme in June and July The Hague. As part of her research, Dani conducted interviews with over 20 experts including data scientists, researchers, ethicists, and decision makers spanning the humanitarian, academic, and private sectors. The draft Framework was further detailed with input from Leonardo Milano, Stuart Campo, Manu Singh, and Kirsten Gelsdorf, among others. We appreciate the time and consideration of the many people who have contributed to this process.

I. Annex A

Peer Review Framework - Readiness Assessment

The moderator will use the Readiness Assessment template to record information regarding each item. The client may request to see the Readiness Assessment template in preparation for a peer review request.

Centre's Predictive Analytics Team Member: _____

The Client: _____

Review request initiated: ___ / ___ / ___

Readiness Assessment: ___ / ___ / ___

Domain	Item	Description
Model overview		
	1	Summarize the prediction problem (i.e. model objectives, setting, affected population, predictors, and proposed interpretation of the output):
	2	List any partners and their role in model development and proposed use, including funding sources:
	3	Define the outcome to be predicted:
	4	Identify the key techniques used to build the model:
	5	Describe the action that the model output will inform:
	6	Describe any initial ethical concerns:
	7	Summarize engagement with stakeholders:
Availability of supporting materials		
	8	State whether the development code will be available for review:
	9	State whether the data will be available for review:

II. Annex B

Peer Review Framework - Ethical Matrix

The Ethical Matrix is to be used by the ethical reviewer. The moderator should share the matrix with the client in preparation for peer review. The following questions should be answered with the client before completing the more detailed ethical matrix below.

- Does the design and development of the model include human subjects research? [Yes / No]
- Is there a ‘Risk, Harm, and Benefit Assessment’ included with the model documentation, including measures to minimize adverse effects of the model? [Yes/No]
- In cases where personal data (either as microdata or in aggregate form) is included as an input to the model, does the analytical approach and intended use of the model outputs align with the consent provided at data collection? [Yes / No]
- Have adequate measures been taken in the model development to ensure data privacy and security and prevent the reidentification of individuals or vulnerable groups during the modeling process and/or in the model outputs? [Yes / No]
- In what ways could the model perpetuate and encode past mistake (e.g. ossification)?

Based on the reviewer’s understanding of the model and its intended application, the Ethical Matrix should be completed.

Concern / Stakeholder	In-accurate	False positive	False negative	Transparency	Gaming	Bias	xxxx
Modeller							
Affected population							
Decision maker							
OCHA							
Host government							
Donor							
INGOs							
NGOs							
xxxx							

Consequences:

Good
Worrisome
Bad

III. Annex C

Peer Review Framework - Humanitarian Relevance Checklist

The Humanitarian Relevance Checklist incorporates domains identified by humanitarian practitioners and scholars as critical to the translation of predictive analytics to action.

Domain	Item	Checklist Item
Model output	1a	Is the output provided in a useful form?
	1b	Is the output consistent with government policy in the recipient country?
	1c	Is the output consistent with established triggers for action?
	1d	Has the output been ground truthed?
Timeliness	2	How frequently are outputs updated? What is the lag between the output and action?
Impact	3a	Are the outputs actionable?
	3b	Is there a funding mechanism using the output?
	3c	Is there local capacity for action?
	3d	Are there other inputs required for decision making?
Coordination	4a	Are there competing models? If so, what is the benefit of using the model under review?
	4b	Has the Client made an attempt to synthesize a single and consistent message to facilitate decision making?

IV. Annex D

Peer Review Framework - Technical Checklist

Domain	Item	Description	Page ¹
Data source	1a	Describe the data source and whether the data is publically available (list separately for the development and validation datasets, if applicable.)	
	1b	Specify the start date and end date of the dataset(s).	
	1c	Remark on the quality of the data.	
	1d	Provide summary statistics of the data used in the model (mean, median, standard deviation).	
Input	2	Clearly define all predictors used in developing or validating the model, including how and when they were measured.	
Output	3	Clearly define the output format (e.g. probability, real numbers) with confidence intervals if computable.	
Missing data	4	Describe how missing data were handled (e.g., exclusion, single imputation, multiple imputation) with details of any imputation method.	
Assumptions	5	Summarize model assumptions and approximations.	
Bias	6	Identify sources of potential bias.	
Analysis methods	7a	Specify type of model, all model-building procedures (including predictor selection and calibration), and methods for internal validation (e.g. random forest with univariate feature correlation, GLM checking for multicollinearity).	
	7b	Specify all measures used to assess model performance and, if relevant, to compare multiple models.	
	7c	Describe any model updating (e.g., recalibration) arising from the validation, if done.	
	7d	Explain how the data was divided for validation, training,	

¹ If available, the Client may indicate the page of the code or other documentation on which the item is addressed.

		and testing.	
	7e	Identify any differences from the development data in setting, eligibility criteria, outcome and predictors (e.g., differences in data collection method from one time point to another).	
	7f	If applicable, describe any ground truthing of model outputs.	
Model development	8	If applicable, report the unadjusted association between each candidate predictor and outcome.	
Model specification	9	Present the full prediction model to allow predictions for events (i.e., all coefficients and model architecture).	
Model performance	10a	Report performance metrics (with Confidence Intervals) for k-fold or other validation procedures.	
	10b	Compare model performance with historical data and existing models.	
Reproducibility	11	Indicate whether the results are reproducible: using the provided code (type and seed of random number generator if applicable), test data, and results expected from the test data.	
Model maintenance	12a	Identify who is responsible for model updating and/or recalibration.	
	12b	Describe the location and availability of technical implementation tools (e.g. development code, web-services).	
	12c	Identify any technical or package reliance, including version and license.	
	12d	Describe whether the model output is monitored (if part of a feedback loop).	
Limitations	13a	Discuss the limitations of the model (such as few events for an input or predictor, missing data).	
	13b	Describe situations in which the model output is expected to be reliable.	
	13c	Describe situations in which the model output may not be reliable.	

Implications	14a	Give an overall interpretation of the results, considering objectives, limitations, results from similar studies, and other relevant evidence.	
	14b	Discuss the potential use of the model.	

V. Annex E

Peer Review Framework - Assessment and Results

1. Summary Findings

2. Detailed Review Findings

The model has been reviewed against technical, ethical, and humanitarian relevance domains. The full reviews will be made available to the client, in addition to the below summaries, which support the Centre's overall recommendation.

2.1 Technical Domain

2.2 Ethical Domain

2.3 Humanitarian Relevance Domain

3. Recommended Next Steps