Study on

ACAPS' HUMANITARIAN ACCESS INDICATORS

USING BAYESIAN NETWORKS

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ABOUT THIS TECHNICAL BRIEF

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Abstract

This study aims to explore ACAPS' analysis framework for assessing and measuring humanitarian access constraints in operational settings. It does so by analysing different components of the analysis framework, exploring and establishing connections between the used indicators and subindicators. The study chose Bayesian networks[1] as the probabilistic graphical model to explore the conditional dependencies in the set of used variables. This analysis will serve two purposes: to present a review of the current methodology, which can constitute the basis for methodology adjustments, and to provide useful insights for humanitarian access practitioners regarding which constraints are likely to occur together.[2]

INTRODUCTION

'Humanitarian access' refers to the capacity of operational organisations to provide humanitarian services in specific contexts, from conflict situations to sudden onset disasters (OCHA 04/2017). It mainly refers to constraints resulting from specific situations on the capacity of affected populations to access aid and services and the ability of humanitarian responders to reach those in need, as well as generic contextual constraints. To better understand the constraints and eventually measure them with scoring systems, several humanitarian organisations and entities have tried to investigate the phenomenon using a variety of indicators. ACAPS' Humanitarian Access Methodology is an analysis framework aiming to investigate, understand, and measure humanitarian access constraints within humanitarian crises. Its development started with the Humanitarian Access in Situations of Armed Conflict manual of the Swiss Federal Department of Foreign Affairs and OCHA's Humanitarian Access Framework. ACAPS identified relevant common indicators and evaluated them against our knowledge and humanitarian analysis expertise (FDFA 12/2014; OCHA 26/12/2012). We then developed a way to collect data on humanitarian access and measure specific indicators, creating a scoring system that allows comparability between situations and contexts.

This paper aims to investigate through Bayesian networks the relationships between the different indicators used to measure humanitarian access and their dependency on each other. This method allows for an evaluation of current data collection methods, data categorisation, and coding for an overall improvement of the methodology. The data used also allows for an investigation of how the different indicators influence contributing humanitarian practitioners' perception of humanitarian access constraints, comparing them against the constraints measured through the ACAPS model and validating the classification model designed for measuring constraints. Some key questions asked are as follows:

- Are there dependencies between the humanitarian access indicators?

- If so, how much do the variables influence each other?

- Are specific indicators influencing the perception of humanitarian access constraints?

To answer these questions, the study first presents the analysis framework behind the humanitarian access measurements. It then briefly explains the methodology and analysis followed in this paper (for the complete methodology and analysis, please refer to the original paper). The study ends with a discussion of the results and conclusions.

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1   Bayesian networks are a type of probabilistic graphical model that can be used to build models from data and/or expert opinion. A graphical model is where a graph represents relationships between variables.
2   This paper was originally the final work for the completion of a master's degree in Data Science for Economics, Businesses, and Finance at the University of Milan. Given the usefulness of its findings, it has been adapted to cater to a broader public audience, dropping the more technical content. Tthe original paper can be found here.

METHODOLOGY

Humanitarian access analysis framework

ACAPS' humanitarian access analysis framework puts together qualitative conditions to measure the level of constraints in specific crises. These conditions are then further framed into indicators and pillars.

The framework involves three core dimensions of investigation called pillars:

#	Pillar
1	**Access of affected population to aid**
2	**Access of humanitarian responders to affected population**
3	**Physical, environmental, and security constraints**

Under these three pillars, there are nine indicators:

PILLAR	INDICATOR	NAME
1	1	**Denial of existence of needs or entitlement to assistance**
1	2	**Restriction and obstruction of access to services and assistance**
2	3	**Impediments to entry into the country**
2	4	**Restriction of movements within the country**
2	5	**Interference in implementation of humanitarian activities**
2	6	**Violence against humanitarian personnel, facilities, and assets**
3	7	**Insecurity and hostilities affecting humanitarian assistance**
3	8	**Presence of landmines, improvised explosive devices (IEDs), explosive remnants of war (ERW), or unexploded ordnance (UXO)**
3	9	**Physical constraints in the environment**

The measurement of these nine indicators varies per organisation, their mandate, and their interest in specific issues. Given ACAPS' mandate, which belongs to an analysis domain and a strictly non-operational environment, all indicators have been objects of monitoring and measurement. Given the broad dimension of each covered topic, ACAPS has developed subindicators for each indicator, which might comprise differing aspects. The subindicators are in the form of questions or 'conditions' that can simply be tagged as 'Yes' (condition met), 'No' (condition unmet), or 'I do not know' (information gap). This format allows for a certain degree of detail and nuance and keeps primary data collection through questionnaires easy. For the entire list of questions, please see Annex I or the ACAPS Methodology Note, where the scoring model is explained in detail.

Data collection, structure, and methodology

Data collection for this paper took place between 2020–2021 in a partnership framework between ACAPS and other organisations interested in assessing the humanitarian access constraints in their countries of operation. We sent out a questionnaire reporting the questions based on the listed indicators, and answers were given by selected key informants comprising humanitarian professionals dealing with humanitarian access in the countries involved. To assess the methodology scoring system against the participants' perception of humanitarian access constraints, we added an ad hoc question: how would you rate the access situation in this area? Response options were 'high', 'medium', and 'low'. The questionnaires demanded different information based on the geolocation of the assessed areas and the possibility of providing additional qualitative information. Since this study exclusively focuses on the dependencies of the indicators and the perceptions expressed by the respondents, many fields of the original datasets have been dropped.[3] The dataset has been anonymised for data confidentiality: all the geo-information, along with any qualitative information provided, have been dropped. The data used is anonymous, and no sensitive information can be inferred.

The dataset comprises 327 observations (assessed areas) and 31 variables (subindicators). Each column comprises an answer to a different question, as per the list in Annex I. There are usually three answer options: 'yes', 'no', and 'dnk' (which represents 'I do not know'). The only exceptions are Q8.1, the question on landmine contamination (which provides four different options: 'confirmed', 'suspected', 'no', and 'dnk'), and the questions on 'Perception', which have the options 'low', 'medium', and 'high'. The three missing values in the 'Perception' columns were handled by assigning predicted values through a classificatory Naïve Bayesian algorithm.

This paper uses a Bayesian network probabilistic graphical model to outline the dependencies and interactions of the indicators used

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3   All information about the context and names of areas, as well as qualitative information about specific situations, was dropped as irrelevant to the purpose of the study.

in the study. Bayesian networks are a class of graphical models that allows for a representation of the probabilistic dependencies between variables as a graph, where each node represents one variable and the arcs between them are the dependencies (Nagarajan et al. 2013). This study in particular uses categorical or discrete Bayesian networks, which represent a non-linear relationship between variables (Balov and Salzman 09/03/2020).

Data was manipulated and prepared for the analysis after an exploration of the best Bayesian learning algorithm to identify the dependencies between the variables. The study tested a variety of algorithms (Hill-Climbing, Incremental Association, Max-Min Parents and Children, Semi-Interleaved HITON-PC, Sparse Candidate, Max-Min Hill Climbing, and Hybrid HPC) and evaluated their plausibility against expert knowledge, comparing the resulting graphs computed. It identified the best performance in the Hybrid HPC algorithm (Gasse et al. 2012). The study fitted the structure of the Bayesian network identified to estimate the probabilistic parameters of every variable part of the network. It then used the Junction Tree algorithm to infer the variables of the network. The process of inference in Bayesian networks is called 'belief updating' or 'probabilistic reasoning', and it is used to answer questions about the data being examined (Nagarajan et al. 2013; Koller and Friedman 2009). The Junction Tree algorithm allows changes in the variables (in our case, 'yes' and 'no') and in specific nodes (answers to questions for this study) to see how the dependent probability changes. In other words, it allows us to see the probability of an answer to a question depending on the answer to another question. The two questions should be connected in the network identified in the step before.

For the complete methodology, code, and article, please refer here.

Are there dependencies between the humanitarian access indicators? If so, how much do the variables influence each other? Are specific indicators influencing the perception of humanitarian access constraints? If the answer to some or all of these questions is yes, then the study could be used to fine-tune the access assessment methodology. It also means that operational responders could use its findings to gain awareness of the mechanisms, perceptions, and dependencies of the conditions influencing humanitarian access.

RESULTS

Beliefs updates

The results of the beliefs updates performed on the identified network are below. Results are to be read with the subindicator table in Annex I. In general, the first part of the sentence in the header refers to the code in the first column, while the second part of the sentence in the header refers to the code in the first row. Example from P(Q1.1 | Q1.2) – if humanitarian needs are reported inconsistently, they are likely denied in 19% of the cases (P=0.19462366).

P(Q1.1 | Q1.2) – probability that if humanitarian needs are reported inconsistently, these are denied by authorities

	Q1.1 - no	Q1.1 – yes
Q1.2 - yes	0.8043011	0.19462366
Q1.2 - no	0.9293086	0.06088751

P(Q1.2 | Q3.1) – probability that if authorities put in place a complex registration process for organisations to be able to operate, discrepant needs are also reported compared to the real situation

	Q1.2 – no	Q1.2 - yes
Q3.1 - yes	0.4900731	0.4900731
Q3.1 - no	0.7540555	0.2265829

P(Q3.1 | Q2.2) – probability that if there are administrative requirements to access assistance for people in need, there is also a complex registration process for organisations to be able to operate

	Q3.1 - no	Q3.1 - yes
Q2.2 - yes	0.3374827	0.6486860
Q2.2 - no	0.7535243	0.213715

P(Q5.1 | Q7.1) – Probability that if there is violence in a certain area, there is also interference in aid delivery.

	Q5.1 - no	Q5.1 - yes
Q7.1 - yes	0.5909398	0.3901285
Q7.1 - no	0.8633763	0.1359084

P(Q1.3 | Q5.1) – probability that if there is interference in aid delivery, the denial of right to assistance occurs

	Q1.3 - no	Q1.3 - yes
Q5.1 - yes	0.5456885	0.42985843
Q5.1 - no	0.8382699	0.15702868

P(Q2.3 | Q1.3) – probability that if there is a denial of the right to assistance of certain groups, there is also forced displacement away from services

	Q2.3 - no	Q2.3 - yes
Q1.3 - yes	0.4319880	0.53961136
Q1.3 - no	0.8782998	0.08903803

P(Q4.5 | Q7.1) – probability that if there is violence, humanitarian organisations are also on hold

	Q4.5 - no	Q4.5 - yes
Q7.1 - yes	0.6457066	0.32927654
Q7.1 - no	0.8505007	0.09084406

P(Q5.2 | Q7.1) – probability that if there is violence, there are also counterterrorism measures in place

	Q5.2 - no	Q5.2 - yes
Q7.1 – yes	0.6902238	0.27679623
Q7.1 – no	0.8939173	0.07055961

P(Q7.3 | Q7.2) – probability that if there is violence targeting civilian facilities, humanitarian activities are likely suspended

	Q7.3 - no	Q7.3 - yes
Q7.2 - yes	0.4252061	0.57361602
Q7.2 - no	0.9026764	0.07493917

P(Q3.3 | Q9.3) – probability that if there are logistical constraints, there are also constraints in importing items and visa concessions

	Q3.3 - no	Q3.3 - yes
Q9.3 - yes	0.4411178	0.53093812
Q9.3 - no	0.8152800	0.17477760

P(Q4.3 | Q3.3) – probability that if there are import and visa constraints, there are also checkpoints

	Q4.3 - no	Q4.3 - yes
Q3.3 - yes	0.1257209	0.8627451
Q3.3 - no	0.5042100	0.4596335

P(Perception | Q4.1) – probability of the territory being not entirely controlled by the same authority influencing access constraints perception

|	Perception - high	Perception - low	Perception - medium
Q4.1 - yes	0.37844488	0.1304134	0.4906496
Q4.1 - no	0.07786885	0.5485948	0.3729508

P(Perception | Q7.1) – probability of the active presence of violence in an area influencing access constraints perception

	Perception - high	Perception - low	Perception - medium
Q4.1 - yes	0.3012047	0.2337750	0.4642796
Q4.1 - no	0.1702379	0.4162820	0.4127150

Perception against access constraints score

This section tests the 'Perception' variable against the humanitarian access constraints score calculated through the ACAPS model. It uses the Spearman correlation4 test to check if the perception ranking ('high', 'medium', or 'low' classified as 3, 2, or 1, respectively) correlates with the ranking of constraints in the ACAPS methodology (1 to 5, where 1 is low and 5 is high). Spearman's rank correlation coefficient suggests a moderate positive correlation between the access constraints scores and the respondents' perception. In most cases, their perception aligns with the computed score in the ACAPS access model.
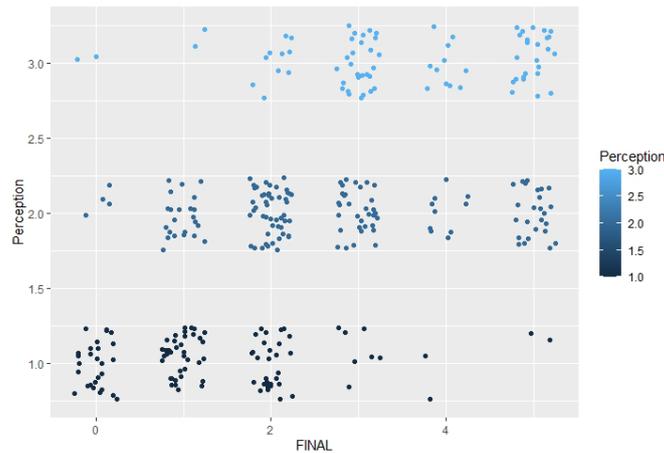
DISCUSSION

The beliefs updates give some interesting results on how the probability parameters change depending on the answers of the respondents in the data. Based on the results, there are some key points identified that will be further discussed:

• the influence of how authorities behave

• the influence of the presence of violence

• the presence of logistics constraints

• what influences the perception of humanitarian access constraints.

Influence of how authorities behave

The analysis shows that when national authorities reported the humanitarian situation differently than the international humanitarian community, the existence of humanitarian needs was denied in 19% of cases, versus the 6% occurrence when their reports matched (P(Q1.1 | Q1.2)). This proportion suggests that discrepancies in reports of humanitarian needs do not necessarily mean the denial of the existence of needs. The occurrence of a complex registration process for operational responders also seems to often coincide with authorities reporting discrepant needs (i.e. in 49% of cases) (P(Q1.2 | Q3.1)). Administrative requirements imposed on people in need of aid were present in 64% of cases when a complex registration process was imposed on responders (P(Q3.1 | Q2.2)). On the contrary, when there were no requirements to access assistance for people in need, there were also no further administrative complications over the registration process in 75% of cases. These connections flag a possible general tendency for authorities to require specific complicated registration procedures for both providing and receiving aid. The proportions suggest that if conditions were imposed for receiving aid, they were also most likely imposed on aid providers.

Influence of active violence

Active violence seems to influence a variety of subindicators. P(Q5.1 | Q7.1), which asks how interference in aid delivery changes with the presence of active hostilities, shows that the presence of conflict led to 39% of cases experiencing aid delivery interference from local authorities or other groups. In the opposite case of no violence, interference was not reported in 86% of cases. If interference was reported, authorities denied the right to assistance of people in need in 42% of cases P(Q1.3 | Q5.1). Authorities also denied the right to assistance of people in need in 53% of cases when forced displacement away from services was reported (P(Q2.3 | Q1.3)). Violence occurred in 32% of cases when humanitarian organisations were on hold despite being ready, but when violence was not reported, organisations were operational in the vast majority of cases (85%) (P(Q4.5 | Q7.1)). This type of relationship also occurred between violence targeting civilian infrastructures and 'counterterrorism' measures: they simultaneously occurred

4   The Spearman correlation test is used to compare ranks. In this case, perception can be ordered from lowest to highest (low, medium, high) and using the ACAPS severity ranking (from 1 to 5).

in 27% of cases, while there were no such measures in 69% of cases where no violence was reported P(Q5.2 | Q7.2). When there was violence against civilian infrastructure, humanitarian responders suspended operations in 57% of cases P(Q7.3 | Q7.2). Based on these findings, interference with aid provision was more common when there was violence than in contexts with no reported violence. The presence of 'counterterrorism' measures was also reported more frequently when there was violence. Violence towards infrastructure also influenced the behaviour of humanitarian responders in their operational decisions on security.

The presence of logistical constraints

Exploring one other identified cluster of connections, the presence of logistical impediments (e.g. scarcity of consumable goods, embargoes, etc.) also involved import or visa constraints in 53% of cases (P(Q3.3 | Q9.3)). Visa constraints seemed to be flagged 86% of the time when checkpoints in the territory were reported (P(Q4.3 | Q3.3)). These proportions might indicate a general tendency for internal or international logistical situations to influence internal import and visa policies, as well as consequent internal enforcement through controls and checkpoints.

What influences the respondents' perception of access constraints?

One identified connection was key informants' perception of constraints being influenced by a situation where more than one authority had control over the territory in a certain region (P(Perception | Q4.1)) and the presence of violence affecting people's movement (P(Perception | Q7.1)). If multiple entities controlled a territory, access constraints were perceived as high (37%) and medium (49%). Conversely, high constraints were perceived very rarely (7%) when a singular authority controlled a territory. In terms of the presence of violence (Q7.1), the expressed perception of constraints was high (30%) and medium (46%) in the majority of cases, but when no violence was reported, the perception of high constraints dropped to 17%. These proportions suggest the impact of the two variables in influencing the perception of data collectors, who, in most cases, were humanitarian access officers in specific countries, when thinking about the humanitarian access constraints in their areas of operation.

CONCLUSIONS

Regarding the described findings and the overall relationship between the different subindicators, it is possible to point out four main relevant findings, further explorable:

- When national authorities or armed groups in the countries of operation are imposing restrictions and administrative burdens, they are likely to do so on both populations in need and operational responders.

- The presence of violence influences the roll-out of humanitarian operations in terms of interference from authorities and armed groups, the denial of the right to assistance to meet needs, forced displacement, and the operational-security strategy of humanitarian organisations.

- Logistical contextual constraints, such as the scarcity of resources or embargoes, are connected with the occurrence of constraints in importing relief items and obtaining visas for staff. The presence of checkpoints is also connected with the occurrence of logistical constraints and may be seen as the practical enforcement of some of those logistical constraints.

- Multiple authorities controlling a state territory and the presence of violence seem to be the primary influences on the general perception of respondents of humanitarian constraints.

This analysis of the humanitarian access methodology, through the use of Bayesian networks, could be useful to inform analysts or programme officers facing access constraints in operational settings. Exploring the identified dependencies and connections between different indicators and subindicators can be useful when facing access constraints, since particular conditions are likely to influence or occur in combination with other conditions. The findings can help analysts and officers overcome information gaps regarding certain contexts, as they work on the probabilities of the simultaneous occurrence of specific constraints suggested in this paper. The study might be of particular help in volatile situations or sudden onset disasters, where the context might change rapidly and humanitarian responders might be asked to take timely action.

Of particular interest is the analysis of the perception of constraints based on the answers of the respondents: the correlation with the ACAPS methodology access constraints scoring system is moderate, showing that the scoring system grasps the access constraints perceived by the respondents. Personal perception is not objective and cannot be used as a measure to compare contexts, but it can be used to validate a scoring system aiming to do so.

From a different point of view, it can be useful for an operational organisation dealing with humanitarian access to consider that the perception of constraints seems to be mainly influenced by the occurrence of two conditions: a territory being controlled by multiple authorities and the active presence of violence. The findings of this study can be a potential lesson learnt to shape the analysis for a broader and more comprehensive concept of access.

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ANNEX I – ACCESS QUESTIONNAIRE

INDICATOR	SUBINDICATOR	QUESTION/SUBINDICATOR
1	Q1.1	Do the local or national authorities deny the existence of humanitarian needs in the area?
1	Q1.2	Do the local or national authorities report different needs compared to the real situation in the area?
1	Q1.3	Are some groups of people or some specific parts of the territory denied the right to assistance by rule or law?
2	Q2.1	Are any travel restrictions enforced on people (such as besieged or other restricted areas)?
2	Q2.2	Do people need to meet any bureaucratic or administrative requirements to access assistance?
2	Q2.3	Are people being forced away from services?
3	Q3.1	Is the registration process to be able to operate in the area complex, costly, or time-consuming because of government decisions?
3	Q3.2	Is the authorisation to operate in the area randomly assigned or denied?
3	Q3.3	Are there constraints on importing relief items or equipment or on providing visas and permits for staff?
3	Q3.4	Are aid organisations systematically not allowed to operate in the area?
4	Q4.1	Do different authorities other than the State control the territory?
4	Q4.2	Are any taxes, fines, or limits imposed on the passage of goods to reach the people in need in the area?
4	Q4.3	Do aid providers need to pass checkpoints to reach the people in need in the area?
4	Q4.4	Is the passage to the affected areas closed?
4	Q4.5	Are humanitarian responders in the area ready to operate but on hold?
5	Q5.1	Do conditions imposed by local authorities or other groups influence aid delivery?
5	Q5.2	Are there special sanctions or 'counterterrorism' measures in place in the area that affect the general roll-out of operations?
5	Q5.3	Have the authorities or other groups diverted or confiscated aid?
6	Q6.1	Have aid workers been killed or kidnapped?
6	Q6.2	Have aid workers been targeted or injured?
6	Q6.3	Have humanitarian facilities been targeted?
7	Q7.1	Does violence affect the movements of the population?
7	Q7.2	Have public services, schools, hospitals, or other civilian facilities been targeted?
7	Q7.3	Does violence lead to the relocation of humanitarian staff or the suspension of operations?
8	Q8.1	Are there mines, IEDs, UXO, or ERW present?
8	Q8.2	Have there been victims of mines, IEDs, UXO, or ERW?
9	Q9.1	Is it the rainy or monsoon season?
9	Q9.2	Are infrastructures such as bridges, roads, and airports severely disrupted?
9	Q9.3	Are any constraints on consumable goods affecting the logistics of the operations (e.g. the scarcity of fuel and embargoes)?
9	Q9.4	Is the area considered a remote area (for geographic position)?