Towards a Repository for Datasets of Mass Casualty Incidents

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ABSTRACT

Many mathematical models and algorithms addressing logistics around mass casualty incidents (MCI) have been proposed in the literature. However, hardly any data sets exist that can be used to analyse, validate, and evaluate approaches and solutions. As MCI are comparably rare, real-world data is scarce and often extremely sensitive, making it difficult for researchers to get access and build test datasets. In this paper, we therefore present the first steps towards a repository for the exchange of datasets to facilitate validation and comparison. We first provide an overview of potential stakeholders such as working groups, review disaster-related databases and existing repositories for other fields followed by a preliminary taxonomy to identify and structure the relevant entities and their characteristics within models for disaster management.

Keywords

Dataset, taxonomy, disaster management, operational research, decision support

INTRODUCTION

In 2022, 185 million people were injured, homeless or otherwise affected by disasters (Centre for Research on the Epidemiology of Disasters (CRED) et al. 2022). Providing help to such a high number of people combined with the short or complete lack of time to prepare for a disaster poses logistical challenges. With an increasing number of disasters over the past years, the field of disaster management has received more attention in the literature (Tippong et al. 2022), resulting in a steadily increasing number of published articles that propose models to solve (a subset of) the problems arising in disaster management.

An ongoing problem in developing, validating, and comparing these models is the lack of comprehensive publicly available datasets that include all the necessary information. One reason for the lack of those datasets is the unpredictability of disasters. In contrast to daily operations for which the data collection can be planned in advance, disasters usually occur at no or only short notice and lead to exceptional situations. As a consequence, collecting comprehensive data of good quality is difficult (Shi et al. 2023). Despite these difficulties, several statistics of disasters are publicly available, but these are often not detailed enough to test and validate models. Consequentially, researchers have to make assumptions and educated guesses for a varying range of parameters based on their knowledge of the on-site conditions. From an academic perspective, this approach leads to limited comparability of the models, unclear practical value, and the risk of "over-fitting" the model without the intention to do so.

To overcome this problem, one solution would be to collect, structure, and share existing datasets and add missing information based on expert knowledge. One approach to then provide access to these datasets could be a repository. Such a repository would have multiple advantages. First, it would facilitate access to existing datasets and reduce researchers' workload when testing their model. Second, such a collection of datasets would also facilitate the comparison of actual or assumed values for different parameters across datasets. On the one hand, such a comparison could support the analysis of differences between data sets (e.g. due to different local conditions or disaster types), and, based on this, the general validity of a proposed model. On the other hand, an overview of realistic values for parameters can also support researchers to create, derive, and verify new datasets.

To create a repository that shares the datasets in a structured way, the following steps are necessary (adapted from Leeftink and Hans 2018).

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- **Step 1** Search for existing databases and interest groups.
- **Step 2** Develop a taxonomy to categorise existing models and their datasets.
- **Step 3** Validate the taxonomy with researchers and experts from practice and link the existing datasets and the parameters used therein to the developed taxonomy.
- **Step 4** Derive standardised validation datasets based on existing datasets and discussions with experts.

In this paper, we present the first two steps, while the remaining steps will be part of future works. As the field of disaster management covers a broad spectrum of problems, we will first focus on the subarea of casualty management, which includes models related to managing the needs of casualties, such as treatment, transport, shelter, and relief supplies (Farahani et al. 2020). The remainder of the paper is structured as follows: The next section describes the current work performed for Step 1, followed by a description of Step 2 and a preliminary framework. We conclude the paper with an outlook of future steps and a summary.

STEP 1: WORKING GROUPS, DATABASES, AND REPOSITORIES

To assess whether repositories or validation sets exist, we conducted a literature search and identified and screened potential hosts of these repositories such as working groups, databases and other repositories as examples.

Working Groups in Humanitarian Logistics and Repositories

Worldwide, many different working groups in the area of humanitarian logistics exist. While we focus on Operational Research (OR) / Information system (IS) groups, it is worth noting that input for datasets can also come from medical or practice groups, e.g. the working group on disaster medicine of the German Society for Interdisciplinary Emergency and Acute Medicine (DGINA) (AG Katastrophnemedizin DGINA 2024).

Within the IS community, the Information Systems for Crisis Response and Management (ISCRAM) group is probably the most fitting for our endeavour. As stated on their website (ISCRAM 2024), "the ISCRAM Association's primary mission is to foster a community dedicated to promoting research and development, exchange of knowledge and deployment of information systems for crisis management, including the social, technical and practical aspects of all information and communication systems used in all phases of management of emergencies, disasters and crises." While OR/Management Science models represent a subset within this field, the scope of this working group is broader with respect to the applied methodologies. With yearly conferences and additional events, ISCRAM is one of the main conference outlets for crisis-related research. We also searched within the Association for Information Systems (AIS) and identified the Special Interest Group on IT in Healthcare, AIS SIGHealth, as potentially relevant as well (AIS SIGHealth 2024). In contrast to ISCRAM, the working group does not organise an individual conference, but offers healthcare tracks at the main IS conferences, e.g. ECIS. It seems less suited to host the repository but can still offer valuable access to existing data sets and the chance to advertise a repository, once it exists.

On the OR side, two working groups within the Association of European Operational Research Societies, EURO, are most promising: 1) HOpe, the EURO working group on Humanitarian Operations (EURO working group HOpe 2024), and 2) ORAHS, the EURO Working Group of Operational Research Applied to Health Services (EURO working group ORAHS 2024). The purpose of HOpe "is to create a platform that facilitates communication among the interested parties and forms an active group" (EURO HOpe mini conference 2024) while "Humanitarian Operations Research studies decision-making problems related to providing logistical assistance for humanitarian purposes, and in response to humanitarian crises" (EURO HOpe mini conference 2024). The College of Humanitarian Operations and Crisis Management (HO & CM) of POMS "seeks to create a focus group of researchers and practitioners to study how to manage operational systems under stress or severe resource constraints. A prime objective is to foster a creative environment among academics and practitioners to recognise how operations management plays a crucial role in dealing with the alleviation of human suffering under conditions triggered by cataclysmic acts of man and nature." Within the Institute for Operations Research and the Management Sciences (INFORMS), we also identified two potentially fitting working groups, namely the Health Applications Society (INFORMS Health Applications Society 2024) and the Military and Security Society (INFORMS Military and Security Society 2024), although it is not clear from their website whether they also focus on the humanitarian aspects. Moreover, we identified additional associations, mainly country-specific, that also include humanitarian logistics, e.g. during their yearly conferences. Examples include the Decision Science Institute (DSI), the German OR Society and the UK OR Society.

Based on our investigations we conclude that to the best of our knowledge, a repository for research does not exist on the websites of any of those working groups yet.

Existing Databases

Besides repositories provided by working groups, other sources for input data are existing databases. Within the field of disaster management, various databases exist. A widely cited database with global coverage is the Emergency Event Database (EM-DAT) (Jones et al. 2023) hosted by the Centre for Research on the Epidemiology of Disasters (EM-DAT et al. 2024). The database includes natural and technological disasters and provides information about a disaster's type, region, humanitarian, and economic impact. Data on disasters with a terrorist background is collected by the Global Terrorism Database (LaFree and Dugan 2007). For each recorded incident, the database provides information about the location, the attacker, the method, and the number of casualties. Datasets from various sources are made available on the Humanitarian Data Exchange (HDX, OCHA 2024) platform hosted by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA). Unlike the other two databases, this platform does not only focus on disasters, and datasets are provided by various organisations, resulting in different data structures. Besides these databases, several databases on a national level exist, such as the Canadian Disaster Database (CDD 2024), for example. Although these databases can be useful for getting insights about the size of a disaster, they usually lack the detailed information required for validating models for disaster management, such as locations of included hospitals and shelters, their capacities, or the available fleet of vehicles.

Repositories and Benchmark Sets Outside of Humanitarian Logistics

While we could not identify any existing repositories for humanitarian logistics, there exist repositories or benchmark sets for other problems within the field of OR which can provide insights into the purposeful design of a repository and/or taxonomy. The VRP-REP (Mendoza et al. 2014) is a repository for instances of the Vehicle Routing Problem (VRP). It stores problem variants, references, datasets, and the best-known solution for each combination of problem variants and datasets. Instances for shift scheduling problems can be shared on www.schedulingbenchmarks.org (*Schedulingbenchmarks* 2024). The repository differentiates between instances for nurse rostering, multi-activity multi-day and other employee scheduling problems, and similar to VRP-REP links the different instances, references and best-known solutions. Instances for planning and scheduling of projects are collected and shared by Ringer and Fox (2024). The aim is to provide realistic instances to enhance the development of models with significant practical value. For problems related to operating room scheduling, Leeftink and Hans (2018) developed a benchmark generator to facilitate the access to realistic datasets. Moreover, for each of the different instances as identified by Leeftink and Hans (2018), 200 samples are provided to enhance comparison between different models and, if already found, provide the optimal solution.

These repositories can serve as a guideline for the development of a repository of humanitarian logistics. With the large variety of problems addressed within the literature on disaster management, the repository should provide an overview of existing variants, provide realistic values for the different characteristics, and allow scholars to create a dataset based on their needs.

STEP 2: TAXONOMY

After having identified relevant working groups, existing databases and repositories, the following step is to develop a taxonomy for classification. First, we review the literature for existing frameworks that could be applied to our purpose, before we present our developed taxonomy to describe the relationship between the attributes of different entities.

Previous Taxonomies

In the past years, several taxonomies have been presented within the field of disaster management. On a broader level Kuipers and Welsh (2017) provide a taxonomy to classify the literature. Based on frequent terms and keywords used they derive 19 umbrella terms, thereof ten for crisis types and nine for crisis themes. Wong et al. (2017) present a taxonomy that provides an overview of evaluation typologies. Therefore, they define three layers, the timeline of the disaster, the status, and the overarching theme of resilience, to which the different typologies are related. Rauner et al. (2018) propose a taxonomy that links tasks in disasters to responders. They identify eleven interventions in various phases of the response and three broad categories of responders, further refined for each category. Tatham and Spens (2011) develop a taxonomy to store explicit knowledge in humanitarian logistics. Combining two existing frameworks, the "Supply Chain Operations Reference" and the "Lines of Development", the authors adopt the five primary processes of the supply chain and eight force elements to create a taxonomy. Besides these taxonomies, several other taxonomies have been published. However, these focus on very specific aspects of disaster management, such as simulation tools (Barthe-Delanoë et al. 2015), volunteers (Betke et al. 2023), or IT support (Pottebaum et al. 2014), among others. Taxonomies have also been proposed in related areas like emergency logistics (Reuter-Oppermann and Bernath 2016; Reuter-Oppermann and Rachuba 2017, for example), which might also provide some relevant insights.

Despite the variety of taxonomies within the literature, we could not find any taxonomy addressing humanitarian logistics on a sufficiently detailed level so that it could serve as a basis for the classification of datasets. Therefore, in the following, we present a preliminary taxonomy for the purpose of classifying datasets.

Preliminary Taxonomy

To develop the taxonomy, we follow the approach suggested by Nickerson et al. (2013) and Kundisch et al. (2022). The purpose of this taxonomy is to identify and structure the relevant entities and their characteristics within models for disaster management. This leads to the meta-characteristic of our taxonomy, namely, to enhance the classification of datasets and the therein included parameters. We set objective and subjective ending conditions and defined the objective ending conditions to be met once all papers of our sample have been examined, and the entities and characteristics have not been changed (i.e. no elements were added, deleted, or updated). For the subjective ending condition, we evaluated whether the proposed taxonomy is concise, robust, comprehensive, extendable, and explanatory. Eventually, as an evaluation goal, the taxonomy should support users to classify and analyse models and datasets within the field of disaster management. We chose an empirical-to-conceptual approach and analysed a selection of papers within the field of casualty management in disasters as presented in Farahani et al. (2020). We opted to use this literature review as a starting point, as it covers the relevant papers within the field until 2019. We acknowledge that by doing so we exclude more recently published papers. However, we believe that the selection of the papers is broad enough to develop a general taxonomy that should also be applicable to papers published after 2019, and if necessary, be extendable to incorporate new characteristics as a next step. From the selected papers, we collected the parameters and sets used in the mathematical models. For the first version of the taxonomy, we derived the entities based on the most common sets in the models and their characteristics based on the indexed parameters. For each entity, we then assessed whether *i)* the entity has unique characteristics or could be merged with another entity, and *ii)* the entity is common enough to be considered a general entity in the taxonomy. We then re-evaluated the attribution of the characteristics, in particular those characteristics that originate from parameters with multiple indices. For each characteristic, we assessed *i)* the dependency, both on entities and on other characteristics, and, similarly to entities, *ii)* their generality. We then used this first version for a (preliminary) validation and assessed the taxonomy's applicability. Based on the results, we modified the taxonomy and repeated the process until the ending conditions were met.

Eventually, we identified ten entities and clustered them into three subcategories, as depicted in Table 1.

Table 1. Entities

Overarching entities	**Immobile entities**	**Mobile entities**
Network	Incident sites	Casualties
Budget	Medical centres	Vehicles
	Distribution centres	Commodities
	Shelters	Staff

The characteristics of each of these entities are explained in more detail in the following subsections and are summarised in Table 2.

Network

The network, or graph, formalises the spatial relationship between entities. The locations of immobile entities can be represented as nodes, and the transportation network connecting these locations as arcs (Figure 1). Each node and arc can have several attributes. The attributes of nodes depend on the type of the entity and will be further explained in the respective section. Arcs can be characterised by two main attributes: the distance, i.e. the length of an arc, and the status. The status refers to the condition of an arc. Especially after natural disasters, arcs can be damaged or blocked, leading to a reduced capacity or (partial) unavailability for routing.

Table 2. Overview of characteristics

	Network	Budget	Incident sites	MC	DC	Shelters	Casualties	Vehicles	Commodities	Staff
Distance	✓									
Availability of arcs	✓									
Capacity of arcs	✓									
Free budget		✓								
Designated budget - MC		✓								
Designated budget - DC		✓								
Designated budget - Shelters		✓								
Designated budget - Commodities		✓								
Designated budget - Casualties		✓								
(Initial) Location			✓	✓	✓	✓	✓	✓		✓
Onset time			✓							
Damage			✓							
Required staff			✓		✓		✓			
Required commodities			✓				✓			
Level / type				✓	✓	✓	✓	✓	✓	✓
Capacity				✓	✓	✓		✓		
Variable capacity				✓	✓					
Fixed capacity				✓	✓					
Storage capacity					✓	✓				
Distribution capacity					✓	✓				
Capacity for affected people						✓				
Stock					✓	✓				
Establishment cost				✓	✓	✓				
Extension cost				✓	✓					
Fixed required staff					✓					
Variable required staff					✓					
Number							✓	✓		✓
Priority							✓		✓	
Survival probability							✓			
Maximum waiting time							✓			
Eligible destinations							✓			
Eligible vehicles							✓			
Treatment times				✓			✓			
Transportation cost							✓	✓		
Travel speed								✓		
Eligible arcs								✓		
Facilities for (un)loading								✓		
Time for (un)loading								✓		
Supply / Availability									✓	
Supplier									✓	
Dimension									✓	
Unit cost									✓	
Holding cost									✓	
Shortage penalty									✓	
Qualification										✓
Allowed tasks										✓
Skill level										✓
Wages										✓
Availability										✓
Shifts										✓

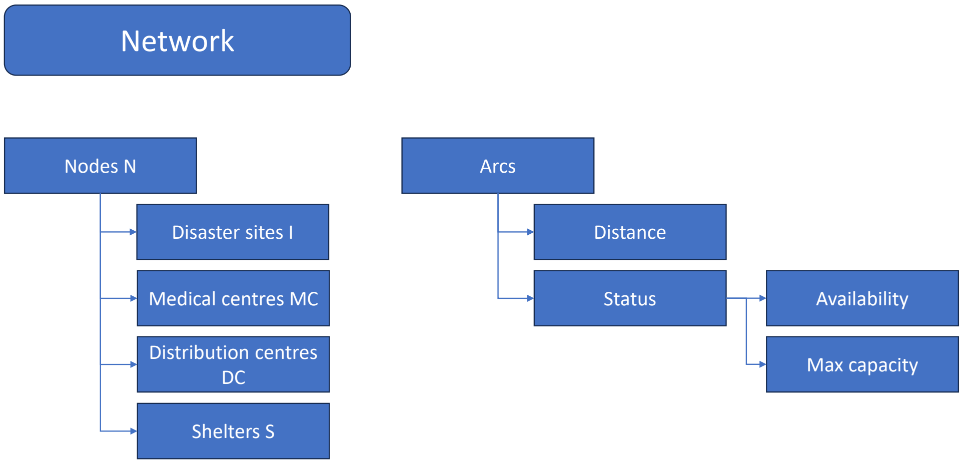

Figure 1. Network

Budget

The budget includes the financial funds to manage the disaster. It can be divided into designated and free budgets (Figure 2). Free budget can be used for any disaster response relief measure, while designated budget is reserved for specific measures, such as constructing shelters, medical centres or distribution centres or the purchase of commodities. Although usually not referred to as budget, a frequently used alternative is to define the number of potential distribution centres/medical centres/shelters to be located or commodities to be bought. This slightly different definition of budget by dividing the monetary budget by the costs for construction or purchase may facilitate the interpretation of these values.

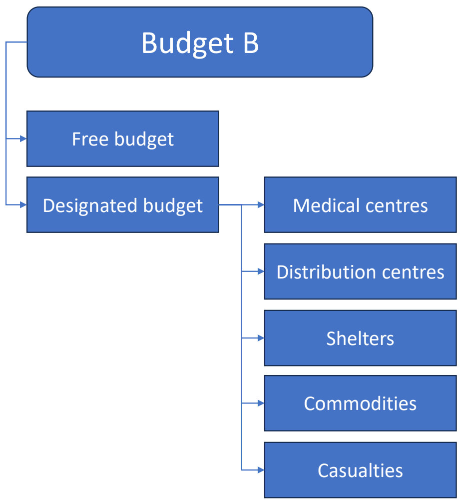

Figure 2. Budget

Incident Sites

The most important nodes in the network relevant to disaster management, although often not explicitly mentioned, are the incident sites (Figure 3). These incident sites are primarily defined by their geographical location, usually defined by a single pair of coordinates for a central point such as a point of registration. Each location can differ in terms of the disaster's onset and the resulting damage. Combined, these characteristics determine, among others, the number of casualties and affected people or the status of the close transportation network at a certain moment. To be able to respond to a disaster, each incident site may require different resources such as commodities and staff. While some of these resources depend on the number and type of casualties and are therefore linked to the entity of casualties, other resources depend mainly on the location of the disaster. Examples of such location-dependent resources are staff required for general tasks as search and rescue or managing the disaster site and equipment or commodities not linked to specific entities.

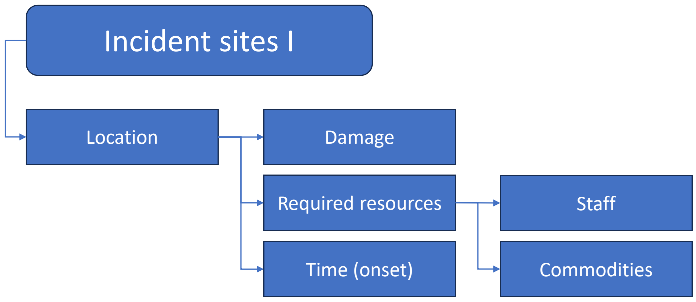

Figure 3. Incident sites

Medical Centres

A medical centre is an entity that provides treatment to casualties (Figure 4). The location of this entity can either be predefined or to be selected from a subset of potential locations. Medical centres can vary in their level, ranging from top-tier hospitals to temporary care units. A level is characterised by the capacity to treat casualties, which can be a fixed capacity or extendable as needed. Moreover, the level of a medical centre can impact the treatment times due to the equipment and the general experience of their staff. These treatment times may further depend on additional factors such as the casualty type or the skill of the treating staff. However, these factors are not explicitly mentioned in the overview to keep the taxonomy as general as possible. Beyond the level's impact on treatment-related attributes, the differences in size and equipment can also be reflected in the establishment and expansion costs.

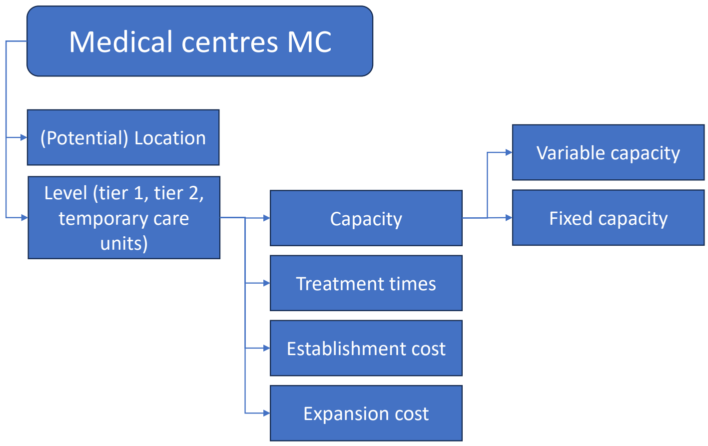

Figure 4. Medical centres

Distribution Centres

Distribution centres (DC) are entities that store and distribute commodities (Figure 5). Their location may be predetermined or selected by the disaster manager from a set of potential locations. DC can also differ in their level, ranging from national DC to temporary local DC, each level impacting various attributes. The most important attributes include the capacity to store and distribute commodities and the current stock. Similar to medical centres, the capacity can be fixed or extendable. While these attributes describing the capacity can be further specified, such as by commodity type, for the sake of generality, these extensions are not explicitly listed in the overview. To operate a DC of a certain level, staff is necessary, which can be further specified by the fixed staff requirement, e.g. for administrative tasks, and the capacity-dependent staff requirement. The differences among DC levels are also reflected in the associated establishment and extension costs.

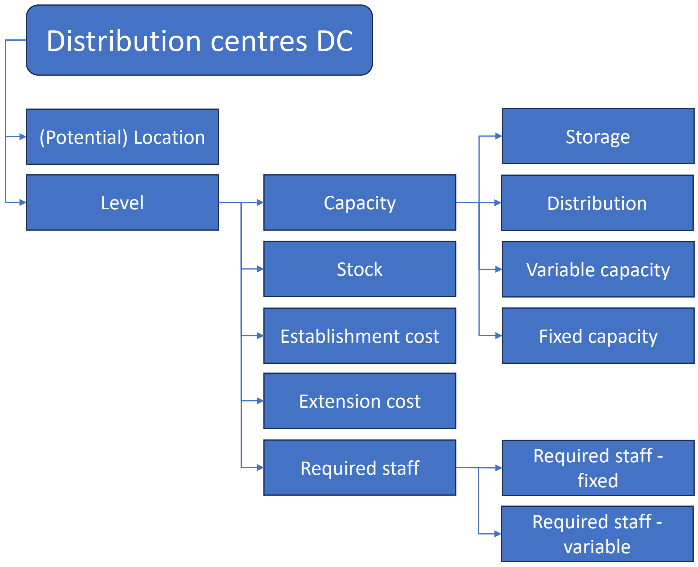

Figure 5. Distribution centres

Shelters

In the literature of disaster management, shelters are entities that can handle commodities and provide shelter to affected people. Hence, they share some characteristics with DC and medical centres (Figure 6). Their location is already predetermined or must be selected by the decision maker. Shelters can be characterised by their type, which may vary in terms of their capacity, stock, and the cost of building a new shelter. Similar to DC, capacity refers to the storage and distribution of commodities. Moreover, as shelters also provide a safe place for those affected, another characteristic of capacity is the number of people that can be accommodated in a shelter.

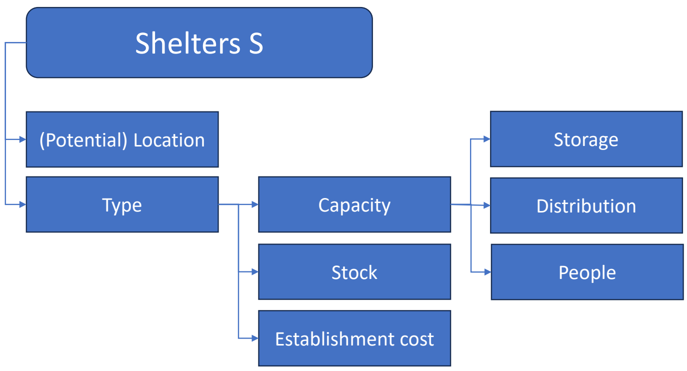

Figure 6. Shelters

Casualties

Casualties are the most important entity in casualty management (Figure 7). This entity usually has three main attributes, namely the type, e.g. the injury types or triage categories, the initial location, which is usually one or more incident sites, and the number of casualties, which is defined either by a fixed number or an arrival rate, e.g. to represent rescue/extrication. The type of casualty has an impact on several other attributes. First, it can determine the priority and the survival probability function or the transition probability from one type to another, the latter of which can be interpreted as a discrete form of the survival probability function. Regardless of the formulation, both can determine the maximum waiting time for a casualty. At the incident site, casualties may need treatment, and the treatment time depends on their type. Different types of casualties may also require different additional resources, resulting in different eligible medical centres or shelters, eligible vehicles, required commodities, such as water, food, or blankets, or required staff per time unit.

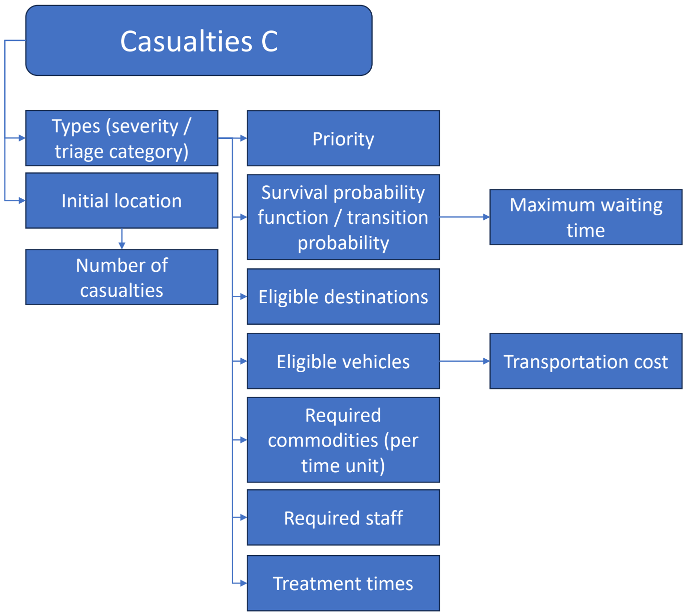

Figure 7. Casualties

Vehicles

Vehicles are entities for transporting casualties, commodities, and staff, and can be characterised by the location, the number of vehicles available and the type (Figure 8). Vehicle types can differ in their travelling speed and eligible arcs, which together with the distance of those arcs determine the travel time between two locations. In addition to the travel time, loading and unloading the casualties and commodities may require additional time or specific facilities. The quantity of commodities and people that can be transported is determined by the capacity of a vehicle type and can be defined by the eligible load, the weight, or the volume of commodities or casualties. Transport costs vary among vehicle types and may also be influenced by the specific load type. However, for the sake of generality, this detailed specification is not included in the overview.

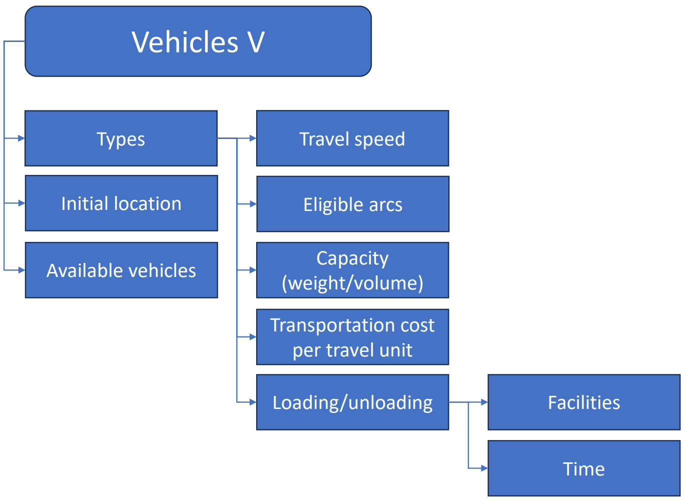

Figure 8. Vehicles

Commodities

To supply affected people and casualties, various types of commodities are required. These types can differ in their priority, dimensions, associated costs, and availability (Figure 9). Costs can include unit costs, holding costs and penalties for shortage (other potential cost types are not included in the taxonomy for reasons of generality). Availability can further be specified on a supplier level.

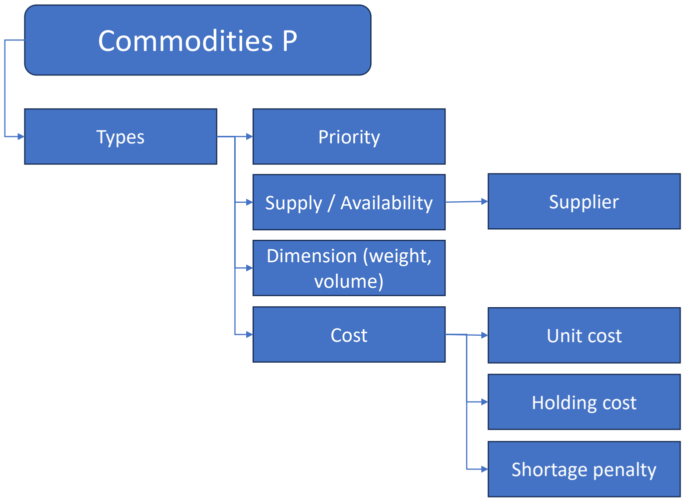

Figure 9. Commodities

Staff

Staff is an entity that treats patients, handles commodities, or fulfils other necessary tasks (Figure 10). It includes paid staff as well as (spontaneous) volunteers. Similar to casualties and vehicles, staff can be characterised by their type, location, and number. The number of staff can either be static or change over time due to availability and resulting shifts. The type of staff can affect the associated wages and can further be specified by the qualification. The qualification may determine the tasks staff members are allowed to perform and can be further refined by the skill level, which in turn may affect the quality and time required to complete a task.

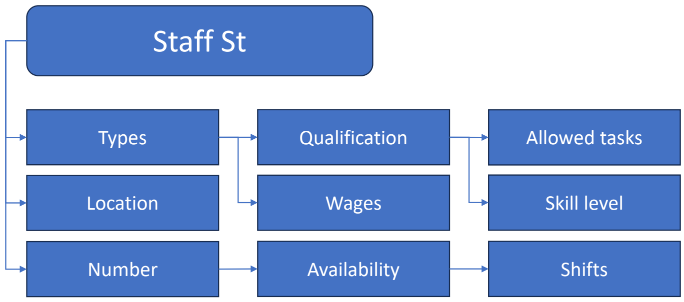

Figure 10. Staff

NEXT STEPS

The next step is to validate the presented taxonomy (Szopinski et al. 2019). For this process, we will invite academics and practitioners with strong expertise in disaster management to participate in discussion rounds, focus groups or interviews. We also aim to discuss the inclusion of entities and characteristics that are not or only implicitly mentioned in the literature and therefore are not (yet) included in the taxonomy. For instance, in practice, general circumstances such as the weather or the region might impact the characteristics of various entities. While they are generally not described in the literature, they could be added to the taxonomy as an additional overarching entity for completeness. Another point for discussion could be the definition of a disaster site. Currently, scholars define them as a set of single coordinates representing one specific point within a disaster area, such as a casualty collection point. However, depending on the disaster, single points may not be the best representation, and instead of defining a discrete set of locations, defining an area might be more representative. Furthermore, to facilitate the use of the repository, clear minimum requirements for the metadata should be defined. For instance, although certain disaster characteristics do not directly affect the model parameters (e.g. the specific cause of building damage) or are already implicitly included in the entity characteristics (e.g. the size of the affected area represented by the number of nodes and distances) and are therefore not included in the taxonomy, adding such information could be valuable for researchers to validate and compare their models.

After the evaluation with experts, we aim to map the published data (sets) and parameters to the taxonomy from both, articles used for taxonomy building, i.e. the articles selected by Farahani et al. (2020), and more recent articles. These two approaches should allow us to obtain an overview of available instances, which can be based on either real or hypothetical data. Based on this, we aim to create benchmark datasets in collaboration and discussion with experts and publish them in a repository to facilitate the comparison of existing and validation of future models in the field of disaster management.

CONCLUSION

In this paper, we proposed a road map for the creation of a repository for the sharing of humanitarian logistics datasets. We provided an overview of currently existing working groups and benchmark sets and presented a preliminary taxonomy for the field of casualty management. These two steps serve as a basis for the future set-up of a repository. Apart from the steps outlined in the previous subsection, future research could focus on extending the taxonomy to other areas of disaster management that are not yet covered to expand the usability of such a repository.

REFERENCES

AG Katastrophnemedizin DGINA (2024). URL: https://www.dgina.de/arbeitsgruppen/ag-katastrophenmedizin (visited on 01/29/2024).

AIS SIGHealth (2024). URL: http://www.aissighealth.com/wordpress/ (visited on 01/29/2024).

Barthe-Delanoë, A.-M., Truptil, S., and Benaben, F. (2015). "Towards a taxonomy of crisis management simulation tools". In: *Proceedings of the 12th International ISCRAM Conference*. ISCRAM, 7–p.

Betke, H., Bosse, M., Sackmann, S., and Reusch, C. (2023). "Towards a Taxonomy for Classification of Coordination Systems for Spontaneous Volunteers". In: *Proceedings of the 20th International ISCRAM Conference*. ISCRAM, pp. 751–760.

CDD (2024). *Canadian Disaster Database*. URL: https://www.publicsafety.gc.ca/cnt/rsrcs/cndn-dsstr-dtbs/index-en.aspx (visited on 01/25/2024).

Centre for Research on the Epidemiology of Disasters (CRED), Université Catholique de Louvain (UCLouvain), and United States Agency for International Development (USAID) (2022). *Disasters in numbers*. https://www.cred.be/sites/default/files/2022_EMDAT_report.pdf (visited on 03/27/2024).

EM-DAT, Guha-Sapir, D., Below, R., and Hoyois, P. (2024). *The CRED/OFDA International Disaster Database*. URL: www.emdat.be (visited on 01/25/2024).

EURO HOpe mini conference (2024). URL: https://www.bath.ac.uk/events/euro-hope-mini-conference-2023/ (visited on 01/29/2024).

EURO working group HOpe (2024). URL: https://www.euro-online.org/web/ewg/39/euro-working-group-on-humanitarian-operations-hope (visited on 01/29/2024).

EURO working group ORAHS (2024). URL: https://orahs.di.unito.it/ (visited on 01/29/2024).

Farahani, R. Z., Lotfi, M., Baghaian, A., Ruiz, R., and Rezapour, S. (2020). "Mass casualty management in disaster scene: A systematic review of OR&MS research in humanitarian operations". In: *European Journal of Operational Research* 287.3, pp. 787–819.

INFORMS Health Applications Society (2024). URL: https://connect.informs.org/healthapplications/home (visited on 01/29/2024).

INFORMS Military and Security Society (2024). URL: https://connect.informs.org/militaryandsecurity/home (visited on 01/29/2024).

ISCRAM (2024). URL: https://iscram.org/ (visited on 01/29/2024).

Jones, R. L., Kharb, A., and Tubeuf, S. (2023). "The untold story of missing data in disaster research: a systematic review of the empirical literature utilising the Emergency Events Database (EM-DAT)." In: *Environmental Research Letters* 18.10, p. 103006.

Kuipers, S. and Welsh, N. H. (2017). "Taxonomy of the crisis and disaster literature: Themes and types in 34 years of research". In: *Risk, Hazards & Crisis in Public Policy* 8.4, pp. 272–283.

Kundisch, D., Muntermann, J., Oberländer, A. M., Rau, D., Röglinger, M., Schoormann, T., and Szopinski, D. (2022). "An update for taxonomy designers: methodological guidance from information systems research". In: *Business & Information Systems Engineering* 64, pp. 421–439.

LaFree, G. and Dugan, L. (2007). “Introducing the global terrorism database”. In: *Terrorism and political violence* 19, pp. 181–204.

Leeftink, G. and Hans, E. W. (2018). “Case mix classification and a benchmark set for surgery scheduling”. In: *Journal of scheduling* 21, pp. 17–33.

Mendoza, J., Guéret, C., Hoskins, M., Lobit, H., Pillac, V., Vidal, T., and Vigo, D. (2014). “VRP-REP: the vehicle routing community repository”. In: *Third meeting of the EURO Working Group on Vehicle Routing and Logistics Optimization (VeRoLog)*.

Nickerson, R. C., Varshney, U., and Muntermann, J. (2013). “A method for taxonomy development and its application in information systems”. In: *European Journal of Information Systems* 22, pp. 336–359.

OCHA (2024). *Humanitarian Data Exchange*. URL: https://data.humdata.org (visited on 01/25/2024).

Pottebaum, J., Marterer, R., and Schneider, S. (2014). “Taxonomy of IT support for training emergency response & management.” In: *Proceedings of the 11th International ISCRAM Conference*. ISCRAM, pp. 379–383.

Rauner, M. S., Niessner, H., Odd, S., Pope, A., Neville, K., O’Riordan, S., Sasse, L., and Tomic, K. (2018). “An advanced decision support system for European disaster management: the feature of the skills taxonomy”. In: *Central European Journal of Operations Research* 26, pp. 485–530.

Reuter-Oppermann, M. and Bernath, C. (2016). “German data sets for comparing ambulance location models”. In: *Proceedings of the Second Karlsruhe Service Summit Research Workshop*, pp. 102–109.

Reuter-Oppermann, M. and Rachuba, S. (2017). “Towards a Testing Framework for Location Problems in EMS Logistics”. In: *Proceedings of the KSS Research Workshop: A Selection of Talks and Presentations on Designing the Digital Transformation*.

Ringer, M. and Fox, B. (2024). *Planning & Scheduling Benchmarks*. URL: https://www.cs.jhu.edu/~jason/325/hw2/benchmrx/default.html (visited on 01/29/2024).

Schedulingbenchmarks (2024). URL: http://www.schedulingbenchmarks.org/ (visited on 01/26/2024).

Shi, Y., Liu, N., and Wan, G. (2023). “Treatment Planning for Victims with Heterogeneous Time Sensitivities in Mass Casualty Incidents”. In: *Operations Research*.

Szopinski, D., Schoormann, T., and Kundisch, D. (2019). “Because Your Taxonomy is Worth It: Towards a Framework for Taxonomy Evaluation.” In: *Proceedings of the 27th European Conference on Information Systems (ECIS)*.

Tatham, P. and Spens, K. (2011). “Towards a humanitarian logistics knowledge management system”. In: *Disaster Prevention and Management: An International Journal* 20.1, pp. 6–26.

Tippong, D., Petrovic, S., and Akbari, V. (2022). “A review of applications of operational research in healthcare coordination in disaster management”. In: *European Journal of Operational Research* 301.1, pp. 1–17.

Wong, D. F., Spencer, C., Boyd, L., Burkle, F. M., and Archer, F. (2017). “Disaster metrics: a comprehensive framework for disaster evaluation typologies”. In: *Prehospital and disaster medicine* 32.5, pp. 501–514.