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ASSESSMENT OF HURRICANES POST-DISASTER IN THE UNITED STATES USING COBRA MODEL

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Abstract: System resilience is defined as the ability of a system to prepare for hazards, adapt to changing conditions, and withstand and bounce back rapidly from a defined disruptive state. The key steps to resilience include prevention, protection, mitigation, response, and recovery. There are two types of resiliency plans: pre-disaster plans and post-disaster plans. The objective of this study was to compare the post-disaster plans after hurricane Maria to the ones used for older hurricanes in terms of severity, damage, and recovery. Hurricane Maria was selected due to the short amount of time since the disaster and the researchers' ability to gather enough information post-disaster. The methodology used to compare the hurricanes was Community Based Resilience Analysis (CoBRA) model. CoBRA was designed as a conceptual framework to assess and measure the impacts of drought risk reduction in European countries. The researchers implemented the model by modifying key factors that typically affect communities during a hurricane. The pros and cons of the updated model are discussed. The results of this study give a better idea of how reacting to hurricanes changed over the years and to determine the efficiency of the resiliency plans. Recommendations were made based on the results to enhance the current resiliency plans and to improve the response and recovery rates post disaster. The ongoing research includes selecting participants from the communities that faced the disaster to discuss the resiliency levels after the event. Required data was collected for the phases and steps included on the CoBRA assessment including utilities, transportation and communication systems.

1. INTRODUCTION

Community resilience is defined as the ability of a community to cope up with the damage and disturbance as a result of social, political, and environmental change. Community resilience can be analyzed for all types of natural disasters such as earthquakes, tsunamis, hurricanes, and floods. There are several influential factors and indicators for each type. Previous studies reveal that these factors are based on geographical location and the type of the disaster. There are several models that talk about a particular type of disaster or focus on a particular category of influential factors.

Previous studies show no evidence of experimenting a model designed for one type of disaster on a different disaster. This study focuses on such experimentation hoping for better results in understanding the factors affecting a community during a disaster. Current study focus is on hurricanes. Hurricanes severity is recognized based on the category number, lower number means a less severe hurricane and higher number indicates a major hurricane. According to the statistics of the United States, ten hurricanes occurs every year with three to four hurricanes being greater than category 3 (Hurricane Research Division 2019).

Factors affecting a community pre-disaster and post-disaster are categorized as influential factors. Different types of influential factors categories frequently used by researchers are social, economic, financial, human, physical, environmental, infrastructure, and natural. Defining the scale of the study is important too. City level, state level, nation level are the possible scales of study. This study focuses on all the factors affecting on community level.

The first objective of this study is to understand the existing CoBRA model that is designed for droughts and gap analysis that is usually done to identify the less-severely damaged portions of a city/state/nation. This type of gap analysis being performed is part of the Oregon Resiliency Plan for earthquakes. The second objective of this study is to develop a model compatible for hurricanes analysis using CoBRA assessment and gap analysis and conclude with pros and cons of the revised model. The reason behind using earthquake and drought models for hurricane is to have fresh set of eyes in understanding the disaster.

Following a drought crisis in 2010-2011 in Africa, United Nations Development Programme (UNDP) initiated a project in 2012 to develop an analytical tool named CoBRA. CoBRA was designed and the initial guidelines were released in 2014 and the second version of guidelines were released in 2017 with few modifications. The first phase of the CoBRA assessment engaged the communities in North Rupunni, Guyana to study droughts (Berardi et al. 2013). Later, the CoBRA assessment was used in different projects that included fire risk management (Project Cobra 2019). Since the tool was used for variety of disasters, the idea of using it for hurricanes emerged. The common goal of using this tool was to incorporate local community ideas based on their past experiences (COBRA 2019).

The scope of this study is limited to hurricanes. The aim is to develop a model that can be applied to hurricanes all over the world, irrespective of the category and its origin location. Few modifications would be needed to infer the results, such as, the influential factors might be different for hurricanes in different geographical locations. The unique contribution of this paper is that this study is different from previous studies done on measuring resilience for hurricanes because two different models are combined to recreate a new model and the results are more accurate in understanding all the influential factors. The results from this study can be used by researchers to apply the model to different hurricanes or, if feasible, adapt the same model for different types of disaster.

2. LITERATURE REVIEW

There are numerous models used to assess and measure resilience of many types of natural disasters including hurricanes. The purpose of having a new model is to improve the resilience in the communities affected by a disaster. Whether the old models served the purpose or not, is checked by assessing old hurricanes that are already assessed by some previous models. The comparison of this model to the old models gives a better idea on how to improve resilience and where the researchers are lagging behind and needs to focus more.

Existing resilience models can be categorized generally into two groups (COBRA 2010):

- Models that attempt to capture and describe a system-wide approach to resilience (e.g., DFID, Technical Assistance to Non-Governmental Organizations [TANGO], Practical Action, Fraser, etc.); and
- Models that attempt to define and measure the characteristics of resilience at a community level (e.g., Food and Agriculture Organization of the United Nations [FAO], Oxfam, Tulane University, etc.).

Resilience can be measured in two ways (COBRA 2012):

- A universal measure or indicator(s) of resilience supports understanding of whether resilience is increasing, decreasing or staying the same; and
- Composite and contextually specific indicators of resilience support understanding of how local drivers of resilience are expanding or contracting, and the impact of interventions on those drivers.

According to Johansen (Johansen et al. 2016), currently, there exist many metrics within each of the three categories of community-level, sector-specific, and sociological measures of resilience. These have been described and compared based on the metric, type of tool, applicable location, framework outputs, hazards addressed, and communities studied. Combining community-level metrics with sector-specific and sociological measures would enable an assessment with the breadth and detail required to comprehensively address resilience.

According to Lam (Lam et al. 2016), the ultimate goal is to identify existing capacities that are associated with a community's ability to reduce damage and bounce back from coastal hazards. Lam developed Resilience Inference Measurement (RIM) approach and the framework is seen in Figure 1.

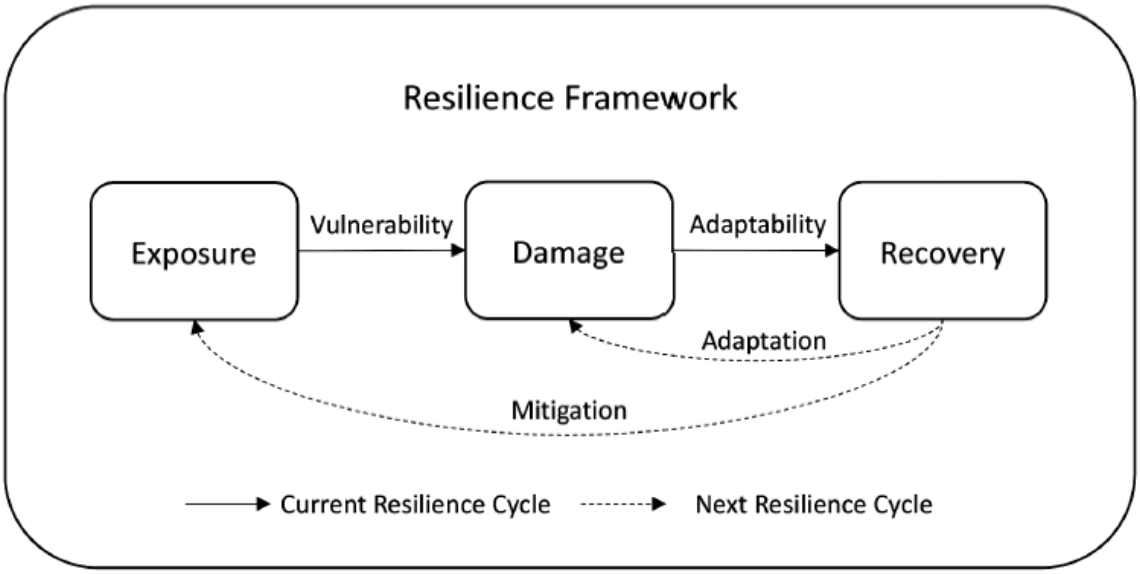

Figure 1: RIM Approach (Lam et al. 2016)

3. METHODOLOGY

The first step of this research is to identify previous models developed for different types of natural disasters. The models are studied in such a perspective to find out whether they are suitable for hurricanes. During this study, the researchers were convinced that cobra used for droughts and gap analysis used in Oregon Resiliency Plan are feasible to use to analyze hurricanes. Study of hurricanes can be done pre-disaster and post-disaster. The researchers chose to do the post disaster analysis because of the accuracy of the data collected after the event. This section explains the cobra methodology and gap analysis.

CoBRA methodology:
CoBRA is selected because a study by Sharifi (Sharifi 2016) reveals, after analyzing 36 models developed for resilience, that all types of influential factors are considered in this model. The influential factors include social, physical, human, financial, and natural. Cobra is a qualitative analytical tool to measure resilience and was initially designed to reduce risk related to droughts and improve human livelihood. Eventually cobra helped identify both contextual and universal characteristics of resilience. Cobra methodology has four objectives (COBRA 2012):

1. Identify the priority characteristics of disaster resilience for a target community;
2. Assess the community's achievement of these characteristics at the time of the assessment (generally carried out during a 'normal' period) and during the last crisis or disaster;

3. Identify the characteristics and strategies of disaster-resilient households; and
4. Identify the most highly rated interventions or services in building local disaster resilience.

Figure 1 shows the phases and steps involved in undertaking CoBRA assessment.

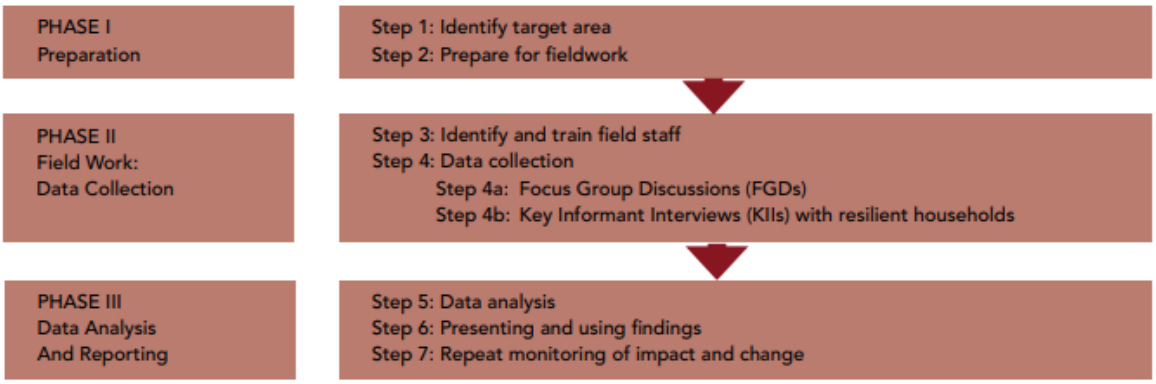

Figure 2: Phases and steps in undertaking CoBRA assessment

Gap analysis:
Gap analysis (ORP 2013), (Clear Point Strategy 2019), in general, is identifying the difference between and where we are currently and where we want to be and identify the gaps and improve them to achieve the final goal. The first step is to identify the target area and dividing it into tiers such as national highways, state highways, community buildings, schools, and hospitals. Estimated time of recovery for each of these is predicted and the target area to be focused on is selected based on the analysis. This analysis could be done for any disaster and hence is selected for this study.

4. RESULTS

Modified methodology for hurricanes:
The CoBRA assessment and gap analysis explained in the methodology section are combinedly used to have a modified methodology for hurricanes. The steps involved are explained below with the model's potential pros and cons.

Figure 2 explains steps involved in the revised model:

1. Perform gap analysis to identify the target area
2. Use focus group discussions (FGDs) for data collection
3. Presenting and findings are analyzed the using the same techniques from CoBRA assessment

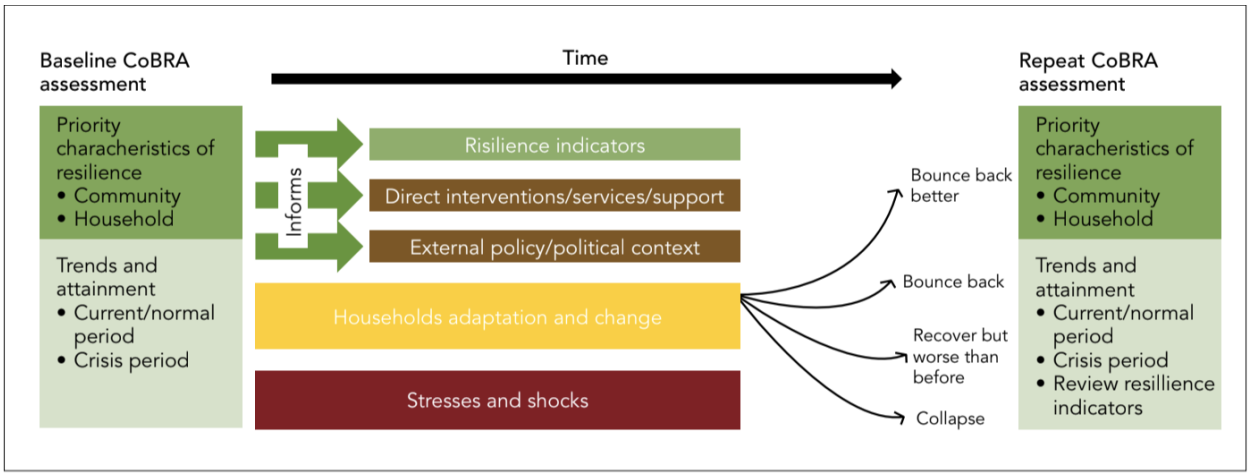

Figure 3: Revised CoBRA model

Pros of the revised model:

CoBRA assessment has four objectives and these objectives are the major pros for the revised model too. In addition, gap analysis helps the researchers select and narrow down the scale of the study, where more research is required and needed.

- Identify the priority characteristics of resilience for a target community;
- Assess the communities' achievement of these characteristics at the time of the assessment and during the last crisis/disaster;
- Identify the characteristics and strategies of resilient households; and
- Identify the most highly rated interventions or services in building local resilience.

Cons of the revised model:

- The model is still being tested practically on few old and latest hurricanes. The validity and reliability of the model are still unknown.
- CoBRA was developed for droughts in Africa and has never been used in other locations or other disasters. This approach has equal chances of not being able to fulfill the elements missed by old models used to assess hurricanes.
- The model developed was conceptual and this study makes sure that real time analysis is done for accurate results.

5. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The first objective of this study to introduce CoBRA assessment and gap analysis is done in methodology section. The steps involved in both the analyses are explained. There is a continuation and synchronization between both the models which helped in combining them and the revised model made more sense.

The second objective is to develop a revised model using the two types of analysis explained in the methodology. The revised model is explained in results section along with its pros and cons. The model not being used to assess hurricanes or other droughts in the United States makes it difficult to expect a positive result from the study.

This study helps researchers have a new approach to the disasters. All the previous models might be looking at the disaster in the same old-fashioned way. Resilience is something that cannot be understood or measured qualitatively or quantitatively. The influential factors are to be chosen in such a way that there is a balance.

Recommendations/ Future Work

The next step in this study is to collect required data and apply the model to the real time data. Data is collected for hurricane Katrina and hurricane Maria. Hurricane Maria is a recent hurricane and hurricane Katrina is an old one. Enough data is available for hurricane Katrine and resilience assessments and measurement were made by a bunch of researchers. Now by applying this new model to an old hurricane would give results that makes it easier to compare with the older assessments. Hurricane Maria can be assessed for resilience to check if the researchers succeeded in preparing communities to face the disasters better.

While CoBRA is used for most of the assessment, the scale of the study is decided using gap analysis. Once the required data is collected to select the scale of the study, the actual real time data is collected by performing focus group discussions with members from the community affected by the disaster. The researchers performing the group discussions are to be trained on how to perform the process. Once the group discussions are done, the collected data is analyzed, and the results are presented.

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