Using Innovative Blockchain Technologies in Emergency Management and Disaster Response

Monroe J. Molesky, Integrative Physiology/History Student
Willard Rose, Healthcare Administration Student
Jarod Arendsen, Healthcare Administration Student
Brandon McDaniel, Healthcare Administration Student

ALMA COLLEGE

Purposes & Objectives

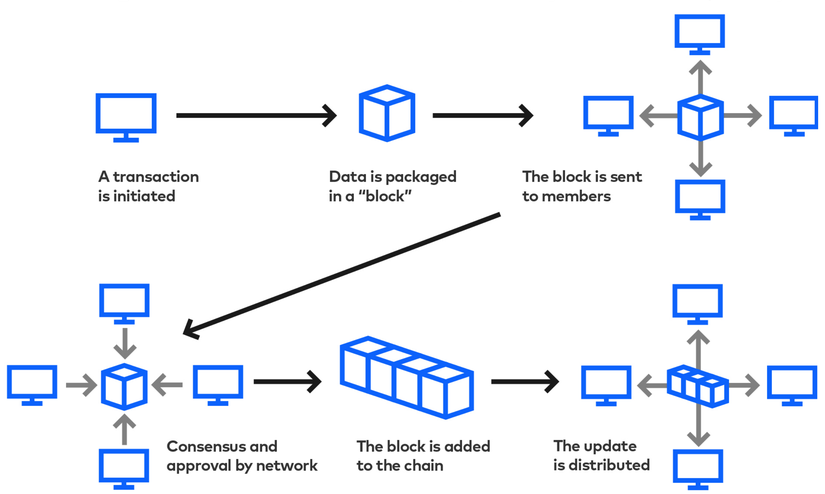
Purpose

With the complex nature of emergency management, utilizing new technologies to improve response logistics and reduce cost is crucial. Blockchain is a secure, distributed, and immutable digital ledger that records transactions across a business network. Using blockchain in emergency management can provide interoperability between many parties involved in response and provide transparency. Looking to new technologies would help reduce the 80% of humanitarian relief that is spent on logistics and speed recovery claims that take months (Wassenhove, 2006). The purpose of this review is to explore blockchain as a cost effective, innovative tool for improving emergency management systems and response programs.

Objectives

1) Be able to define basic principles of blockchain
2) Be able to distinguish the benefits of blockchain in emergency management
3) Be able to discuss/brainstorm how blockchain can improve individual emergency management fields

Figure 1. What is blockchain? (Molesky & Trautman, 2019)



Blockchain

- Business networks (think all steps from farmer to fridge) each have ledger to track supply levels and tractions
- Blockchain puts each member of a network all on the same communication stream.
- Every member has a copy of all the ledgers, to keep each accountable and easy to access information
- Blocks (transactions) can't change or be removed from the chain

Methods & Results

Methods

We performed a comparative literature analysis of thirty-five scholarly articles and white papers reviewing the applicability of blockchain in emergency management challenges such as improving logistic chains, recovery benefit claims, interagency communication, and transparency. Literature searches were conducted using keywords such as systems analysis, blockchain, disaster response, and disaster technology.

Results

Overall, blockchain technologies have shown proven success in reducing logistical and administrative costs across several industries. In addition, reviews suggested that the implementation is complex and cooperation of parties in needed, but it is effective in application.

Figure 2. Supply Chain Improvement (Schulz, 2008)

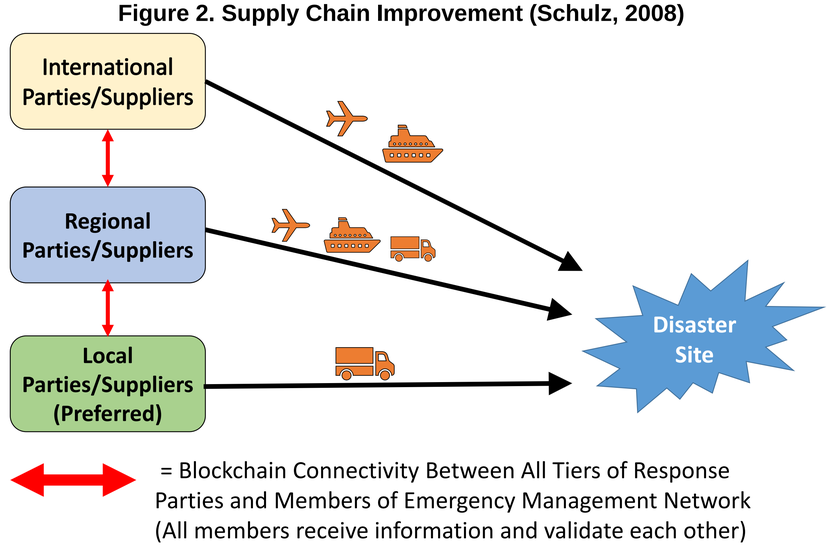


Figure 3. Blockchain Industry Success Cases (Chang et al., 2019)

Use Case	Benefits
BBVA Bank WavePilot	Document transactions reduced from 10 days to <2.5hrs
Maersk TradeLens	20% reduction in shipping-logistics costs (paper reduction & increased accuracy) 40% reduction in packaged materials shipping time
IBM-Walmart	2.2 sec trace back on produce with blockchain from customer to farmer

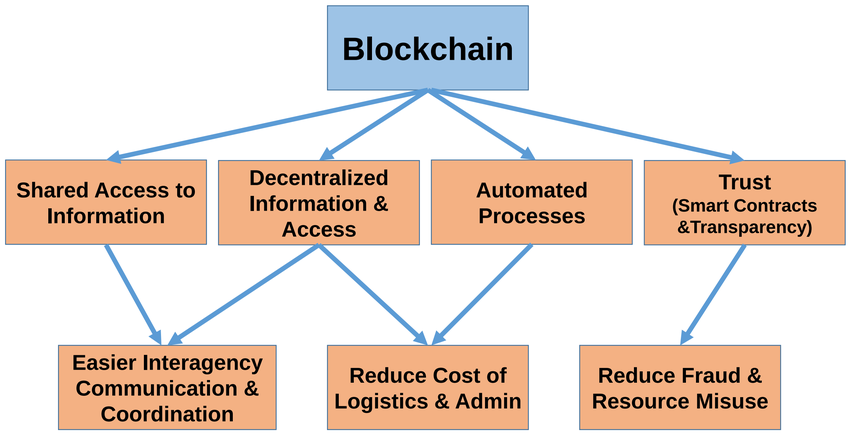
Conclusion & References

Conclusions

Emergency management and disaster response can be significantly enhanced with the implementation of blockchain technologies. Blockchain has had particular success in the financial and shipping industries reducing cost and increasing timeliness of services. These two aspects are especially important in the logistics, recovery, and response capabilities of emergency management agencies such as disaster benefit claims. Hurricane Harvey alone had 91,000 National Flood Insurance Program claims (FEMA, 2018).

Blockchain would significantly reduce the cost of claims, digital connectivity would make the claims process easier, and victims would receive benefits expeditiously. Implementing blockchain in emergency management and response systems could greatly reduce costs (allowing for greater services), unify efforts, and speed response efforts. Blockchain, although complex sometimes to understand, can be easy to integrate and low cost with the right use case.

Figure 4. Emergency Management Blockchain Summary



References

Chang, SE., Luo, HL., & Chen, Y. (2019) Blockchain enabled trade finance innovation: a potential paradigm shift on using letter of credit. *Sustainability, 12(188), 1-16.*

Chang, Y., Iakovou, E., & Shi, W. (2018) Blockchain in global supply chains and cross border trade: a critical synthesis of the state of the art, challenges and opportunities. *International Journal of Production Research.* 1-51.

FEMA Announces Decision on NFIP Proof of Loss Deadline for Hurricane Harvey. (2018, August 24). Retrieved from https://www.fema.gov/news-release/2018/08/24/fema-announces-decision-nfip-proof-loss-deadline-hurricane-Harvey

Molesky, MJ., & Trautman, LJ. (2019) A primer for blockchain. *University of Missouri-Kansas City Law Review,* 88(1), 1-46.

Schulz, SF. (2008) Disaster relief logistics: benefits of and impediments to horizontal cooperation between humanitarian organizations. *Political Science.*

Wassenhove, LV. (2006) Humanitarian aid logistics: supply chain management in high gear. *Journal of the Operational Research Society.* 57(5), 475-489.

Creating a Functional Knowledge Base in Youth by Incentivizing Participation in Emergency Management Training

James Budrick-Diaz: Chemistry/Healthcare Administration Student
Dominic Patino: Healthcare Administration Student

Purposes & Objectives.

Growing ferocity and frequency of disasters, both natural and man-made, has made preparedness increasingly important. Emergency institutions often become overloaded in times of disaster/emergency, hence, civilians having a plan of action is vital to mitigate damage to both property and life. By linking emergency management institutions and local assets to the youth (grades 6 and up) and creating a means for them to buy-in to the program, the consistent exposure to proper emergency response methods may create a functional knowledge base, improving outcomes in times of emergency and disaster.

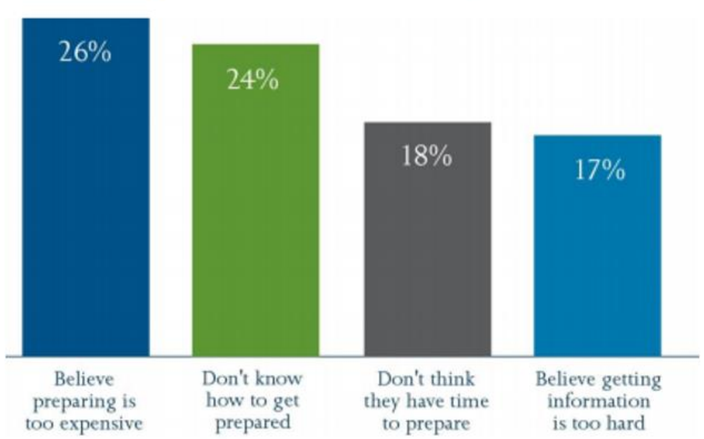
Primary Objectives

- Create LINK programs across the country
- Achieve better health outcomes and mitigate damages for the population in times of emergency or disaster
- Construct a functional knowledge base that is consistently updated throughout the individuals lifetime

Preparedness

- Majority of pop. perceive barriers to preparedness
- Lag time for first responders in disasters
- Probability of teens and young adults to be underprepared for emergencies

Figure 1: Perceived Barriers to Preparedness



FEMA. "Perceived Barriers to Preparedness", FEMA. (2013) https://www.slideshare.net/northlandfox/preparedness-in-america.

Methododology

- Utilization and evaluation of programs and information from local emergency management institutions
- Setting oriented programs for individuals based on risk factors
- Incentive research based off of age and area interests for optimal results
- Implementation of the LINK program and updating it as more feedback becomes available

LINK program

- **L**inkage of emergency management organizations with families and learning institutions
- **I**ncentivizing participation to facilitate buy-in from the youth
- **N**ormalizing involvement with emergency management training and preparation
- **K**indling an interest in emergency management for continued learning and expansion of the individuals knowledge base

Oklahoma State department of Health. (2020) https://www.ok.gov/health/County_Health_Departments/Mayes_County_Health_Department/Emergency_Preparedness_and_Response/index.html.

Conclusion & References

The youth are the future of the United States as they mature and enter their respective professions. As time passes and the programs are modified with each new generation, creation of common knowledge, similar to the "stop, drop, and roll" mantra, increases societal awareness of emergency response standards. This in turn reduces damages and improves health outcomes in times of emergency.

Future Implications

- Better outcomes for the target population that extends to the community as well as faster recovery times due to increased preparedness of individuals
- Inspiring the younger generation to pursue careers in the emergency management field and become involved
- Creation of common knowledge which will lead to a culture of preparedness
    - This may also lead to the creation of collaborative relationships across organizations as the younger generations enter the workforce

References

Chicago Community Trust. "Emergency Management Report." Goto2040, Chicago Community Trust, 2009, ccdcboise.com/wp-content/uploads/2016/02/Document-G1-Emergency-Preparedness-Report.pdf.

Collins, Ashleigh, et al. "Using Incentives to Increase Participation in out-of-School Time Programs." PsycEXTRA Dataset, June 2008, doi:10.1037/e509532011-001.

FEMA. "Preparedness in America." FEMA, Aug. 2014, www.fema.gov/media-library-data/1409000888026-1e8abc820153a6c8cde24ce42c16e857/20140825_Preparedness_in_America_August_2014_Update_508.pdf.

Homeland Security. "2018 National Preparedness Report". FEMA, 2018, www.fema.gov/media-library-data/1541781185823-2ae55a276f604e04b68e2748adc95c68/2018NPRRprt20181108v508.pdf.FEMA.

Equitable Disaster Relief Can be Hindered by Appearance

Taylor Alexander, Neuroscience Student
Alex Kingsley, Neuroscience / Healthcare Administration Student
Quinton Moeggenborg, Accounting Student

Purpose & Objectives.

Purpose

When responding in an emergency situation, first responders tend to operate instinctively due to the fast-paced nature of the disaster. Because of this, there is often a subconscious level of **implicit bias** around **appearance** created through **mental models** that can drive the way first responders react within different populations. Based on a first responders' perception of the population or community that they are serving, it can either disproportionately benefit or harm the disaster mitigation outcomes.

Objectives

1. Be able to define and identify implicit bias.
2. Be able to identify implicit biases in appearance that can arise in an emergency situation.
3. Be able to understand how to avoid implicit bias.

Figure 1 (Blair, Steiner, & Havranek, 2011)

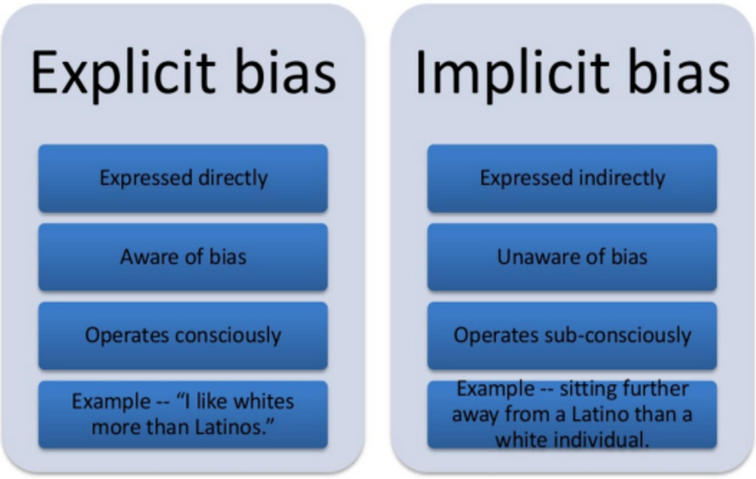
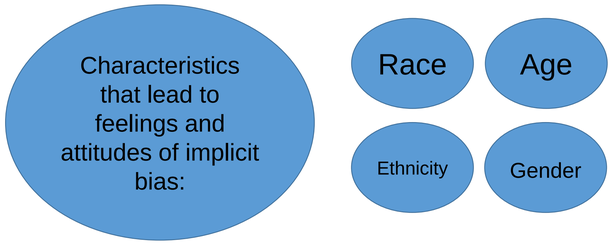


Figure 2 (The Kirwan Institute for the Study of Race and Ethnicity, 2015)



Interestingly, these also make up some of the first aspects we see regarding one's **appearance**—another determinant of implicit bias.

Methods.

Methods

We compiled a literature review based on both **surveys** and **interviews** which targeted the firsthand account of events from a first responder perspective. We researched various **catastrophic events**—notably Hurricane Andrew—and the measures or trainings that were in place to make sure the whole population was receiving **proper delivery of care**.

Figure 3

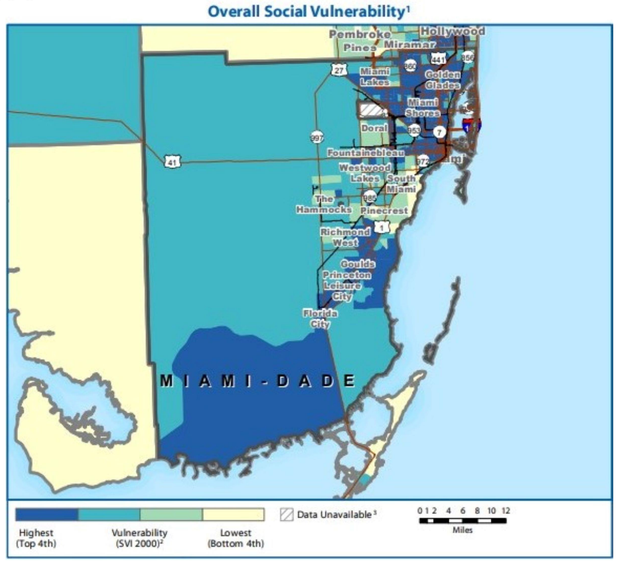


Figure 3 shows the social vulnerability index (SVI) in Miami-Dade County in reference to Hurricane Andrew indicating the many social differences in the county which leads to differences in appearance (CDC, 2000)

Factors that determine the social vulnerability index calculation that also determine what goes into a person's <u>appearance</u>:

- Race
- Ethnicity
- Culture
- Age
- Gender
- Employment
- Education
- Social dependency and social needs

Figure 4

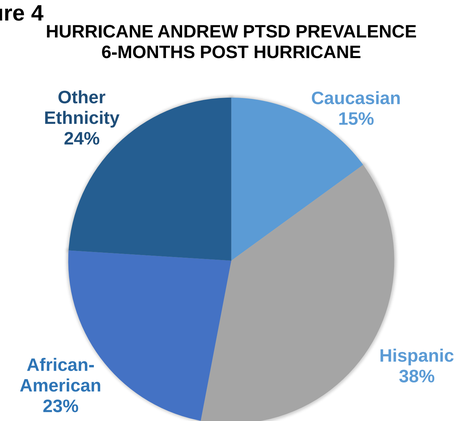


Figure 4 shows the psychological impact of Hurricane Andrew on a large component of appearance—ethnicity. These results show correlation of how implicit bias can affect relief efforts with minority groups compared to the majority (Perilla, Norris, & Lavizzo, 2002)

Results, Conclusion & References.

Results & Conclusion

The outcomes show direct **correlations** between implicit bias being present in **emergency situations** and the **populations** that are being responded to in these situations. It is important to understand that implicit bias exists, and each person will approach a situation differently based on the mental models that they perceive to be the norm. Although eliminating all bias may not be possible, through **education**, first responders can be made aware of bias that they bring and make a conscious effort to provide an **equitable level of care** to those they serve.

Figure 5 (Edgoose, Quiogue, & Sidhar, 2019)

Acronym to remember in order to reduce Implicit Bias:

Introspection
Mindfulness
Perspective-Taking
Learn to Slow Down Thinking
Individuation
Check your Messaging
Institutionalize Fairness
Take Two

Additional Research

1. Ho, C., Hui, S., Mbbs, C., & Chee. (2020). *Mental Health Strategies to Combat the Psychological Impact of COVID-19 Beyond Paranoia and Panic*. Retrieved from http://www.anmm.org.mx/descargas/Ann-Acad-Med-Singapore.pdf

2. Sabin, Janice A., et al. "Physicians' Implicit and Explicit Attitudes About Race by MD Race, Ethnicity, and Gender." *Journal of Health Care for the Poor and Underserved*, vol. 20, no. 3, 2009, pp. 896–913, www.ncbi.nlm.nih.gov/pmc/articles/PMC3320738/, 10.1353/hpu.0.0185.

3. Wright, Alyssa, et al (2018). *POLICE INTERACTIONS WITH INDIVIDUALS WITH DEVELOPMENTAL DISABLITIES: USE OF FORCE, TRAINING, AND IMPLICIT BIAS*.

References

1. Blair, I., Steiner, J., & Havranek, E. (2011). Unconscious (Implicit) Bias and Health Disparities: Where Do We Go from Here? The Permanente Journal, 71-78.

2. Center for Disease Control (CDC). (2000, January). Social Vulnerability Index (SVI). Florida, Miami-Dade.

3. Edgoose, J., Quiogue, M., & Sidhar, K. (2019). How to Identify, Understand, and Unlearn Implicit Bias in Patient Care. Fam Pract Manag., 29-33.

4. Morrow, B. (1997). Stretching the bonds: The Families of Andrew. In W. Peacock, B. Morrow, & H. Gladwin, Hurricane Andrew: Ethnicity, gender and the sociology of disaster (pp. 141-170). Routledge.

5. Perilla, J., Norris, F., & Lavizzo, E. (2002). Ethnicity, Culture, and Disaster Response: Identifying and Explaining Ethnic Differences in PTSD Six Months After Hurricane Andrew. Journal of Social and Clinical Psychology, Vol. 21, No. 1, 20-45.

6. The Kirwan Institute for the Study of Race and Ethnicity. (2015). Defining Implicit Bias. Retrieved from Ohio State University: http://kirwaninstitute.osu.edu/research/understanding-implicit-bias/

Mitigating Tsunami with Multiple Low Frequency Acoustic Gravity Waves

Brian Iveson: Healthcare Administration Student
Chris Dougherty: Healthcare Administration Student
Chase Beecher: Healthcare Administration Student
Jacob Dean: Healthcare Administration Student

Purposes & Objectives

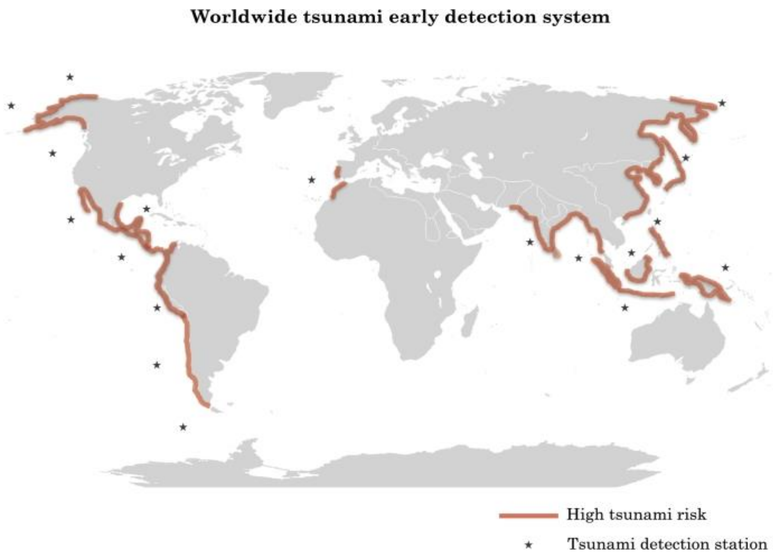
Purpose

- The tsunami that propagated in the Indian Ocean in December of 2004 killed more than 230,000 people.
- Until recently, very few mechanisms have been curated to mitigate a tsunami and most of our focus has been on warning systems.

Introduction

- The size of impact from a tsunami is determined by the wavelength and amplitude of the wave.
- By forcing a wave to interact with resonating acoustic-gravity waves (AGW), its energy can be redistributed over a larger space.
- Acoustic-gravity waves are a form of sound waves which travel in the deep ocean under the visible waves (gravity waves).

Figure 1 (Kadri. U, 2017)



Objectives

- Help people gain an understanding of how Acoustic-Gravity waves can be used to mitigate a tsunami.
- To explain the mechanism of a Resonant Triad interaction and why this is necessary for redistribution of energy.
- To ensure the audience understands the limitations to mitigation and how they can be overcome.
- Describe the importance and benefits of using Acoustic-Gravity Waves to forecast and recover from a tsunami.

Methods & Results

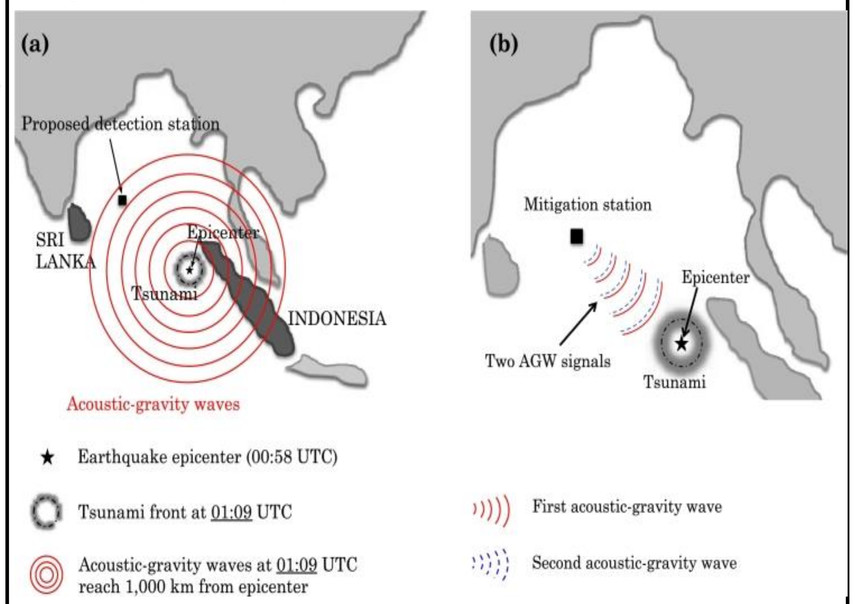
Methods

- The methods include a literature review where select qualitative research was gathered through scholarly journals used to understand the characteristics of tsunamis, AGW's, and their relationship.
- To gain a better understanding, an extensive amount of reading was done through the sources of the primary sources and physics textbooks.
- Interviews with physics professors were conducted as well to help gain a deeper understanding.

Results

- By implementing the AGW systems, it is possible to measure the AGW's of the tsunami wave. With that data multiple waves with the same amplitude and wavelength but a lower frequency can be sent out to redistribute the energy of the tsunami's gravity waves. The waves will undergo a resonant triad interaction. The interaction involves two AGW's sent toward the Acoustic-Gravity Wave of the tsunami. The first AGW will match the frequency and wavelength of the tsunami and the second will be of a smaller frequency and wavelength to disrupt the energy of the wave.

Figure 2 (Kadri. U, 2017)



Conclusion & References

Conclusions

- Considering recent theories surrounding AGW's, there is a great need for research in using them to mitigate tsunamis.
- There are still some limitations surrounding tide-tsunami interactions and constructive interference.
- This research is different from others because it focuses on mitigation of the tsunami and not just warning systems, which tend to create congestion upon evacuation.
- Practical use of this research would be to assist warning systems and utilize general relativity to lower the impact of a tsunami.
- Disaster response/relief can be significantly enhanced through the implementation of Acoustic-Gravity Waves. These efforts will proactively prevent the loss of life, property damages, and even environmental damages.

References

Bernard, E. N., Mofield, H. O., & Titov, V. (2006, June 26). Tsunami: scientific frontiers, mitigation, forecasting and policy implications. Retrieved from https://royalsocietypublishing.org/doi/full/10.1098/rsta.2006.1809

Bernard, E., & Titov, V. (2015). Evolution of tsunami warning systems and products. *Philosophical Transactions: Mathematical, Physical and Engineering Sciences, 373*(2053), 1-14. Retrieved April 3, 2020, from www.jstor.org/stable/24506316

Brown, R. G. (2013). Introductory Physics I Elementary Mechanics. Retrieved from https://webhome.phy.duke.edu/~rgb/Class/intro_physics_1/intro_physics_1.pdf

Bryant, E. (2014). Tsunami. Retrieved from https://books.google.com/books?hl=en&lr=&id=tOkpBAAAQBAJ&oi=fnd&pg=PR9&dq=Bryant+E.+Tsunami:+the+Underrated+Hazard+2014+Springer+&ots=hLGmrtPTKH&sig=PWFnW2g6wGHniDzAp_fo3k9uRtY#v=onepage&q=Bryant E. Tsunami: the Underrated Hazard 2014 Springer&f=false

Kadri, U., & Stiassnie, M. (2012, March 22). Acoustic-gravity waves interacting with the shelf break. Retrieved from https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011JC007674

Kadri, U. (2017, January 23). Tsunami mitigation by resonant triad interaction with acoustic-gravity waves. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5292762/

Kadri, U. (2017, January 17). Tsunami mitigation by resonant triad interaction with acoustic–gravity waves. Retrieved from http://orca.cf.ac.uk/97850/1/1-s2.0-S2405844016318254-main.pdf

Longuet-Higgings, M. S. (n.d.). PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY OF LONDON. Retrieved from https://royalsocietypublishing.org/doi/pdf/10.1098/rsta.1950.0012

Løvholt, F., Pedersen, G., & Gisler, G. (2008, September 16). Oceanic propagation of a potential tsunami from the La Palma Island. Retrieved from https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2007JC004603

Yoon, J., Lee, J., & Ha, T. (2019). Development of a Numerical Algorithm Considering Tide–Tsunami Interaction. *Journal of Coastal Research,* 76-80. Retrieved April 3, 2020, from www.jstor.org/stable/26852481

International Deployments Under the Siege of Symbols

Diego Otegui, University of Delaware

Purposes & Objectives

There is a need to know more about how post-disaster deployments come to exist, about the forces involved in its origination. Humanitarian deployments (and convergence) are inescapably influenced by the individual values, the boundaries defined by organizations, and societal forces that unconsciously determine the way humanitarian executives understand the reality in which they live. These three levels are nested within one another and intimately connected with their personal cognitive space.

The **significance and intellectual merit** of this research resides in the application of a unique theoretical framework that helps us understand how post-disaster operations are constructed with information from the three levels. It can help us know more about the distinct values and meaning that humanitarian interventions have in different areas of the world.

Methods & Results

Institutional Logics

- There are **six distinct institutional orders**: family, religion, state, market, profession, and corporation" (Friedland and Alford 2014).
- Each **institutional order** is composed of a series of ideas that encapsulate the "cultural symbols and material practices particular to that order" (Thornton, Ocasio and Lounsbury 2012 p.54). These are called **institutional logics**.
- Institutional logics allows us to study human behavior from the point of view of the relationships that exist between the individuals, their organizations, and the society at large (Thornton, Ocasio and Lounsbury 2012).

Research Question

Do Institutional Logics help understand international post-disaster convergence? If so, what is their effect?

Sampling

- 30 Open Ended Interviews
- Executives Involved in the Deployment of Personnel
- Humanitarian Organizations
- Trips to 4 countries

Analysis

- Content Analysis
- Three Coding Cycles (Inductive & Deductive)

Conclusion & References

Major Findings

The major findings were presented in two chapters. The first one focuses on how symbolic constructions influence the western humanitarian machine. It presents one critical finding for each of the three nested levels of analysis, the individual, the organization and society. The second expands the discussion and describes the implications for international humanitarian response, emphasizing its effects in the relationship between humanitarian actors and local stakeholders

References

DiMaggio, Paul J. 1988. "Interest and agency in institutional theory" Cambridge, MA: Ballinger.

Dynes, Russell R., and Enrico L. Quarantelli. 1980. Helping behavior in large scale disasters. Newark, DE: Disaster Research Center.

Fritz, Charles E., and J. H. Mathewson. 1957. Convergence behavior in disaster: A problem in social control: A special report prepared for the Committee on Disaster Studies.

Friedland, Roger, and Robert R. Alford. 1991. "Bringing society back in: symbols, practices, and institutional contradictions". The New Institutionalism in Organizational Analysis / Edited by Walter W. Powell and Paul J. DiMaggio.

Contact

dotegui@udel.edu
www.diegootegui.com
diegootegui
diegootegui
diegofotegui

- U.S. Representative, University Network of the Americas for Disaster Risk Reduction
- Board Member, International Humanitarian Studies Association
- A few weeks away from getting my Ph.D. in Disaster Science and Management