Where We Would Go: Reported Household Plans in Emergency Situations

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ABSTRACT

We present ongoing efforts to better understand preparedness and destination choice in emergencies. Using results from a survey instrument (n = 471) sent to households in Akron, OH and State College, PA., we attempt to find spatial patterns in the types of places that households report as potential destinations for weeklong, 2-month long and indefinite evacuation. Our goals are to learn about the extent of households' reliance on social contacts in times of emergencies, and to discern general geospatial patterns of destination choices, e.g. do certain spatial or demographic groups choose to travel near/far? We find that chosen destinations are more local for those living in rural areas than in urban areas. Next, we show that nearly twice as many people who have vacation homes can borrow a vacation home. Moreover, 10% of the population surveyed lack a destination for immediate weeklong relocation, and 15-20% of the population does not have a destination in mind for indefinite relocation. Our future theoretical goals are to link these choices to the locations of existing social ties to better understand the role of friends and family in evacuation destination choice and how geolocated social networks are activated in emergency situations.

Keywords

Household relocation, emergency, disaster response, evacuation, social support.

INTRODUCTION

Emergency evacuations and forced household relocations are not at the forefront of daily family discussions, although planning for detrimental events can assure safe departure and relocation. Collecting data on relocation ideation and actual sets of geographic destinations *before* disasters occur can tell practitioners which areas or demographics may lack a plan, so that budgetary resources and communication strategies can be allocated towards these groups. In addition, the collection of actual sets of geographic places allows for a crowd-sourced frequent item-set of places that can be clustered and used for on-demand transportation. If common destinations are listed, responders can facilitate and disseminate information on carpools or bus travel to these chosen locations. For example, early findings from this exploratory research in-progress shows an encouraging pattern that Akronites choose to travel to the Carolinas and State College residents choose to go to the Philadelphia region.

Our larger goal is to address an information gap between what is available to emergency planners, and what may help them understand the travel and transportation routes that community members plan to take in an evacuation setting. In addition, this research begins to investigate the existence of plan ideation for emergencies—i.e. whether respondents have a relocation destination in mind for an emergency. Four areas of interest are Akron, Exurban Akron ("Ex-Akron"), State College and Exurban State College ("Ex-State College"). We report working results for three different topics:

1. Destination ideation by each of four areas
2. Vacation home ownership by educational attainment.
3. Chosen destinations and distances by each of four areas

We present work in progress by describing an initiative to gather data on the locations and variations of locations that households reported that they would choose to go if they had to evacuate their area. These questions were asked as part of the larger Neighborhood Connectivity Survey (NCS). Survey respondents were asked to provide three locations: a destination they would choose if they had to *evacuate for a week*, *2 months*,

or indefinitely. Survey responses are compiled for three areas, State College, PA and Akron, OH are reported in this document, and Philadelphia, PA is currently being sampled and has not yet been recorded.

SOCIAL SUPPORT AND EMERGENCIES

Results can help strategically allocate limited emergency resources to target neighborhoods without external social ties during hazard and disaster evacuation efforts. Geolocated social support data is crucial for emergency responders and studies of social vulnerability to hazards (Cutter et al., 2002) because they will allow responders to target areas where residents have little social support. Our theoretical goal in this research is to better understand how social ties may influence where people go in evacuation scenarios. Our survey instrument (described in the third section) also collects the locations of friends and families, locations of travel, and locations of past residences. Using text mining, we will match these locations to those reported for evacuation to see where intersections occur. These results will tell us whether this is a social tie at the location, whether the location was a vacation home or previous travel area, or whether the location was a previous residence of the household members. In a review of migration and environmental hazards literature (Hunter, Luna and Norton, 2005), it is determined migration literature can be applied to the reasons why people would leave due to a hazard event—such as favorable conditions in the locations, etc., yet the existence of social ties is not explicitly mentioned.

Still, previous research has shown how social support helps survival in emergency situations. New Orleans residents chose to stay in New Orleans leave the city as a result of Hurricane Katrina depending on where they had social capital (Elliott and Pais, 2006; Eisenman et al., 2007). A lack of social capital can lead to potentially dangerous consequences. One example comes from the 1995 Chicago heat wave where the isolated elderly shared a disproportionate amount of the heat-wave related deaths. These deaths were predominately located in poor African American communities with minimal public space and social capital (Klinenberg, 2015). Elderly African American women living in public housing fared exceptionally poorly after Hurricane Andrew, as a result of separation from social support (Sanders, Bowie, and Bowie, 2003). This segment of the population was most in need of housing even several years after the hurricane (Morrow, 1996).

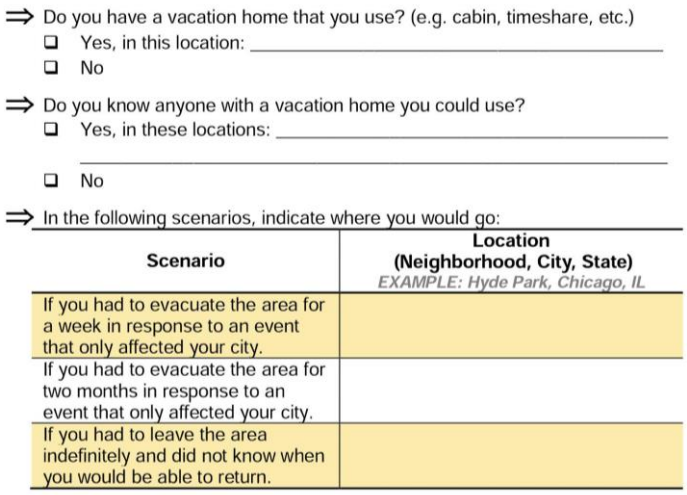
Households of the area's predominant race are most likely to seek out family or friends (Whitehead et al., 2000) Hurricane evacuation statistics show that 45%-70% of households evacuate to friends and family, 20%-40% choose hotels/motels and the remaining 5%-25% go to public shelters (Cuellar et al., 2009). In a demographically-oriented evacuation model of Hurricane Ike, those staying with friends and family in the simulation traveled farthest, those choosing hotels go to larger cities, while those seeking public shelters will travel the least (Cuellar et al., 2009). Others estimate shelter use is about 13%, and ranges—for example: 1% for the Three Mile Island evacuation to 40+% in the Nanticoke hazardous materials evacuation (Sorensen and Sorensen, 2007). Authors agree evacuees often choose relatives, friends, or hotels, especially when more affluent or younger. Even if they don't stay with friends or relatives, in one study, it was found that most evacuees dropped their pets off with these social ties before evacuating (Nelson et al., 1989 via Sorensen and Sorensen, 2007).

ABOUT THE NEIGHBORHOOD CONNECTIVITY SURVEY

The Neighborhood Connectivity Survey (NCS) initiated in June, 2017 and has three waves. In summer 2017, 1,000 mailings were sent to the State College, PA area, including Philipsburg, Milesburg, Centre Hall, Bellefonte, and Boalsburg. In November, 2017, another 10,000 surveys were sent to Akron, OH, suburbs and surrounding areas of Kent, Ravenna and Barberton. By December, 2017, 471 surveys were available for quantitative analysis (Table 1). Currently, survey mailings are underway in Philadelphia, PA. These three cities are chosen in part because they are of interest to our research sponsor. Respondents were chosen randomly from a geographically-stratified sample of Census block groups that served as local centers of population density. NCS respondents were mailed or e-mailed a gift card or e-gift code for $5 for their responses. The survey takes about 30 minutes to complete.

The overarching goal of the NCS is to understand the geolocated topology of social ties and social support for households and individuals. The NCS survey instrument includes questions on the following topics: demographics, questions about local and distant social support, and questions on potential and actual connectivity patterns. on demographics such as household size, race, education level, age, gender, marital status, political preference and employment status. Questions were specifically posed on evacuation and vacation

homes (Figure 1). We use education level as a proxy for income (U.S. BLS, 2014) and refrain from asking about income to deter possible cultural offensiveness in the U.S.



⇒ Do you have a vacation home that you use? (e.g. cabin, timeshare, etc.)
- ❑ Yes, in this location: _____
- ❑ No

⇒ Do you know anyone with a vacation home you could use?
- ❑ Yes, in these locations: _____
- ❑ No

⇒ In the following scenarios, indicate where you would go:

Scenario	Location (Neighborhood, City, State) *EXAMPLE: Hyde Park, Chicago, IL*
If you had to evacuate the area for a week in response to an event that only affected your city.	
If you had to evacuate the area for two months in response to an event that only affected your city.	
If you had to leave the area indefinitely and did not know when you would be able to return.	

Figure 1. Graphical snippet of evacuation questions from NCS survey handbook. The questions are found on page 2 of the 10-page survey booklet. Respondents can also answer questions using an online form accessible by mobile phone or on a desktop/laptop computer.

Table 1. Number of Respondents per Geographic Group

Group	Respondents
Akron, Ohio	190
Exurban Akron ("Ex-Akron") (inc. Stow, Cuyahoga Falls, Kent, Ravenna, and Barberton)	135
State College, Pennsylvania	99
Exurban State College ("Ex-State College") (inc. Philipsburg, Centre Hall and Boalsburg)	47

INITIAL RESULTS

In this section, we report on initial results from our household surveys. This research is a work-in-progress, as we receive new responses daily, and are working to tabulate our findings.

Existence of Formal Plans

About 10% of the general population lacked a specific destination for a weeklong or two-month long evacuation, whereas these numbers were slightly higher for long-term relocation plans. 12.2% of Metropolitan Akron Area and 10% of Metropolitan State College Area respondents indicate that they do not have places to go when they need to evacuate for a week. As for evacuating for two months, 13.6% of people from Akron region and 9% of State College area respondents lacked a relocation destination. When being asked about evacuation indefinitely, there are 22% of people from the Akron area and 14% of people from State College suggest that they do not have a place for relocating if they had to evacuate the region.

Vacation Home Availability

The percentage of households that evacuate to a vacation home during emergencies is not clear. In some cases, such as Hurricane Sandy, vacation homes were a significant type of property that was destroyed. Yet, the prospect of staying in a second home is clearly helpful for evacuation security. Those without a college degree are least less likely to own a vacation home than the other sectors. However, in both areas the number of households that say they have a friend, family member, etc. whose place they can borrow is about three times the number who own a place. This indicates that although this population does not have access to their own second home, their social networks allow for them to perhaps stay at an alternative location. For those without a

college degree, in Akron, 8% have a vacation home and 25% can borrow a vacation home. In State College 12% have a vacation home, and 36% can borrow a vacation home.

Akron: 10% have a vacation home and 29% reported they could borrow a home. In State College, 9% owned a vacation home, and 18% said they could borrow a vacation home. This sector is lower than the others in terms of being able to borrow as a percent of ownership. Finally, for those with graduate level degrees, in Akron, 18% own a vacation home, and 32% can borrow a vacation home. In State College, graduate degree holders own a vacation home at the rate of 27% and can borrow at the rate of 37%.

Vacation home ownership at the levels of bachelor's degree and no degree were equally lowest regardless of locale (near 10%). Rates for borrowing were the highest for those with graduate degrees OR no degree in State College (over 35%). A graduate degree in State College is more likely to lead to vacation ownership than in Akron (27% vs 18%, respectively). Rates of borrowing ability are lowest for those which a bachelor's degree in State College (18%). These numbers do not seem to lead to major conclusions about place—but do indicate that people with lower income may still have social capital options for evacuation. However, in a time of emergency, this home may be being occupied by the friend homeowner, if their household is affected by the same emergency.

We are now conducting cross-tabulations of these records to divide the categories into categories of (Vacation Home/Contacts' Vacation Home). The results will be divided into Yes/Yes, Yes/No, No/Yes and No/No. This way, we will know whether those who have vacation homes already are those who also have friends with vacation homes, and isolate those with neither option.

Locations of Evacuation Plans

Destinations of respondents from both the Akron area and State College area were reported. In summary, Urbanites of State College are focused toward Eastern Pennsylvania, whereas Akronites have less clear patterns, but also choose to stay nearby or go to the Carolinas. Center cities such as Akron and State College show a stronger tie to their surrounding cities if people need to evacuate their places (Figure 2). People from Ex-Akron regions, such as Cuyahoga Falls, Stow, Kent, and etc., tend to choose to move to Akron when evacuation is needed. Similarly, People from Ex-State College, such as Philipsburg, Bellefonte, and etc., prefer to relocate to State College if needed. Besides evacuate to places close to Akron, people from Akron are also more likely to relocate to places in the Southeast, such as Charlotte, SC, and Florida. Another direction is moving to mid-west cities, such as Chicago, IL. Moreover, most people from State College tend to relocate to the east of Pennsylvania.

For the duration of two months, Akron and State College as the centers of these two areas are the main target destinations for people in those areas to move to (Figure 3). Most People from Ex-Akron still choose to go to places that are close to Akron. People from Ex-State College also tend to go to State College. We can also notice that there are more locations to the south of Pennsylvania that people would choose to move to for emergency. Destinations of people from Akron show a larger span spatially.

Regarding indefinite movement, we can notice the distribution of locations is spreading out spatially comparing to shorter durations of time (Figure 4). Locations are not densely clustered in Akron or State College, even though they are chosen by many nearby residents. Respondents from the Akron region are more likely to move to southeast states during indefinite evacuation However, most people from State College still prefer to go to places in the Northeast Megalopolis region, although there are several records located in the Florida. Indefinite evacuation plans illustrate that Ex-Akronites will also be more to choose locations in the Carolinas, whereas Ex-State College residents still remain near their hometown.

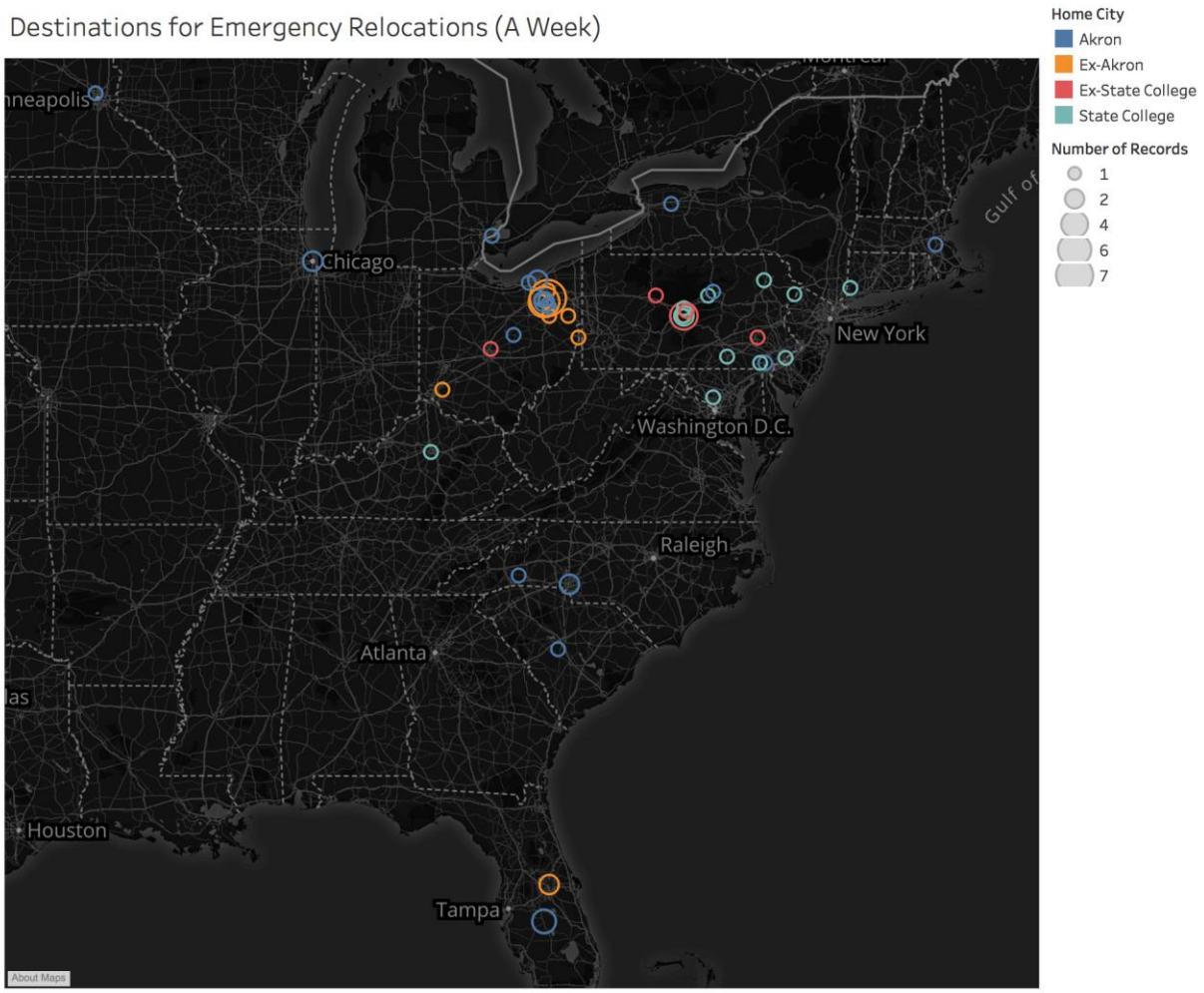


Figure 2. Chosen destinations for emergency relocations for one week by residential locale (map focused on the Eastern U.S.). The sizes of circles indicate the number that people mentioned this location while color represents the different types of residential locales.

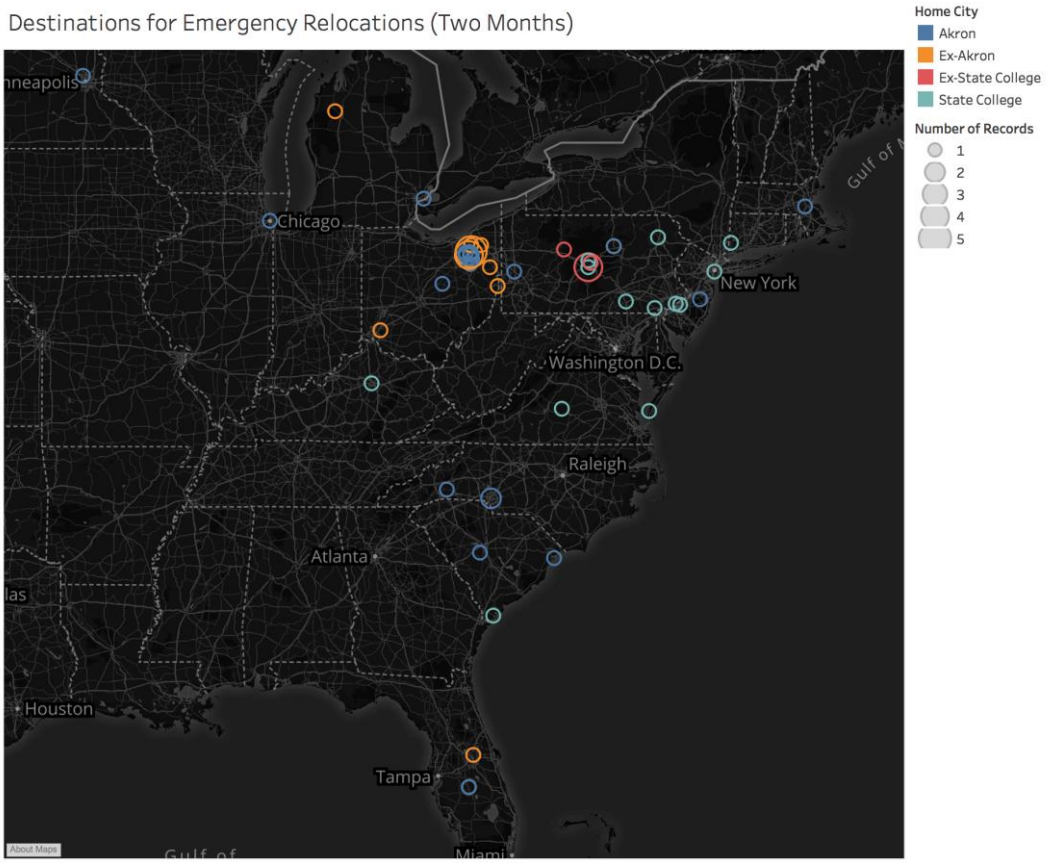


Figure 3. Chosen destinations for emergency relocations for two months (map focused on the Eastern U.S.).

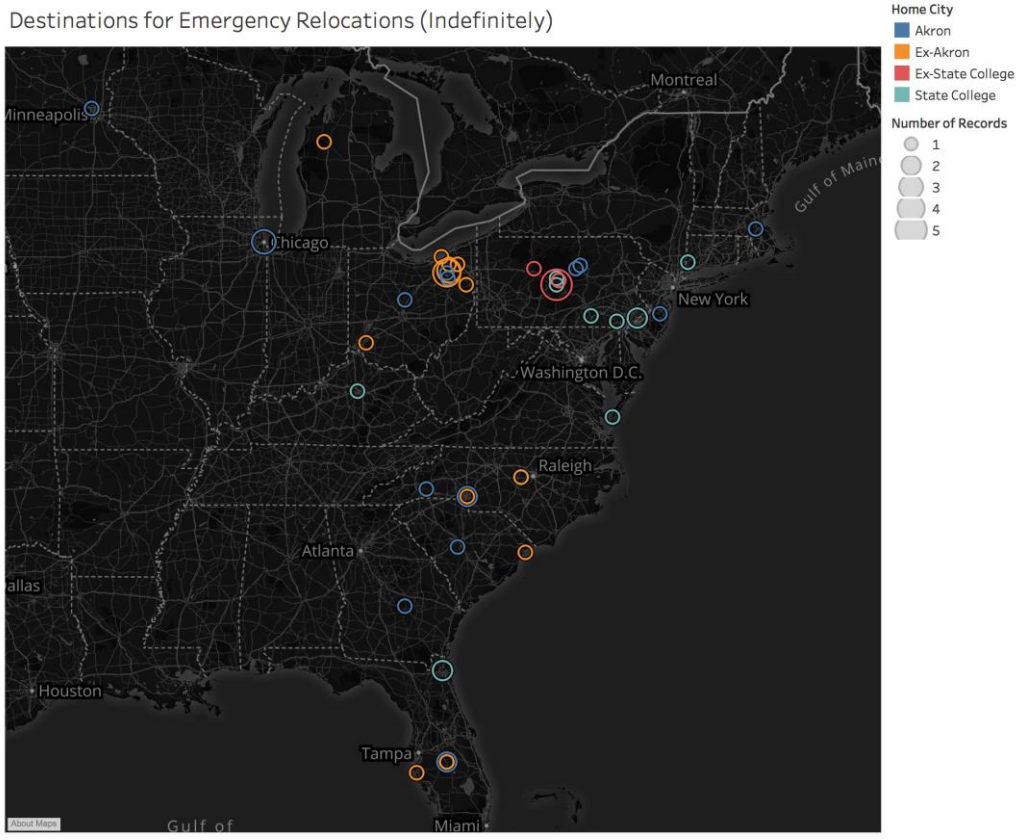


Figure 4. Chosen destinations for emergency relocations for an indefinite time period (map focused on the Eastern

U.S.).

Distance Summaries of Relocation Plans

We also compute the mean distance for each location type and visualize the differences below (Figures 5 and 6). Although there are dissimilarities between location time, the statistical differences for these values are not well-delineated. We also find that there is a variety of distances for each group, raising the standard deviation to higher values. Notably, the rural Pennsylvania contingent remains the most consistently local in their responses.

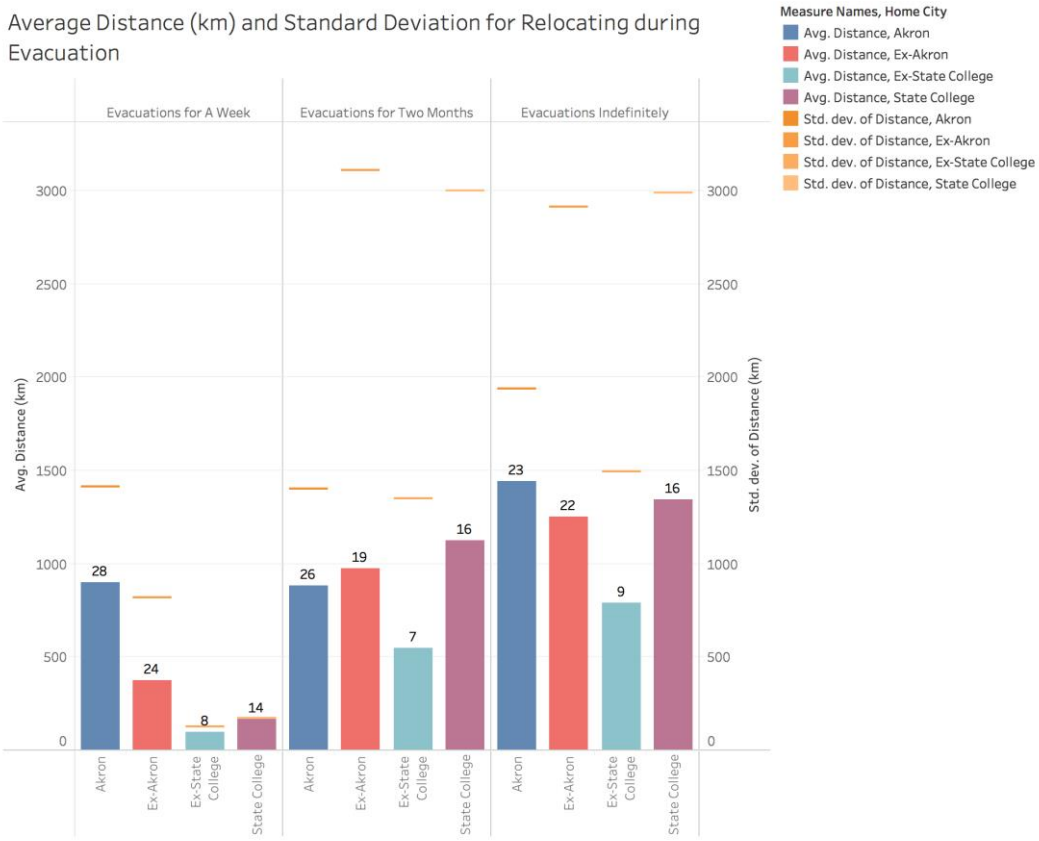


Figure 5. With longer evacuation time, respondents choose farther destinations. State College residents tend to have local plans for a week-long evacuation period. Akronites tend to have the most distant plans for evacuation at any range, although this difference is not statistically-different.

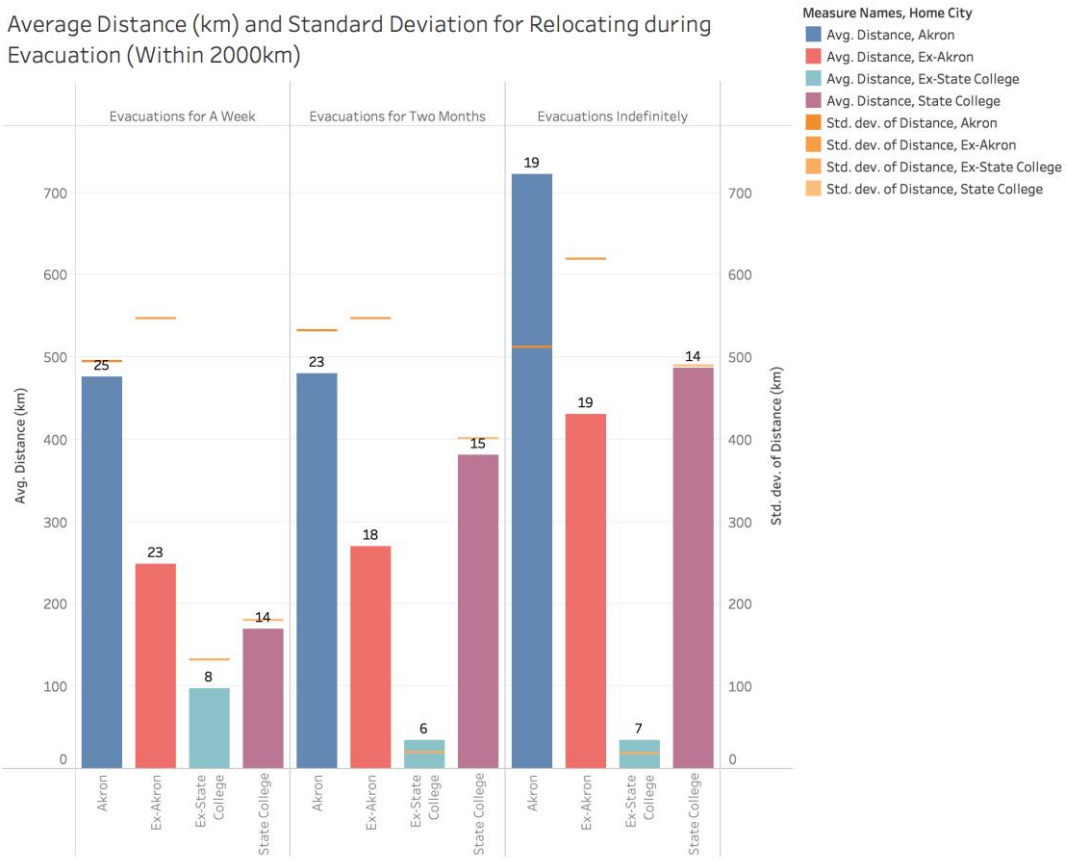


Figure 6 This chart filters out outliers of (2000+ km) to show a greater disparity in the rural Pennsylvania (Ex-State College) areas than other regions. Respondents from these towns reported that they would locate somewhere nearby more often than other respondents. Responders may put more emphasis on relocation efforts for these places, as they may lack choices outside the region.

RESEARCH CHALLENGES AND IMPROVEMENTS

We are currently working to create knowledge about why certain locations were chosen. The survey also has information on vacation home locations but also the locations of friends and families, locations of travel, and locations of past residences. Using text mining, we match these locations to those reported for evacuation to see where intersections occur. These results will reveal the level of social attachment to that place. The survey can be reworded in the future to ask respondents tell us why they were evacuating to these locations to remove this 'guesswork'.

Race has not been examined thus far because there is very little variation in responses in terms of race. Our research in Philadelphia is underway. Surveys were sent January 2018 to 10,000 households in the city. This survey is particularly interesting because we hope to solicit more responses from African American (AA) and Hispanic households than we were able to obtain in the Akron and State College surveys.

The geographic distinctions presented here were insufficient for an understanding of how population density and level of urbanization may affect evacuation choices. In future work, we will isolate similar towns in the Akron area to better match the rural areas in the State College area. Currently, Ex-Akron includes the college town of Kent, and the suburbs of Cuyahoga Falls and Stow, which act like the State College region in demographic makeup and income levels. We will then include Ravenna and Barberton as external to Akron as they are small towns with their own Main Streets and centers.

Another drawback of this research is the decision of the three time frames where we asked for information. One week was chosen to mimic a short vacation. In larger disasters, more time is needed: Miami took three weeks to return to a "normal business schedule following Hurricane Andrew (Yelvington 1997). Two months was chosen based on previous literature that illustrated how tent cities were closed two months after the Hurricane Andrew (Yelvington 1997). We also considered this a manageable time frame in terms of being able to pay rent, utility

bills or mortgages without reaping the benefits of living in this location. Longer than two months would mimic the upkeep of a second home, which is out of reach for most people. Indefinite relocation is a well-documented phenomenon in emergency situations (Hunter, Luna and Norton, 2015).

CONCLUSIONS

Our early results are visual in nature but suggest differences between different locales / demographics and their security in having a place of relocation. In addition, we describe these locations and find out how they differ based on city of origin. This type of research can help us understand how geolocated social networks are activated in emergency situations. From our sample of 471 records from the Neighborhood Community Survey, we find that chosen destinations are more local for those living outside of their anchor city, that about 10% of householders do not have an idea of where they might go, and that about twice as many people who have vacation homes can borrow a vacation home. Our future theoretical goals are to link these choices to the locations of social ties to better understand the role of friends and family in destination choice. We look forward to analyzing more of our incoming Akron data and finding results for the Philadelphia, PA area. The generalizability of these results, of course, will be an issue. However, case study research (ex. Hurricane Andrew, the Chicago Heat Wave and Hurricane Katrina (Morrow, 1996; Elliott and Pais 2006; Klinenberg, 2015) in evacuation and emergency management has successfully led to many valuable lessons.

ACKNOWLEDGMENTS

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