"Disaster in Kansas": The Tornado in Greensburg

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Abstract

On May 4, 2007, a 1.5 mile wide Category F-5 tornado, with winds estimated at 205 miles per hour, destroyed 95% of the southwestern Kansas town of Greensburg. Utilizing data collected from in-person and telephone surveys of 63 Greensburg tornado survivors, this paper investigates the emergency responses undertaken in the aftermath of this extreme event. Specifically this paper examines the search and rescue operations, emergency supplies and medical care (including mental health counseling), debris removal, and the provision of temporary shelter for tornado victims. Given the extent of the tornado's destruction of commercial and residential buildings in Greensburg, information on the prospect of rebuilding was also collected from victims and other relevant private and public agencies, and individuals. Analysis of the survey data reveals that overwhelming majority of the respondents expressed their satisfaction with the emergency responses. But most of them maintain that rebuilding and reconstruction of Greensburg is progressing slowly, which may hurt its recovery. Another potential barrier for recovery is the plan of the city government to turn Greensburg into Green Town.

Introduction

On the evening of May 4, 2007, a 1.5 mile wide Category F-5 tornado hit the southwestern Kansas town of Greensburg. With winds estimated at 205 miles per hour, the tornado destroyed 95 percent of this farming community of 1,500 people (Figure 1 and Picture 1). Although a 30-minute advance warning allowed residents of this town a chance to seek shelter in storm, 13 people died from this tornado, 10 of whom were Greensburg residents. Without this advance warning, the deaths associated with this tornado would have been much higher.

However, almost all survivors of this tornado in Greensburg lost their homes and most of their possessions. The next morning, May 5th, homeless Greensburg residents were asked to leave town and take temporary refuge in public shelters opened for them in neighboring towns, or with their relatives and friends. Victims had limited access until May 7, 2007 to retrieve any salvageable belongings. Access was controlled given concerns about looting and complete disruption of water and electricity, but also because of the dangerous cleanup conditions - - including leaking hazardous chemicals. In addition to household residences, the tornado destroyed the institutions of the town including its churches, schools, hospital, and Main Street retail establishments.

There have been both public sector and non-governmental responses to this disaster. Local law enforcement officers were among the initial responders, which included the Kansas National Guard, the Department of Transportation, and the Highway Patrol. Kansas Governor Kathleen Sebelius and U.S. Senator Sam Brownback have both toured Greensburg. Further, immediately after the tornado, the Kansas Department of Social and Rehabilitation Services office in Pratt was taking applications for people who needed emergency assistance in the form

of food stamps. At the federal level, President Bush declared parts of Kansas a disaster area on May 6, 2007. This made federal funding available for tornado victims of Greensburg, which included grants for temporary housing and home repairs, low-cost loans to cover uninsured property losses, and other programs to help individuals and business owners recover from the effects of this disaster.

President Bush visited Greensburg on May 9, 2007. The Federal Emergency Management Administration (FEMA) ordered trailers to house the displaced. Federal funding is also available to state and eligible local governments and certain private nonprofit organizations, on a cost-sharing basis, for emergency work and the repair or replacement of facilities damaged by the severe storms, tornadoes, and flooding in Kiowa County. In addition to government responses to the Greensburg disaster, non-governmental organizations such as the American Red Cross, the Salvation Army, and the United Way have provided relief assistance.

Objectives

The main objectives of this research project were to:

(i) Explore the nature and extent of public and private emergency responses undertaken in Greensburg following the devastating tornado of May 4, 2007, and

(ii) Gain an understanding regarding the prospects for recovery and rehabilitation of the tornado victims.

In the context of emergency response, interest here was on search and rescue operations undertaken at various levels and by different agencies and individuals for Greensburg tornado survivors. In addition, emergency medical care for the injured and other victims of this disaster, removal of debris, and the provision of temporary shelter was investigated. We posited that emergency response for the Greensburg tornado would have been a challenging task for several

reasons. Unlike most tornado disasters, the Greensburg tornado demolished about 95 percent of the town, including its downtown. Additionally emergency response efforts were hampered by bad weather, which persisted for about two days following the tornado.

As noted, most victims of this tornado were evacuated from Greensburg and had limited access to the town. These situations make emergency response for the Greensburg tornado different from tornado responses undertaken for most similar communities. This unique situation will make this study especially useful for the many agencies, at different levels of government, who were involved in the emergency response, and for others -- such as disaster managers and planners.

The researchers thought that recovery and rehabilitation of tornado victims of Greensburg would be a difficult task both for city authorities, and other relevant public agency personnel. Natural disasters often generate both large and small-scale migrations of people away from affected areas (see, Blaikie et al. 1994; Paul 2005; Smith and Ward 1998). For example, Spencer, a small town of 320 people in South Dakota, was impacted by a tornado in 1998, causing damage to about 84 percent of its 186 buildings. By 2000, only around one-half of its former residents had returned (Cross 2001). Another tornado devastated parts of residential neighborhoods of Hoisington, a town of approximately 3,000 people in central Kansas in 2001. A study by Brock and Paul (2003) reported that some 70 families migrated from this community because of the 2000 tornado.

We suspected that because of the extent of devastation, many Greensburg tornado victims would not return and rebuild until adequate financial and other incentives were provided. It is always difficult to rebuild a community when an extreme natural event destroys its downtown area – the core of most small to medium-sized communities (Brock and Paul 2003). We were

interested in observing how Greensburg rebuilds in the future. In this project we will shed some light regarding the prospects of such rebuilding through information and opinions collected from victims, emergency responders, and other relevant agencies and individuals.

Research Design

Data Collection Procedures

Data for this research was collected from both primary and secondary sources. To accomplish both objectives of this study, relevant information was collected from participating responders and tornado victims through an open-ended structured questionnaire. The questionnaire used to collect information from the respondents included 44 questions (Appendix 1). Thirty-eight questions were asked to gather information on various aspects of emergency response, such as search and rescue operations, emergency medical care received (including mental health counseling), debris removal, temporary sheltering options, and rebuilding efforts. Six demographic and socio-economic questions were included to collect information on the respondents' gender, age, marital status, educational attainment, employment status, and annual household income.

Nine questions were asked to record respondent level of satisfaction with search and rescue operations, emergency medical care provided, mental health counseling delivered, debris removal operations, public sheltering options available, and emergency supplies provided by external sources as well as overall emergency response. For all opinion-related questions, a 1 to 5 Likert scale, where 1 signifies highly dissatisfied and 5 highly satisfied, was used to record responses. A score of 3 infers the respondent was neither particularly dissatisfied nor satisfied.

In order to interview as many tornado victims as possible, we conducted in-person as

well as phone interviews. Phone interviews were necessary because an overwhelming majority of tornado victims were (and still are) living outside Greensburg, and many of them were not present in Greensburg at the time of the person-to-person interviews. We visited Greensburg three times between May 31, 2007 and October 6, 2007 in order to administer the questionnaire surveys in person, as well as to observe the destruction and progress toward rebuilding of the town.

Another important purpose of these visits to Greensburg was to gather information on the victims' personal experiences, their opinions regarding emergency response and rebuilding efforts, and other pertinent information from community leaders, emergency officials, private constructors, and members of volunteer groups helping tornado victims cope with impacts of this devastating tornado, and assisting in relief and debris removal. We also communicated with a number of government officials and workers from cities and communities around the state, as well as other tornado victims.

As noted, in addition to face-to-face interviews, phone interviews were also conducted. After many failed attempts, we were able to obtain telephone numbers of considerable number of tornado victims from a Greensburg city employee. In the course of an interview, the city employee indicated that a cell phone list of many people who had previously lived in Greensburg had been disseminated at a previous public meeting. At the time of this interview, the employee did not a copy on hand, but later faxed it to us. Though we now had this list, we were not able to interview all of them because of schedule conflicts, unwillingness of some victims to participate in telephone interviews, and other reasons. In all, we received a total of 63 properly completed questionnaires. Reports published in electronic and print media about the Greensburg tornado were also regularly monitored and provided valuable information and insight regarding

rehabilitation and rebuilding efforts for the town.

Characteristics of the Respondents

Table 1 presents demographic and socio-economic characteristics of the respondents. The table shows that the majority of respondents were male (70%). This is a result of the demographics of the people at the survey site at the time that the face-to-face interviews were conducted. The interviews were conducted during the daylight hours when most of the respondents were working or cleaning up debris outside their homes along with their friends and relatives. It was apparent to researchers that more men were involved in clearing debris from damaged homes and property than women. Additionally, when both husband and wife were present at the interview site, despite our requests, wives almost invariably asked their husbands to complete the interview.

More than three-fourths of all respondents were married at the time the questionnaire survey was administered (Table 1). Slightly over 17% were single and the remaining respondents were either divorced or widowed. Nearly 21% of all respondents were under 37 years of age and those over 64 accounted for slightly over 19% of all respondents. Table 1 shows that nearly 56% were between the ages of 37-55. As shown in the table, the level of education of the respondents was categorized into four classes. Nearly half of the respondents attended some college, but did not receive a college degree. Slightly over 19% of all respondents had received their high school degree.

Nearly three-fourths of all respondents were employed and only 6.35% were unemployed at the time the survey was conducted (Table 1). Nearly 16% of all respondents were retired. Table 1 shows that modal annual household income was between $20,000 and $39,999. Only eight respondents (12.70%) reported income over $59,999 and 12 (19.05%) less than $20,000.

All socio-economic and demographic characteristics of the respondents surveyed suggest that they represent a cross-section of residents of Greensburg, Kansas.

Results

According to damage estimates reported by 50 of the 63 respondents, losses incurred by the 2007 Greensburg tornado amounted to over $9 million. This figure represents an average loss of $181,860 per respondent household, although reported damage estimates ranged from $8,000 to $700,000. Half of all respondents reported experiencing damage ranging from $100,000 and $200,000, 18% experienced more that $200,000 damage, and 32% experienced less than $100,000 damage. With the exception of two survey respondents, this tornado completely destroyed the homes of all other respondents. These two respondents, who reported damage between $8,000 and $15,000, experienced only partial damage to their homes probably because these homes were located in the southwestern portion of Greensburg, which was not in the direct path of the tornado. In addition to homes, the tornado also damaged vehicles, uprooted trees and utility poles, and destroyed almost all belongings and household goods.

Analysis of the survey data reveals that 60 of the 63 respondents (95.24%) received emergency supplies for their family from external sources during the post-tornado period. Public and private agencies, such as FEMA, the Salvation Army, the American Red Cross (ARC), as well as numerous church groups and volunteer organizations provided emergency assistance to tornado victims of Greensburg. Types of support received by victims from the four major aid providers included: food, drinking water, clothing, cash, vouchers, rental assistance, cleaning supplies, medicine, and counseling. All respondents received support from three to four major sources. Ninety percent of all respondents who received emergency assistance reported that they

were highly satisfied with the aid they received from external sources.

Only ten respondents (15.87%) reported tornado-related injuries in their households. One respondent reported two injuries in his family including the family dog; the remaining respondents reported only one injury in each one of their households. All injuries reported were minor and caused by flying debris. The absence of fatalities and the relatively low number of injuries were the result of a tornado warning, which was issued 30 minutes in advance of this tornado. This timely warning provided ample opportunity to seek and obtain safe shelter. All respondents were home when the tornado warning was issued and after receiving the warning, all respondents took shelter in their basements. No respondents reported going outside in order to see the tornado and/or to visually verify the threat before taking shelter. This implies that the tornado warning was taken seriously by residents of Greensburg on May 4, 2007.

Emergency Response

Although emergency response refers to all actions taken immediately before, during, and after a disaster occurs in an effort to save lives, minimize damage to property, and enhance the effectiveness of recovery, it is generally more narrowly defined to include the actions taken immediately after the occurrence of a disaster (Mitchell and Cutter 1997). Emergency responses are disaster-specific. In the context of tornados, such actions undertaken immediately after its occurrence include: search and rescue operations for survivors, emergency medical care for the injured, provision of mental health counseling and temporary shelter, and debris removal. Other typical responses, such as the disposition of dead bodies, and the provision of security for victims and their property, were not included in this study.

Search and Rescue Operations: All respondents were asked whether they and/or any member of their family participated in search and rescue operations during the post-tornado period. Slightly

over 68% of all respondents answered this question affirmatively. Twelve (27.91%) of the 43 respondents who participated in the search and rescue operations joined the operations immediately after the tornado left Greensburg. Another 12 respondents joined within an hour, and the remaining 19 joined some time after one hour of the tornado's passage. Conversations with a considerable number of respondents revealed that most of the respondents of the last category were not able to join rescue operations immediately after the tornado, because they first had to rescue and/or attend to the needs of members of their own families, and then to others, such as neighbors and relatives.

Twenty (32%) of the 63 respondents did not participate in search and rescue operations. A close examination of the survey data reveals that there is a strong association between not participating in the operations, and gender and age of the respondents. Eleven of the 19 female respondents (58%) included in this study did not participate in the search and rescue operations after the tornado in Greensburg. Similarly, 10 of the 12 respondents (83%) who were over 64 years of age did not join in the rescue operations. Several of these elderly men and women were injured, which made them unable to participate in such activities.

Among all respondents who participated in search and rescue operations, nearly 42% of them spent less than five hours in such operations. Approximately 47% spent between 5 and 10 hours, while the remaining 11% spent more than 10 hours of their time assisting in emergency operations. On average, respondents spent 6 hours of their time in search and rescue operations. Such operations started immediately after the tornado and lasted until the respondents were asked to leave Greensburg. In addition to tornado victims and local Police, and Fire Department personnel, many individuals and organizations from neighboring towns, such as the Kansas National Guard, Kansas Department of Transportation personnel, the Kansas Highway Patrol, the Salvation Army, and

numerous Fire Department personnel began search and rescue missions soon after the tornado moved through Greensburg.

Respondents were asked to express their satisfaction with overall search and rescue operations undertaken in Greensburg by external sources as well as by local police and fire department personnel using a five-point Likert Scale. The average score was 4.67, indicating the vast majority of respondents were very satisfied with the way search and rescue operations were undertaken. As can be seen from Table 2, 45 (71.43%) of the 63 respondents reported that they were very satisfied with the rescue operations.

Only one respondent indicated s/he was neither satisfied nor dissatisfied, and another reported that s/he was not satisfied with search and rescue operations. According to this respondent, operations progressed slowly and an adequate number of people were not involved in the operations. However, the overwhelming majority of respondents believed that operations were very well organized, implemented well, and began in a timely manner. One respondent indicated that there was lack of communication among participating organizations and many individuals assisting operations lacked appropriate search and rescue training.

Emergency Medical Care: In addition to causing fatalities, tornados also injure people. Both deaths and injuries are caused by falling roofs, walls, uprooted trees, and flying debris. Fortunately, only 10 people were injured in the Greensburg tornado and needed emergency medical care. Four people had to be transported to the Pratt Hospital and all of them suffered injuries due to a broken neck. The remaining six people sustained minor injuries such as small cuts. The survey data reveals that more female and elderly were injured than male and non-elderly people.

All ten respondents expressed their satisfaction with emergency medical care provided for any injured member of a respondent's family (Table 2). Respondents were also asked to report their

satisfaction with the way emergency medical care was delivered in Greensburg during the post-tornado period. Five respondents did not report their satisfaction level. Forty (71.43%) of the 56 reporting respondents indicated that they were very satisfied with emergency medical care delivered in Greensburg after the tornado (Table 2). Only four respondents (7.14%) indicated they were neither satisfied nor dissatisfied. The mean score is 4.79, which indicates that the respondents, as a group, were very satisfied with the emergency medical care delivered in Greensburg.

Respondents were generally satisfied with emergency medical care for several reasons. An overwhelming majority of the respondents surveyed claim that the medical services provided were adequate, timely, and well coordinated. However, several respondents reported that services available were much more than what they needed. For example, they reported too many ambulances available immediately after the tornado hit the town and about half were not necessary. These ambulances came from neighboring towns - - as far as Wichita, located 110 miles east of Greensburg. In contrast, four respondents maintain that more help was needed. These respondents also claim that not enough physicians were available for providing emergency medical care to tornado victims in Greensburg.

Mental Health Counseling: Disaster survivors often face post-traumatic stress and depression, and thus need mental health counseling. The questionnaire survey reveals that only five respondents needed such counseling. One respondent mentioned that his job required health counseling for his father. Respondents were mixed about the level of satisfaction they expressed with mental health counseling delivered to members of their families during post-tornado period (Table 2).

Respondents were also asked to report their satisfaction level with mental health counseling delivered in Greensburg; thirty (47.62%) of the 63 respondents expressed their satisfaction. The average score is 4.53, indicating that the respondents, in general, were satisfied with the mental

health counseling provided in Greensburg (Table 2). Almost all respondents who expressed their level of satisfaction maintained that the services provided by health counselors were commendable. Only one respondent claims that the number of counselors was inadequate, and as a consequence, tornado survivors had to wait in order to receive mental health counseling. This individual questioned why this the case since the home office of the Iroquois Center for Human Development, a non-profit community mental health center serving Clark, Comanche, Edwards, and Kiowa counties, is located in Greensburg.

Debris Removal: More than two dozen public and private organizations, such as the Kansas National Guard, the Kansas Highway Patrol, FEMA, the Salvation Army, USDA Forest Service, and various county agencies began clean-up operations soon after the tornado. Tornado survivors, neighboring ranchers and farmers, and people from nearby towns also helped in clearing streets. However, it took more than five months to clear nearly all of the debris. All but seven respondents participated in debris removal efforts. Ill health and advanced age were the primary reasons given by these seven respondents for their non-involvement in clearing operations. Respondents who participated in debris clearing operations removed their own debris first, and then joined others to help clean streets and public places.

On average, each participating respondent spent nine days searching for personal belongings through debris on their property or on streets and in assisting others in debris removal. However, many were not involved in this task in a continuous manner; whenever they had time they came to Greensburg to remove debris on their property or elsewhere. Time spent on clearing debris varied among respondents from one day to up to two months, even more for some. At the time of our last visit, seven respondents were still clearing debris close to their home. In addition, personnel from several private construction companies also participated in removing debris from Greensburg.

Respondents were asked to express their satisfaction with the debris removal operation undertaken in Greensburg by sources other than from tornado survivors. Fifty-nine (93.65%) of the 63 respondents reported their level of satisfaction using the five-point Likert Scale. The average score was 4.78, indicating the vast majority of respondents were satisfied with debris removal operations (Table 2). Fifty respondents (84.75%) indicated they were very satisfied with the debris removal operation. According to them, all individuals and agencies involved in the operation did an excellent job. They were quick, efficient, and genuinely sincere. One respondent, however, noted that there was not enough heavy equipment to haul off removed materials. Another respondent said that: "there was a lot of volunteers, which created some coordination problem."

Location and Nature of Temporary Accommodations: As indicated, almost all of the residents of Greensburg were forced to leave the town within 12 hours after the Category F-5 tornado demolished about 95 percent of its structures. Evacuees had only limited access to their damaged residences for some time. All respondents were asked to report (in chronological order by number of days) all the locations they had used and/or were still living in, after the tornado destroyed their former residences. Thirty-nine of the 63 respondents (61.91%) reported that they had stayed at two different places – including their current location -- at the time of the questionnaire survey was administered. Thirteen respondents (20.64%) indicated they had lived in three different places (including their current location) and only one respondent indicated living in four different places since this tornado

ravaged Greensburg (Table 3).

As many as 54 of the 63 respondents (85.71%) used private means for their first temporary accommodations, consisting of the dwellings of relatives and friends, hotels/motels, private trailers, and other homes. It is important to note that the use of private dwellings is important as it reduces

the need for public shelters. Among the private accommodations sought by respondents, the most popular choice was residences of relatives, followed by hotels/motels (Table 3). Nearly 43% of all respondents sought refuge in the dwellings of relatives after they were forced to evacuate their destroyed/damaged homes (Table 3). Among relatives, most respondents indicated they stayed with their parents and/or sons and daughters. Table 3 shows that two respondents did not evacuate because their residences were located at the edge of the tornado-impacted area and were not completely destroyed by the tornado. In addition, two respondents used their own mobile homes as shelters after placing them outside the Greensburg city limits.

Figure 2 shows the location of shelters where respondents took refuge immediately after they were asked to leave Greensburg. Only 23 (36.51%) of all respondents specified their evacuation location and, based on their reported information, they went to 10 towns and cities for temporary shelter. An overwhelming majority of respondents chose to seek temporary shelter within a 50 mile radius of Greensburg (Figure 2). This includes nine residents who went to stay in public shelters located in Haviland, Mullinville, and Bucklin. The largest number of evacuees went to Haviland, followed by Pratt, and then Mullinville. Sixteen respondents stayed in hotels and motels, but they did not specify the location of these accommodations. Most respondents who reported temporarily residing in hotels/motels were likely in Pratt.

Only nine respondents (14.29%) opted for residing in public shelters, temporarily organized by both public and private agencies such as the American Red Cross and the Salvation Army in the neighboring towns of Haviland, Mullinville, and Bucklin (Figure 2). Designating public buildings, such as school buildings and hospitals as public shelter, emergency managers provided temporary accommodations for the tornado victims of Greensburg. It appears from the above discussion that private shelters were more popular among tornado evacuees than public shelters, and this may

explained in a number of ways. Evacuees often perceive that they are safer and more familiar with their friends and relatives than with strangers encountered in public shelters. Eight respondents complained that authorities were slow to set up designated public shelters after the tornado passed through Greensburg. Available studies (e.g., Charnkol and Tanaboriboon 2006) suggest that socio-economic factors and shelter attributes are the primary determinants of the destination choices of evacuees forced from their domiciles due to an evacuation order.

Regarding the duration of stay at their first temporary shelter, an overwhelming majority of respondents found accommodations in hotels/motels and public shelters – and were there for several days before moving in with friends, relatives, or to apartments/houses either as renters or owners. Duration of stay was longest for those who found accommodations with friends and relatives. At the time of the survey, as many as 41 respondents (65.08%) were still living with their relatives and friends. While away, most respondents returned periodically to Greensburg at least until July 2007 to clear rubble and collect emergency relief assistance, if available. The above mentioned circumstances are likely the reason many survey respondents stayed close to Greensburg.

Table 3 suggests that a smaller number of respondents used dwellings of their relatives and friends as a second shelter compared to their use as their first shelter. The same is also true for hotel/motel usage among Greensburg evacuees. This behavior can likely be attributed to two reasons. After staying in aforementioned shelter types, some respondents opted to use private trailers for shelter. And within a month of the May 4, 2007 tornado, FEMA established temporary mobile homes in an area in Pratt and later in Greensburg. Now there is only one FEMA trailer park located in the southeastern part of Greensburg, which is known locally as 'FEMAville' where about 430 people currently live (Picture 2). FEMA-provided mobile homes are relatively spacious. Additionally for the first 18 months in the FEMA Greensburg trailer park, residents will not be

charged rent. However, if FEMAville residents' home insurance policies had a Cost of Living Allowance (COLA) benefit, then residents are charged that amount for the mobile home. Thus for the first 18 months, residents pay only for utilities, not rent, out of pocket. This arrangement likely led a number of respondents to opt to live in such shelters – at least on a temporary basis. After 18 months up until the time the mobile homes are removed from the private property FEMA is renting, residents who chose to stay in the homes will be charged market rates for rent.

Table 4 presents information on the type of shelters respondents were using at the time of questionnaire survey and/or telephone interviews. Since the survey and interviews lasted for more than four months (May through October 2007), some changes surely occurred in current respondent accommodations. However, the information presented in Table 2 will provide some indication about whether respondents will rebuild their homes in Greensburg. Table 2 clearly reveals that nearly two-thirds of all respondents were living with friends or relatives at the time of the face-to-face and/or telephone interviews. Since most respondents are living within a 50 mile radius of Greensburg, it is logical to assume that they may be willing to return to Greensburg, if adequate incentives are provided.

Table 4 further shows that no one mentioned hotels/hotels as their shelters. Nearly 16% respondents were living in FEMA mobile homes at the time interviews were conducted. Two respondents were living in mobile homes on private land outside the Greensburg city limits. These are positive signs for rebuilding in Greensburg. There are however, also discouraging signs, which suggests that not all respondents will return to the town. Three respondents bought houses away from Greensburg – one at Medicine Lodge, and the other two in Pratt and Bucklin, respectively. Two people were living in relatively distant cities – one in Wichita and the other one in Hays. Conversations with several respondents who were living in the Greensburg FEMA mobile home

park, do not intend to rebuild; they were living there because of the low cost (i.e., no rent, only utilities).

Irrespective of their sheltering status, all respondents were asked to express their level of satisfaction with public sheltering options available to tornado victims of Greensburg. It is worth noting that school buildings in Mullinvile, Haviland, and Bucklin were designated as public shelters after the tornado hit Greensburg. After couple of days, FEMA mobile homes, located in Pratt and Bucklin, were opened as public shelters. When FEMA finally opened a mobile home park in Greensburg, the public shelter options available in neighboring towns closed.

The questionnaire survey reveals that 51 of the 63 respondents (80.95%) expressed their level of satisfaction with the public sheltering options available to Greensburg tornado victims (Table 2). Among respondents who expressed their level of satisfaction, slightly over 88% reported that they were either highly satisfied, or at least satisfied with public sheltering options available to them. A considerable number of respondents mentioned that public shelters were small -- but clean, safe, and comfortable, particularly the FEMA mobile homes. Personnel responsible for managing public shelters established in schools did an excellent job in providing quality care for tornado victims. There was plenty of food and water, and local people were very hospitable. However, half a dozen respondents expressed concern that the schools had to suspend normal operations for use as public shelters. These respondents also complained that there were limited options for accommodation in public shelters. One indicated that kennels were not set up with the facilities, which was a problem since dogs were not allowed inside the public shelters. Further, they indicated they did not know where their friends went to take refuge, and that such information would have been very helpful to them.

Overall Emergency Response: Almost all respondents surveyed sincerely believe that the overall

emergency response undertaken in Greensburg was timely, adequate, and effective. Given the level of satisfaction with each activity of emergency response included in Table 2, this finding is not unexpected. Seven respondents mentioned that the emergency response was more than adequate since many ambulances came as far as Wichita to rescue tornado survivors immediately after the tornado struck the town. Half of these available ambulances were not used. However, the respondents suspected that without timely, adequate, and effective response, more deaths would have occurred in Greensburg.

Figure 3 illustrates respondent satisfaction level with the overall emergency response undertaken in Greensburg. Forty-three (68.25%) of the 63 respondents reported that they were highly satisfied and another 18 (28.57%) were satisfied with all emergency activities undertaken in the town. This finding is consistent with respondent satisfaction levels reported earlier. However, one respondent noted a lack of communication among responders. This is not unexpected because numerous individuals and agencies from different parts of Kansas and even the United States were involved in providing emergency services to Greensburg tornado victims. Despite some minor shortcomings, it is evident from questionnaire surveys, and conversations with tornado victims and other relevant personnel that the emergency response operations in Greensburg proceeded smoothly and extremely well.

Prospect of Recovery and Rehabilitation

As noted in the sub-section on location and nature of temporary accommodations, a significant number of Greensburg tornado victims are currently living in nearby towns. This implies that given the right opportunity and/or incentive(s), they might be willing to rebuild in Greensburg. This notion was also reflected when respondents were asked whether they are rebuilding or intend to rebuild their home in Greensburg. Fifty (79.37%) of the 63 respondents indicated their intention

to rebuild, while only six respondents (9.52%) did not want to rebuild in Greensburg. One of these six respondents did not want to rebuild his/her home. Rather this individual opted to live in a rented house. Three respondents have already bought homes in neighboring towns. The remaining two respondents had hoped to live in the local retirement center. Seven respondents (11.11%) were not sure at the time the survey was conducted whether they would resettle in Greensburg or not. A few who rented indicated that while they hoped to stay, it would ultimately depend on the decisions of landlords and whether the rental properties "come back".

Much uncertainty exists over whether to rebuild or not. For one respondent, this decision will depend on "what will evolve in town". She was concerned that five months after the tornado, there were limited services (i.e., medical supplies, restaurants, stores). For many other homeowners, the gap between what they receive in insurance payments and the costs of building new homes may be prohibitive. Given the age of the housing stock, the average Greensburg home was valued at $46,500. In contrast, the estimated cost for site work and building a new 1,300 square foot, three bedroom, two bathroom home is $140,000 (Hall 2007). Financial circumstances may drive Greensburg residents to purchase older, modestly priced homes in nearby communities rather than rebuilding in town. Likewise, the cost of rebuilding rental properties will translate into higher rents. Two hundred properties (duplexes, triplexes and single-family homes) were destroyed by the Greensburg tornado. It is estimated that new construction costs will drive rents up to as much as $750 per month, over twice the average $335 per month rent for the older buildings (Hall 2007).

The extent of housing recovery will shape the town's future. One recent positive development with regards to the housing recovery has been $1 million in USDA funding to help Greensburg pay the planning and administrative expenses needed to implement the USDA's Self-Help Housing Loan program which is used to help the very low and low-income construct their own

homes. To help renters, the Kansas Housing Resource Corporation announced a Rental Assistance Program to help those making no more than 80 percent of the county's median income pay the gap between 30 percent of their income and the monthly rents that will escalate in the newly built rental units (Anderson 2007a).

Immediately after a community experiences an extreme natural event, the primary responsibility of local government is to organize and deliver emergency assistance to disaster victims. Following this phase of the disaster recovery cycle, local government entities together with active support from emergency agencies at the state and/or federal level generally introduce new hazard mitigation measures to better prepare for future disasters (Prater and Lindell 2000; Tierney et al. 2001; Tobin 1993). These measures seek to minimizing chance for loss of life, injury, and/or destruction of property (Mileti 1999; Tobin and Montz 1997).

This recent extreme event of Greensburg provides a window of opportunity for local governments and public agencies to enforce new building codes and land-use regulations, upgrade the quality of construction to better resist subsequent events, and recommend adoption of preventive measures (Prater and Lindell 2000). People, in general, are more receptive to policy changes in the immediate aftermath of an extreme event, and they pay closer attention to things that were just impacted the greatest. Thus devastation caused by extreme events often brings blessings for an impacted community. For example, residents and city authorities of Hoisington, Kansas, believe in many ways that the 2001 tornado was a blessing because it led to the modernization of many buildings and homes that were in need of renovation (Brock and Paul 2003).

The city of Hoisington also enforced two new zoning ordinances that restrict construction of homes on fifty foot lots in the tornado-impacted areas. This often means residents who were rebuilding had to purchase an adjacent lot(s) in order to satisfy requirements. As a result, housing

density in the area impacted by the tornado was reduced significantly relative to pre-tornado density. This ordinance reduces exposure by limiting development and density of human occupancy (Brock and Paul 2003). This was possible because the city authorities moved quickly from the relief phase to the rehabilitation phase. Tremendous support and assistance from private and public organizations in the aftermath of the tornado, and efficient local leadership allowed Hoisington to make rapid progress in recovering from the 2001 tornado (Paul and Leven 2002).

After the initial emergency response phase, Greensburg has moved rather slowly through the reconstruction phase of the disaster cycle. Although it is usually not possible for a community to achieve complete recovery from the effects of a disaster, the recovery process may last anywhere from several months to several years. All indications suggest that it will take a long time to rebuild Greensburg. And this delay may discourage many from rebuilding in Greensburg. Conversations with respondents reveal that a considerable proportion of them wanted to rebuild a few weeks after the tornado, but zoning issues and the need for building permits slowed progress. According to some residents, the City of Greensburg seems more interested in rezoning for industrial and business enterprises than for residential development. Further complicating disaster recovery efforts is a new state eminent domain law which took effect on July 1, 2007 that restricts local governments from seizing private property (land, housing) to use for private development without permission from the Kansas Legislature. Under this law, cities can only clear debris, not demolish abandoned property until they have purchased or condemned the property as unsafe. In the latter case, owners of condemned properties must be paid at least twice the property value. By mid-August 2007, 90% of the debris in Greensburg had been cleared, but most of the remaining debris was on abandoned property (Bauer and Sullinger 2007).

Although the near total destruction of Greensburg ironically allowed for new, differential

paths for reconstruction and reinventing the city, many tornado victims maintain that the plan to convert Greensburg as 'GreenTown' is slowing the rebuilding process. Many believe that they could not afford to live in a 'green' city, given the increased up-front construction costs – even acknowledging the reduced energy costs over the long-term. There seems to be tension between Greensburg residents and businesses owners who prefer to rebuild "fast and cheap" with development generally reflecting what the town was like prior to the tornado, versus the City Manager, the former and current Mayor, and other supporters favoring detailed master plans and upgraded building codes. Conversations with tornado victims on the first day of field survey, revealed that prior to the tornado, a considerable number of people -- particularly elderly residents -- were either in the process of leaving Greensburg or thinking about moving to other towns or cities. The May 4, 2007 tornado probably helped many decide to migrate elsewhere. One encouraging news for the elderly population of Greensburg is that Kansas Housing Resources has a plan to build a senior retirement community where the Greensburg High School once stood, with the land donated by the School District. It will have the capacity of housing 64 individuals.

It is evident from relevant literature and consultations with many survey respondents and emergency response personnel in Greensburg that success of reconstruction depends largely on how quickly authorities provide incentives to disaster survivors to rebuild where they once lived. No such attempt was initiated in Greensburg during the emergency response phase. Rather, various restrictions were imposed on housing construction, slowing rebuilding and recovery. Delay in such actions often lead to a large scale exodus of victims. After Hurricane Andrew struck Homestead, Florida (a city of 32,000) in 1992, many victims left because of delays in public response. With a reduced tax base, Homestead experienced multiple financial crises during the 1990s – events that are likely to have occurred less frequently had more people remained (Paul 2007).

The main problems in rebuilding Greensburg are the lack of a clear, long-term reconstruction plan; the absence of adequate and informed leadership and resources; and a lack of coordination between various reconstruction-oriented groups. The town initially faced problems in staffing positions dealing with preparing building codes and issuing building permits. This need for help was underscored by the sheer number of permits being issued in the early part of reconstruction phase (Associated Press 2007). Greensburg needs funds to rebuild, and these funds must come from the top – both private and public agencies.

Many Greensburg tornado victims seem uncertain about what to do. The encouraging news is that FEMA has built a 250-unit mobile home park in the southeastern part of Greensburg, where about 430 people now live. In addition, there are 20 to 30 such homes on private land just outside town. Other good news is that Greensburg has issued scores new building permits and dozens of homes are currently being built. Additionally, more than 70 residents have found work under a $20 million National Emergency Disaster Recovery Grant (Paul 2007). These are good signs for the rebuilding and reconstruction of Greensburg. However, if authorities do not act quickly and implement victim-friendly reconstruction plans, the town will have a difficult time in rebuilding Greensburg to anything like it was prior to the May 4, 2007 tornado.

Conclusions

The purpose of this research project is to explore and analyze disaster response efforts undertaken for the May 4 Greensburg, Kansas tornado. The findings of this research will help local, state, and federal disaster managers to successfully plan recovery and rescue operations for victims of future catastrophic tornadoes. While victims were generally satisfied with the disaster response efforts, such operations can still be improved. A full-time emergency manager could

have facilitated the response to the tornado which destroyed Greensburg. Kiowa County, like 67 out of Kansas' 105 counties, has a part-time emergency manager. In many of these counties which have less than 25,000 residents, the part-time emergency manager has multiple responsibilities, including law enforcement and administrative duties in addition to emergency management (Green 2007). Having one person responsible for leading disaster responses and for developing detailed plans to coordinate responders' (police, fire, medical) efforts could possibly have reduced confusion resulting from the welcome, yet overwhelming response from other Kansas towns and cities to the plight in Greensburg.

A few of the Greensburg residents surveyed noted that there were too many emergency responders in town and thus confusion during the initial search and rescue operations (i.e., lack of communication among participating organizations, the lack of training among those assisting which required that houses that were initially not entered to check if anyone injured was inside had to be rechecked later). Given the limited resources of some sparsely populated counties, a full-time emergency manager could be shared by a few counties. While a full-time county emergency manager would be preferable, regionalizing this position across a few rural counties with limited resources might be the only feasible option.

Having an emergency database of residents could also have facilitated the response and recovery to the disaster in Greensburg. A little over a month after the tornado, city officials did not know where residents were staying. Although many displaced residents heard about the Town Hall meetings that were convened to discuss the long-term recovery through the media outlets, the city did not know where people were living. After the tornado, cell-phone numbers were gathered at one of the public meetings. This partial list facilitated communication with those listed and was used by this research team to contact former Greensburg residents.

However, a comprehensive database would have lessened confusion regarding the whereabouts and conditions of survivors after the disaster. For communities to better respond to future disasters, an emergency database can help find those with disabilities, special needs (i.e., which FEMA defines as including single working parents, people without vehicles, non-English speakers), and with particular medical needs (i.e., individuals on oxygen) needing assistance. Developing and maintaining such a database is complicated given the changing nature of information and voluntary participation in a registry. Cost and funding sources for developing databases are also an issue in Kansas (Clarkin 2007).

While there are conflicting views of the city government's regulating rebuilding and turning Greensburg into GreenTown, the tornado which destroyed 95% of Greensburg leaves it with a unique opportunity to reinvent itself while taking care to address concerns of those who fear being priced out of town. Greensburg will return with new buildings and infrastructure built under current codes (i.e. the 2003 updated version of the International Building Code). In fact, Greensburg will be unique as the only city in the U.S. with all municipal buildings, including City Hall and the business incubator, at the Leadership in Energy and Environmental Design (LEED) platinum level. LEED buildings can be at one of four levels of energy/environmental criteria which start at certified, then go up to silver, gold, and the highest platinum level. Such designated energy efficiency levels incorporates water and energy management, material usage, indoor environmental air quality, site planning and innovation in design (Anderson 2007b). In reconstructing Greensburg, this Kansas town can be a role model for the U.S. in developing efficient, sustainable buildings that are meant to last 100 years.

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Table 1. Selected socio-economic and demographic characteristics of the respondents.

Characteristics	Number	Percentage
Gender		
Male	44	69.84
Female	19	30.16
Marital Status		
Married	49	77.78
Single	11	17.46
Divorced	2	3.17
Widowed	1	1.59
Age (in years)		
<37	13	20.63
37-55	35	55.56
56-64	3	4.76
>64	12	19.05
Education		
Grade School	11	17.46
High School	12	19.05
Some College	31	49.21
Undergraduate	5	7.94
Graduate	4	6.34
Employment Status		
Employed (full-time)	46	73.02
Employed (part-time)	1	1.59
Retired	10	15.87
Unemployed	4	6.35
Disabled	2	3.17
Income		
<$20,000	12	19.05
$20,000-39,999	32	50.79
$40,000-59,999	11	17.46
$60,000-99,999	5	7.94
>$99,999	3	4.76

Table 2. Respondent satisfaction level with emergency response efforts

Effort	Satisfaction Level 1	2	3	4	5	Mean
Search and Rescue Operations	-	1	1	16	45	4.67
Emergency Medical Care Undertaken for Respondent's Family	-	-	-	3	7	4.70
Emergency Medical Care Delivered in Greensburg	-	-	4	14	40	4.79
Mental Health Counseling Delivered to Respondent's Family	-	1	1	1	2	3.80
Debris Removal Operation Undertaken In Greensburg	-	1	2	6	50	4.78
Public Sheltering Available to Tornado Victims	1	-	5	18	27	4.37

Table 3: Temporary Shelter Options for Respondents (N=63)

Type of Shelter	Order of Shelter First	Second	Third	Fourth
Private				
Relatives	27	20	-	-
Friend	7	4	-	-
Hotel/Motel	16	2	1	-
Private Trailer	2	6	-	-
Others*	2	2	2	-
Public				
Shelter	9	-	-	-
FEMA Trailer	-	5	10	1
TOTAL	63	39	13	1

*Include living in rented and/or owned homes located outside Greensburg.

Table 4: Type of Shelter Respondents (N=63) were Using at the Time of Survey

Type	Number	Percentage

Private		
Relatives	32	50.79
Friend	7	11.11
Private Trailer	2	3.18
Rental	2	3.18
Own House	3	4.76
Public		
Shelter	7	11.11
FEMA Trailer	10	15.87
TOTAL	63	100.00

*Include living in rented and/or owned homes located outside Greensburg.