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The Impact of Forced Transitions on the Most Functionally Impaired Nursing Home Residents

Kali S. Thomas, PhD[1], **David Dosa, MD**[1,2], **Kathryn Hyer, PhD**[3], **Lisa M. Brown, PhD**[3], **Shailender Swamination, PhD**[1], **Zhanlian Feng, PhD**[1], and **Vincent Mor, PhD**[1]

[1]Center for Gerontology and Healthcare Research, Providence, Rhode Islands [2]Warren Alpert Medical School, Brown University, Providence, Rhode Island [3]School of Aging Studies, University of South Florida,Tampa, Florida

Abstract

Background/Objectives—To examine the hospitalization rate and mortality associated with forced mass transfer of nursing home residents with the highest levels of functional impairment.

Design—Retrospective cohort study.

Setting—119 Texas and Louisiana nursing homes that were identified as being "at-risk" for evacuation for Hurricane Gustav.

Participants—6,464 long-stay residents residing in "at-risk" nursing homes for at least three consecutive months prior to landfall of Hurricane Gustav.

Measurements—Using Medicare claims and instrumental variable analysis, we compared the differential mortality (death at 30 and 90 days) and hospitalization rates (at 30 and 90 days) of the most functionally-impaired long-stay residents who evacuated for Hurricane Gustav relative to the most functionally impaired residents who did not evacuate.

Results—Results suggest that the effect of evacuation was associated with an 8% increase in hospitalizations by 30 and 90 days for the most functionally impaired residents. Evacuation was not significantly related to mortality for the most functionally impaired residents.

Conclusion—Our results suggest that the most functionally impaired nursing home residents experience an increase in hospitalizations but not mortality as a consequence of forced mass transfer. With the inevitability of nursing home evacuations for many different reasons, harm mitigation strategies focused on the most impaired residents are needed.

Keywords

Nursing Home; Transitions; Hurricane

Corresponding Author: Kali S. Thomas, PhD Center for Gerontology and Healthcare Research Brown University Box G-S121(6) Providence, RI 02912 Tel: 401-863-9036 Kali_Thomas@brown.edu.

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INTRODUCTION

Hurricane Katrina highlighted the inadequacies in nursing home (NH) decision-making during disasters. Since the widely publicized number of NH resident deaths due to drowning, we have seen an increase in the number of NHs that evacuate in preparation for a hurricane.[1,2] The decision to evacuate is particularly grave given the acuity of residents in NHs. Research from the hospital literature cites evacuation as being detrimental to patients' health.[3–7] Dosa and colleagues noted similar findings in the NH environment in research that showed evacuation had an adverse effect on overall morbidity and mortality.[1]

In 2008, Hurricane Gustav made landfall in Louisiana. In preparation for what was believed to be a powerful and devastating storm, 119 NHs evacuated in response to Hurricane Gustav's threat. However, as Gustav approached shore it significantly weakened and caused relatively minimal damage relative to other major hurricanes. Therefore, Hurricane Gustav provides an adequate storm to study the effects of evacuation on vulnerable NH residents as these residents were unlikely to be affected by the storm effects.

There are many circumstances which prompt transitions or relocation of NH residents from one facility to another. In addition to evacuation for a hurricane, mass transfers of NH residents occur when many residents must leave the facility: closure or evacuation for a natural disaster (such as fire or flood). Research on transfers of residents following a NH closure suggest that it negatively affects residents' health and well-being due to changes in environment, caregivers, and routines of care.[8] Other research suggests that individual transfers (e.g., to hospital) can lead to changes in eating habits, sleeping patterns, and locomotion, decline in ability to perform Activities of Daily Living (ADLs), as well as increased dependency and feelings of insecurity.[8–10] For residents with disabilities, medical or mental illness, or cognitive impairment, the act of being transferred to a different facility can intensify symptoms of existing illnesses and further impair functioning.[11]

This paper seeks to build on these findings by studying the effect of NH evacuation on the NH residents stratified by their degree of frailty. Simulating a natural experiment, we examine the hospitalization and mortality rates of the most functionally impaired NH resident populations who evacuated compared to similar residents at non-evacuating facilities in response to the impending force of Hurricane Gustav, a storm responsible for 5,036 forced NH transitions to other sites of care. While Hurricane Gustav was a storm that significantly weakened before landfall, we hypothesized that the disruption associated with evacuation, the non-continuity of care, and the trauma of moving itself would have deleterious effects on the frail and impaired population. Specifically we hypothesized that individuals who were the most functionally impaired would have an increased likelihood of hospitalization and death following evacuation compared to similar residents that sheltered in place.

METHODS

Data Sources

Prior to beginning work, we received approval from the Institutional Review Boards at Brown University and the University of South Florida. Resident-level data from the 2008 Minimum Data Set (MDS) were matched to the Medicare denominator files and hospital claims using the Residential History File methodology described elsewhere.[12] Descriptive characteristics for NH residents (e.g., demographics, health characteristics) were obtained from the MDS.[13] Information on the date of death and hospitalization was determined from the Centers for Medicare and Medicaid Services (CMS) enrollment record. Hospitalization events were recorded on Medicare inpatient hospital claims included in the Standard

Analytic File (SAF). NH characteristics were derived from the Online Survey, Certification, and Reporting (OSCAR) file which includes the exact address of the facility used for geo-coding.

Sample

Study subjects were long-stay (>90 days), NH residents who resided in an at-risk Medicare and Medicaid certified facility for at least 3 calendar months prior to date of storm landfall in 2008. At-risk NHs were defined as those homes geographically located in parishes/counties that were included in the National Weather Service's initial Hurricane Watch at 48 hours and the subsequent warning zone at 24 hours.[1] Additional NHs were included if they were located in parishes/counties where at least one NH was known to have evacuated based on lists provided by the state NH associations. NHs in counties/parishes where there were no known evacuations were removed.

The most functionally impaired residents were identified as those who were most functionally impaired as defined by an Activities of Daily Living (ADL) Scale score greater than or equal to 23 out of 28 on the late loss ADL scale.[14] The ADL scale comes from the MDS and contains 7 ADL items (Bed mobility, Transfer, Locomotion, Dressing, Eating, Toilet use, Personal hygiene). Each ADL item has six possible categories that is rated by a trained clinician and assesses the resident's functional capabilities over a 7-day period. The categories of response range from 0 (total independence) to 4 (total dependence). The scale sums the responses for all 7 items; therefore, higher scores indicate greater dependence and higher levels of functional impairment.

Shelter versus Evacuation Data

Residents were considered to have transferred if they resided in facilities that completely evacuated prior to the date of landfall for each storm. Data on a facility's evacuation status was obtained from the Texas Department of Aging & Disability Services and the Louisiana Department of Health and Hospitals. NHs that evacuated after the date of landfall for any reason were considered to have sheltered in place for the purposes of this analysis.

Variables

Using data from Medicare files the likelihood of death and hospitalization by 30-days and 90-days was determined for residents in at-risk NHs. Independent variables characterizing residents (e.g., demographics, health characteristics) were obtained from the MDS. In addition to age, gender, and race, we adjusted hospitalization and death outcomes for cognitive status and other indicators of resident acuity previously suggested to be related to these outcomes. Cognitive status (summed scores on the Cognitive Performance Scale measuring memory impairment, level of consciousness, and executive function and ranging from 0 [intact] to 6 [very severe impairment]) was divided into two degrees of severity: Medium (a score of 3–4) and High (a score of 5–6)[15]. Resident acuity measures were also derived from the MDS and included Cancer, Congestive Heart Failure, Diabetes, Feeding Tube, and The Changes in Health, End-stage disease and Signs and Symptoms (CHESS) Comorbidity Index ranging from 0 (no frailty) to 5 (high frailty)[16]. Other independent variables measured at the facility level included the percent of residents who were ambulatory, the facility's acuity index, for profit ownership, occupancy rate, percent of residents funded by Medicaid and percent of residents with a primary payer other than Medicare or Medicaid.

Analyses

We used instrumental variables (IV) estimation (with IVs, or observable factors that influence evacuation but do not directly affect resident outcomes) to mimic the randomization of "treatment"- or evacuation.[1,17,18] IV modeling, unlike more traditional statistical approaches, such as multivariate logistic regression, helps reduce unmeasured confounding in cases where it is impossible to randomize patients or account for all confounders.[19] Therefore, IV approach was used to mitigate the influence of potential "omitted-variable bias" on the effect of evacuation. To implement the IV estimation strategy, we hypothesized that external factors such as distance from the predicted path, elevation, and distance from shore would be related to the decision to evacuate but not to resident outcomes. As detailed in previous analyses[1], hurricane damage is often a function of high winds, heavy rainfall that causes flooding, and storm surge. The degree of damage sustained from winds is often negatively correlated with distance from the storm (the closer the storm the higher the winds). In addition, storm surge occurs when the low pressure of the storm causes the sea level to rise and strong winds push high waves associated with a hurricane onto the shore. Therefore, distance from the shore and elevation of the facility are also important factors when considering whether to evacuate.

Using probit in STATA, we first tested the geographic characteristics related to the location of the NH relative to the storm as our IVs. The key assumption is that these variables (e.g., perpendicular distance from NH to the path of the storm 48 hours before landfall) will cause variations in evacuation status across NHs that are unrelated to any omitted variable from the regression of patients' outcomes (hospitalization). Since we have more than one IV, the model is considered to be "over-identified." We used Hansen's J-statistic to test the hypothesis that the model is correctly specified.[20]

The IVs include distance from the facility to the *predicted* path of storm at 24, 48, and 72 hours before landfall, a cubic polynomial of distance from NH to the shore, and elevation (feet above sea level) calculated in ArcGIS (ESRI, 2006), a geospatial analysis program. We then calculated the distance of each geocoded NH to the 24-, 48-, 72-hour, and actual path, as well as the distance of the NH to the shoreline using geospatial proximity tool "Near" in ArcGIS. The Near tool determines the distance from each point (the nursing homes) to the nearest polyline (storm paths or shorelines). We downloaded elevation data in the form of raster files from the WorldClim- Global Climate Data website. Using the "Extraction" spatial analysis tool in ArcGIS, we extracted the elevation values from the raster file to each point (nursing home).

The second stage of the model estimated the effect of evacuation on the outcomes of hospitalization at 30 and 90 days. In addition to storm parameters, the second stage model controls for factors that the literature has shown to be related to hospitalization and mortality: demographics (Male, Black, Age), resident acuity (BMI, Cancer, Congestive Heart Failure, Diabetes, Feeding Tube, CPS Score, CHESS score, % Ambulatory, and Acuity Index) and facility characteristics (For Profit, Occupancy Rate, % Medicaid, and % Private Pay). IV analyses were conducted using IVREG in STATA 11.0 to estimate the increase in the risk of hospitalization and mortality for the most functionally impaired residents who evacuated for Hurricane Gustav.

RESULTS

A total of 6,464 residents (1,662 were the most functionally impaired and 4,802 were less functionally impaired) were exposed to Hurricane Gustav. Table 1 presents the resident characteristics and resident acuity measures of the most functionally impaired. Of the most functionally impaired residents, 12% (n= 155) of those that evacuated were hospitalized

within 30 days following the storm and 21% (n=273) were hospitalized within 90 days (see Table 2). Of the most functionally impaired residents who evacuated for Hurricane Gustav, 6.2% (n=80) and 15.2% (n=197) died within 30 and 90 days, respectively.

Table 3 presents the estimated value of the IV coefficients. The results suggest that using the set of IVs, evacuation was associated with an 8% increase in hospitalizations by 30 and 90 days for the most functionally impaired residents. Results do not suggest there is a statistically significant increased risk of death at 30 and 90 days for the most functionally impaired residents who evacuate. Separate analyses were conducted (results not presented) to examine the effect of evacuation on the remaining less functionally impaired residents (those with an ADL score lower than 23). Evacuation was not significantly related to hospitalization or mortality for the less functionally impaired residents suggesting that the detrimental effect of transitions, as measured by hospitalization, was observed only among those who are most functionally impaired.

We also show that the effect of evacuation on hospitalizations at 30 and 90 days is, in general, stronger than the effect of other comorbid conditions, such as obesity, cancer, congestive heart failure, diabetes, and severe cognitive impairment (see Table 3).

DISCUSSION

The present study examined the relationship between a forced mass evacuation and adverse outcomes for a group of the most functionally impaired NH residents. These outcomes were measured in terms of hospitalization and mortality. Results from our study indicate that there is a statistically significant increase in the likelihood of hospitalization following evacuation for the most functionally impaired NH residents. Furthermore, we demonstrate that the more robust and less functionally impaired residents did not experience negative outcomes associated with mass transfer. While we did not observe a statistically significant effect of evacuation on mortality, these findings suggest that the most functionally impaired NH residents bear a great burden when being transferred from one facility to another during mass transfer. Under stressful conditions, transferring the most functionally impaired NH residents may lead to poor outcomes.

Our study is the first to examine the implications of forced mass transfer on the most functionally impaired NH residents. Hurricane Gustav is an appropriate storm for evaluation of resident transitions as it was predicted to be a big storm, led to almost universal NH evacuation orders, but significantly weakened as it approached shore. Indeed, there was minimal flooding and winds abated to less than 60 miles per hour after the storm made landfall suggesting that any consequence experienced following the storm was attributable to the evacuation and not the storm itself. In previous work[1], we looked at four storms and their effects on morbidity and mortality for all residents in nursing homes. We found that certain storms did have a more robust and significant deleterious effect on residents' health. In addition, those that evacuated did experience worse outcomes. Obviously, Hurricane Katrina was associated with a significant increase in the rate of deaths; however, even for Katrina, there was an increase in the risk of dying for those that evacuated versus those who sheltered in place. Our results generally conclude that the effects of the storm, on the aggregate, had less of an impact on mortality and hospitalization than evacuation.

These findings suggest that evacuating the most functionally impaired residents is expensive to health care payers such as Medicare and Medicaid and has direct deleterious effects on the lives of the NH patients. For Hurricane Gustav, approximately 1,650 of the most functionally impaired residents evacuated. Estimates from our IV analyses suggest that there were approximately 132 more hospitalizations among the most functionally impaired

residents who evacuated than those that sheltered in place. If one assumes an average Medicare Diagnosis-Related Group (DRG) payment per hospitalization of $5,000, this would represent an increase in spending for Medicare of $660,000 for evacuating these 1,650 most functionally impaired residents. This DRG payment probably represents a conservative estimate as another study has suggested the average DRG payment for hospitalizations rated as potentially avoidable was $6,500.[21]

Beyond these findings, however, it is important to note that forced transitions occur frequently from one NH to another in our health care environment, especially among the very sick and functionally impaired. Findings from this study point toward the notion that transferring residents from one location to another could disrupt their continuity of care and, therefore, lead to adverse outcomes, such as increased risk of hospitalization. These findings are particularly important as we see an increase in NH closures in recent years.[22] For the past decade, CMS Online Survey Certification and Reporting (OSCAR) data have shown a decline in the number of NHs, from 17,508 in 1999 to 15,713 in 2010. In 2009, there were 231 NH closures and in 2010, there were 191 closures.[23] With the average NH providing care to 100 residents, this suggests that in the two year period, there have been 4,220 NH residents who have been transferred due to closures. Because approximately 22% (n=310,000) of the long-stay residents in NHs (during 2009) are the most functionally impaired (with an ADL scale score of 23 or higher), we can assume that a large number of those transferred were the most functionally impaired.

A practical implication of our finding is that NHAs and staff must pay particularly close attention to the most functionally impaired NH residents during a transition. Furthermore, this attention must extend at least 90 days post-transition as we see increased rates of hospitalization up to 90 days in this study following evacuation. Several initiatives and interventions have been proposed and exercised in an effort to prevent relocation stress.[24,25] Future research could benefit by examining the effects of relocation programs on the most functionally impaired NH residents response to transfers.

We recognize that caution should be used in generalizing our findings to all resident transfers. It is possible that mass forced transfer may have different dynamics than single-person transfers and therefore may result in different outcomes for the most functionally impaired NH residents. Additionally, our estimates measured the effects of the evacuation decision on all residents of the NH using distance variables as instruments. Therefore, the generalizability of the coefficient may not be appropriate for other settings. Finally, although evacuation of the most functionally impaired residents was not found to be statistically significant for mortality, we did identify a trend toward increased mortality. It is important to note that previous work on a larger sample (including all NH residents exposed to Hurricane Gustav) has suggested that evacuation is related to mortality. This association has also been shown for other storms in the gulf coast region, including Hurricanes Katrina, Rita, and Ike. It is likely this lack of statistical significance in our study is an issue of sample size. As such, these null findings should be interpreted with caution.

With these limitations in mind, our results suggest that the most functionally impaired NH residents experience harmful effects as a consequence of forced mass transfer. With the inevitability of transfers among the NH population, it is important that providers establish best practices and specific plans of care when moving those who are the most functionally impaired.

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Table 1

Descriptive Characteristics of the Most Functionally Impaired Residents[a] in At-Risk Nursing Homes that Evacuated versus those that Sheltered in Place

	Evacuated mean (±SD) or %	Sheltered in Place mean(±SD) or %
Male	24%	21%
Black	25%	20%
Age (1/10)	8.35 (±0.02)	8.46 (±0.04)
BMI(1/10)	2.50 (±0.02)	2.56 (±0.03)
Cancer	2%	1%
Congestive Heart Failure	12%	13%
Diabetes	36%	36%
Feeding Tube	24%	27%
Fries/Morris CPS Scale (Medium)[1]	41%	37%
Fries/Morris CPS Scale (High)[2]	46%	54%
CHESS Score[3]	1.06 (±0.03)	1.06 (±0.06)

Notes:

BMI, Body Mass Index; CHF, Congestive Heart Failure; CPS, Cognitive Performance Scale; CHESS, Changes in Health, End-stage disease and Signs and Symptoms Scale;

Age and BMI are divided by 10 for ease of interpretation.

[a] Activities of Daily Living Scale score greater than or equal to 23 (on a 28 point scale);

[1] Score of 3–4 on a scale of 0–6;

[2] Score of 5–6 on a scale of 0–6;

[3] Scale of 0–5;

* p<.05,

** p<.01;

*** p<.001;

Table 2

Distribution of Rates of Hospitalization and Mortality at 30- and 90-Days Post-Storm for the Most Functionally Impaired Nursing Home Residents[a]

	Evacuated	Sheltered in Place
Number of Residents	1,295	367
Death (30 Days)	6.2%	5.4%
Death (90 Days)	15.2%	12.5%
Hospitalization (30 days)	12.0%	8.2%
Hospitalization (90 days)	21.1%	16.6%

Notes:

[a]Activities of Daily Living Scale score greater than or equal to 23 (on a 28 point scale);

Table 3

Results from IV Regression Modeling the Effect of Evacuation on the Most Functionally Impaired[a] Nursing Home Resident Population (N=1662)

	Hospitalization 30 Days	Hospitalization 90 Days	Death 30 Days	Death 90 Days
Evacuation[†]	0.08**	0.08*	0.03	0.06
	(0.029)	(0.038)	(0.023)	(0.037)
Male	0.002	0.026	0.013	0.024
	(0.020)	(0.027)	(0.015)	(0.021)
Black	0.032	0.058*	−0.01	−0.009
	(0.020)	(0.025)	(0.014)	(0.019)
Age (1/10)	−0.013	−0.017	0.008	0.021*
	(0.010)	(0.013)	(0.007)	(0.009)
BMI (1/10)	0.001	−0.01	−0.007	−0.031**
	(0.012)	(0.015)	(0.011)	(0.012)
Cancer	−0.01	−0.106	0.122	0.024
	(0.064)	(0.068)	(0.074)	(0.073)
Congestive Heart Failure	0.044	0.061	0.004	0.036
	(0.028)	(0.034)	(0.018)	(0.027)
Diabetes	−0.027	−0.017	−0.014	−0.025
	(0.015)	(0.021)	(0.012)	(0.019)
Feeding Tube	0.08**	0.10**	0.017	0.035
	0.021	0.031	0.013	0.022
Fries/Morris CPS scale (medium)[1]	0.005	−0.035	0.014	0.019
	(0.026)	(0.032)	(0.017)	(0.028)
Fries/Morris CPS scale (high)[2]	−0.002	−0.05	0.026	0.047
	(0.025)	(0.032)	(0.016)	(0.030)
CHESS score[3]	0.003	−0.011	0.02**	0.02**
	(0.007)	(0.010)	(0.006)	(0.008)
% Ambulatory	0	0.001	0	−0.001
	(0.001)	(0.002)	(0.001)	(0.001)
Acuity Index	−0.009	−0.005	−0.005	−0.02*
	(0.007)	(0.011)	(0.006)	(0.008)
For Profit Ownership	−0.016	0.006	0.002	0.002
	(0.025)	(0.030)	(0.017)	(0.034)
Occupancy Rate Nursing Home	−0.051	−0.092	0.016	−0.046
	(0.051)	(0.069)	(0.039)	(0.060)
% Medicaid (1/10)	−0.01**	−0.003	−0.001	−0.003
	(0.007)	(0.007)	(0.005)	(0.007)
% Other Insurance (1/10)	−0.02*	−0.011	−0.007	0
	(0.009)	(0.011)	(0.006)	(0.010)

	Hospitalization 30 Days	Hospitalization 90 Days	Death 30 Days	Death 90 Days
Constant	0.45**	0.46**	0.005	0.192
	(0.158)	(0.215)	(0.110)	(0.154)

Notes:

BMI, Body Mass Index; CPS, Cognitive Performance Scale; CHESS, Changes in Health, End-stage disease and Signs and Symptoms Scale;

Standard errors robust to heteroskedasticity and clustered within NH are symbolized inside parentheses; Age and BMI are divided by 10 for ease of interpretation.

[a]Activities of Daily Living Scale score greater than or equal to 23 (on a 28 point scale);

*p<.05,

**p<.01;

[†]Instrumental variables are distance from facility to path of storm 24, 48, and 72 hours before landfall, elevation, and a cubic polynomial of distance from NH to the shore;

[1]Score of 3–4 on a scale of 0–6;

[2]Score of 5–6 on a scale of 0–6;

[3]Scale of 0–5;