



CALTECH/MIT VOTING TECHNOLOGY PROJECT

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**TITLE Election Administration during Natural Disasters and
Emergencies: Hurricane Sandy and the 2012 Election**

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Executive Summary

Election Administration during Natural Disasters and Emergencies: Hurricane Sandy and the 2012 Election

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- Jurisdictions most adversely affected by Hurricane Sandy experienced a significantly lower level of voter participation in the 2012 Presidential Election than jurisdictions not affected by the storm.
 - On average, there was a 2.8% decline in voter turnout between the 2008 and 2012 President Elections in jurisdictions most adversely affected by Hurricane Sandy. Jurisdictions unaffected by Sandy experienced less than a 1% decline in turnout.
 - The negative effect Hurricane Sandy had on turnout in affected jurisdictions remains significant when controlling for other determinants of voter participation in the 2012 election.
- Those jurisdictions adversely affected by Hurricane Sandy provide their voters with limited flexibility in when, where and how they cast their ballots.
 - Only three of the ten states with jurisdictions adversely affected by Hurricane Sandy have no-excuse mail-in absentee voting.
 - Only one of the ten states with jurisdictions adversely affected by Hurricane Sandy has in-person early voting or other modes of ‘convenience’ voting e.g., Election Day vote centers.
- There is strong evidence that local election officials in jurisdictions most adversely affected by Hurricane Sandy attempted to enhance voters’ access to balloting on and before Election Day 2012.
 - Maryland implemented in-person early voting for the 2012 Presidential Election.
 - The proportion of vote cast early in counties adversely affected by Hurricane Sandy is significantly related to a higher rate of voter participation.
- The most efficacious action to mitigate the impact of Hurricane Sandy on voter participation in the 2012 election was the consolidation and location of polling places on and before Election Day.
 - Jurisdictions adversely affected by Hurricane Sandy experienced a significant decrease in the number of polling places, an increase in the number of voters casting a ballot per voting place and a concomitant increase in poll workers per voting place.
 - A smaller number of larger polling places, presumably more centrally located and accessible to voters had a positive and significant effect on voter turnout in jurisdictions hit by Hurricane Sandy.

Election Administration during Natural Disasters and Emergencies:
Hurricane Sandy and the 2012 Election

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September 4, 2013

1. Introduction

The conduct of elections is constrained by a myriad of factors that vary greatly across the 3,000+ jurisdictions authorized to administer elections in the United States. Among these factors are anticipated and unanticipated natural and man-made emergencies. Weather is foremost among the anticipated and probabilistic factors that can influence the operation of an election. Rain and other hazardous weather (e.g., hurricanes, tornados, earthquakes, et al) can deter voters from voting (Gomez et al 2007) and interrupt balloting on and before² Election Day. For example, damage to roads and buildings can impede voters and poll workers from getting to and operating polling places on and before Election Day. Moreover, a loss of power can render direct electronic recording (DRE) voting machines unusable.³ Voters that evacuate their homes before and after a natural disaster are indisposed to vote on or even before Election Day at their assigned polling place.

What steps can and do local election officials take to prepare for and respond to natural disasters and emergencies that impede and disrupt the operation of scheduled elections? How efficacious are these actions and practices, and to what extent, if any, can these practices be generalized to the 3,000+ jurisdictions charged with conducting elections? In this report I address these questions by examining the conduct of the 2012 Presidential election in the aftermath of Hurricane Sandy. Hurricane Sandy made U.S. landfall on October 29, 2012 affecting 24 states, including the entire eastern seaboard between Florida and Maine, with particularly severe damage in New Jersey and New York. The Federal Emergency Management Administration issued disaster declarations⁴ in 225 U.S. counties in ten states.⁵ It is in these counties that we might expect to observe Sandy's impact on balloting in the 2012 election. Moreover, Hurricane Sandy provides an extreme case with which to observe and assess current practices for the

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² All 50 states provide their eligible voters opportunities to vote before Election Day; either by mail or in-person (see Cemenska et al 2009).

³ The Election Assistance Commission (2012) reports that over half of polling places in the U.S. rely on electricity for the operation of their polling machines and vote books.

⁴ A disaster declaration by FEMA enables jurisdictions within a affected area to receive federal assistance for recovery efforts. We use this designation as means of identifying those counties most adversely affected by Hurricane Sandy and likely to have experienced the greatest disruption to the conduct of the 2012 election.

⁵ Connecticut, Delaware, Maryland, New Hampshire, New Jersey, New York, Rhode Island, Pennsylvania, Virginia and West Virginia

conduct and administration of elections. The report is organized as follows. In the following next section I review the different ways emergencies might impact the conduct of elections, identifying specific conditions and measures of performance with which to assess the impact of emergencies on the conduct of balloting on and before Election Day. In section three I identify several actions local election officials might take to mitigate the most pernicious effects of emergencies on the conduct of elections. In section four I report on the balloting experience in 3,000 U.S. counties during the 2012 Presidential election. This empirical analysis isolates the experiences and performance of counties that were under disaster declarations from those counties less affected by Hurricane Sandy. Section 5 concludes with a discussion of lessons and best practices learned from Hurricane Sandy and whether these practices are generalized to other jurisdictions not affected by Hurricane Sandy.

2. The potential effect of emergencies on the conduct and administration of elections

Natural disasters and emergencies can impinge on the performance of balloting on or before Election Day in a number of measureable ways. The most obvious is to suppress voter participation. Turnout in elections is determined by a myriad of factors (see Leighley 2008). Weather and emergencies can be significant obstacles to voter participation, particularly among voters with a history of infrequent voting. We might further expect that natural disasters and emergencies increase the frequency with which voters make mistakes when voting, such as in going to the wrong polling place and failing to have adequate identification (as a result of lost or damaged property). Disruptions to Election Day operations might enhance the likelihood that some voters (i.e., frequent and informed voters) will chose and/or attempt to cast their ballot before Election Day, by mail or in-person (i.e., early voting), in those states that allow these modes of voting or where local election officials take steps to encourage these balloting options.

Three measures of election performance would seem most susceptible to being skewed by a natural disaster or emergency preceding Election Day. These include:

- Depressed voter turnout (i.e., the proportion of eligible voters who cast a ballot).
- An increase in the proportion of voters who ballot by mail or in-person early.
- An increase in the proportion of voters who cast a provisional ballot.

Under the provisions of the 2002 *Help American Vote Act (HAVA)* there are opportunities for persons deemed ineligible to vote to cast a provisional ballot. A provisional ballot is used to record a vote when there are questions concerning the voter's eligibility. A provisional ballot can be cast when:

- The voter refuses to show a photo ID (in regions that require one)
- The voter's name does not appear on the electoral roll for the given precinct.

- The voter's registration contains inaccurate or out-dated information such as the wrong address or a misspelled name.
- The voter's ballot has already been recorded

All the conditions for casting a provisional ballot are expected to be attenuated when election balloting coincides with or is preceded by a natural disaster or emergency. Whether a provisional ballot is counted is contingent upon verification of the voter's eligibility as determined by local election officials, usually determined several days after Election Day. Local election officials have considerable discretion in counting or rejecting provisional ballots. This includes allowing provisional ballots to be fully or partially counted when voters go to the wrong voting location or have insufficient vote identification. We might expect local election officials to exercise greater flexibility in counting provisional ballots during and following natural disasters and emergencies.

Independent of other determinants of voter turnout, early in-person, mail-in and provisional voting, we expect:

- Voter turnout to be *lower* in jurisdictions that experienced a severe weather episode or other emergency on or before Election Day, than in jurisdictions that did not have these emergencies.
- The share of votes cast before Election Day to be *higher* in jurisdictions that experienced a severe weather episode or other emergency on or before Election Day, than in jurisdictions that did not have these emergencies.
- The share of votes cast provisionally to be *higher* in jurisdictions that experienced a severe weather episode or other emergency on or before Election Day, than in jurisdictions that did not have these emergencies.
- The share of provisional votes counted to be *higher* in jurisdictions that experienced a severe weather episode or other emergency on or before Election Day, than in jurisdictions that did not have these emergencies.

3. *Election administration practices that mitigate the effects of natural disasters on election performance*

Election administrators' responses to natural and man-made emergencies range between the cancellation and rescheduling of an election (e.g., the New York City mayoral election of 2001) to efforts to mitigate disruptions that come about from damaged infrastructure, poll worker availability, damaged equipment and dislocation of voters. More specifically, we might view a severe weather episode as a major inconvenience to voters and election administrators. The inconvenience to the voter is that she cannot get to her designated polling place or may have lost possessions and property including identification required to vote. A significant portion of the electorate may have evacuated their residences and are not within their voting jurisdiction on or

before Election Day to cast a ballot or to request and receive a mail-in ballot. For election officials and poll workers the challenges of severe weather are largely access to Election Day and before Election Day voting place locations, the status of their voting equipment and their own availability. The literature on convenience voting (see Stein 1996; Stein and Vonnahme 2012a; 2012b; 2011; 2008; Gronke and Toffey 2008; Richey 1998; Gronke, et al 2007; Hanmer and Traugott 2004; Karp and Banducci 2000; Berinsky 2006) provides some guidance to how election officials may respond to these inconveniences.

Three modes of voting other than Election Day precinct balloting may help to mitigate the effects of severe weather and emergencies on conduct of elections and voter participation. These include: mail-in voting, in-person early voting and Election Day vote centers. Each of these different modes of voting affords both the voter and election official significant flexibility and convenience to cast a ballot that might not be otherwise be possible as a result of severe weather or other emergency.

Mail-in voting is available in all 50 states. No-excuse mail-in voting is allowed in 27 states, and eight states have permanent mail-in voting, where voters are sent a mail-in ballot and do not have to request one for each election (NCSL 2012). First adopted by Texas in 1989 in-person early voting, available in 32 states, allows voters to cast ballots days and weeks before Election Day. Voters are not limited to balloting at only one location as on Election Day (Stein 1994; Stein and Garcia-Monet 1996; Gronke and Toffey 2008). Voters are afforded an opportunity to vote at a number of locations, many of which are central to where voters work, shop, recreate and travel in the course of a weekday or weekend. Early voters are given a residentially appropriate ballot for where they live (Stein and Garcia-Monet 1997). Election Day vote centers, first adopted in Larimer, Colorado in 2004 (Stein and Vonnahme 2012a; 2012b; 2011; 2008) similarly allow Election Day voters to ballot at any number of locations throughout the jurisdiction often more convenient to locations than just where the voter resides. As with in-person voting, voters at Election Day vote centers are not required to vote at only one location. Wherever they choose to cast their ballot voters balloting at an Election Day vote center are given a residentially appropriate ballot for where they reside.

Two attributes of election administration - openness and centralization – may be associated with greater flexibility for mitigating the otherwise negative effects of natural disasters and emergencies on election performance. Openness allows individuals to vote at any location throughout the county rather than be restricted to voting at only one location near the voter's residence. As noted above, wherever a voter chooses to ballot on or before Election Day, they receive an appropriate ballot for where they reside in the jurisdiction. Consequently, it is not possible for a person eligible to vote in a jurisdiction to vote at the wrong polling place in that jurisdiction. Of course voting in the wrong jurisdiction (i.e., county) is still possible, but with in-person early voting and/or Election Day vote centers, not being registered in a specific precinct

and voting place location is not possible. Mail-in voting provides the greatest flexibility in terms of where and when voters ballot. The obstacle to mail-in is obtaining and returning the mail-in ballot, conditions influenced by state mandated deadlines for requesting and returning mail ballots and the availability of the U.S. Postal service.

Centralization refers to the accessibility of polling places to where voters not only reside, but where they work, shop, recreate and travel. A small number of larger polling places define a centralized voting system. Stein and Vonnahme (2008) found that larger and more visible polling sites can reduce informational costs that voters incur when attempting to find a polling location. A larger number of parking spaces, voting machines and poll workers reduce voters' time to vote. With more staff at each polling location, poll workers are able to specialize in certain tasks such as checking in voters or assisting them with their ballots, which should lead to more efficient operations and improved service to voters. The efficient use of poll workers should aid errant voters needing information about where they should vote on or before Election Day and what information they need to establish their voter identification. In case of natural disasters and emergencies we might expect that larger and more centrally located polling places e.g., hotels, supermarkets, stadia, and larger public buildings, to be more accessible and powered in the aftermath of a natural disaster.

I expect that features of openness and centralization associated with mail-in, early voting and Election Day vote centers will be more effective at mitigating the consequences of natural disasters on measures of electoral administration and performance e.g., turnout. In addition, the discretion local official officials exercise in accepting and counting provisional ballots when voters show up at the wrong polling place, with insufficient identification and fulfill requests for mail-in ballots outside of prescribed dates and qualifications is expected to lessen the negative effect natural disasters have on voter turnout. Out of necessity a smaller number of larger polling places may have been substituted for a larger number of smaller sized and equipped polling places in aftermath Hurricane Sandy, also lessening the negative effect Sandy had on voter turnout.

4. *Election administration and performance during Hurricane Sandy*

To assess the impact of Hurricane Sandy on the conduct and administration of the 2012 Presidential election I have compiled measures at the county level (N=3000+) on several indicators of electoral performance including: voter turnout, absentee voting, early voting, provisional votes cast, provisional votes counted, the number of polling places and poll workers. These data are mostly culled from the Election Assistance Commission's 2008 and 2012 *Election Administration and Voting Survey* of local election administrators.⁶ Identification of

⁶ My analysis is based on a 'preliminary draft' of the 2012 EAC *Election Administration and Voting Survey* data file. There are several omissions in these data. Early votes cast in Georgia counties are reported as mail-in votes and early votes in Texas are reported as the number of early voting place locations rather than the vote cast early. Early votes cast in Texas were obtained from the Texas Secretary of State's website. My thanks to Charles Stewart for providing me with absentee and early votes cast

those counties that received a disaster declaration, my measure of the severity of Hurricane Sandy in each U.S. county, were obtained from FEMA's website: <http://www.fema.gov/disasters/>.

4.1 Voter turnout, absentee mail-in and early voting

Table 1 reports the mean values for indicators of electoral performance for the 2008 and 2012 Presidential elections for all U.S. counties. A comparison of performance measures between 2008 and 2012 adds some degree of confidence in assessing Hurricane Sandy's impact on performance in affected counties. The 2008 and 2012 elections were Presidential Elections in which one of the contesting candidate, Barack Obama was on the ballot in both years.

Table 1. Mean and *Standard Deviation* values for county level measures of voter turnout, absentee and early voting in 2008 and 2012 by Hurricane Sandy disaster declaration coverage

	2008		2012		Change '08-'12	
	~ Disaster	Disaster	~ Disaster	Disaster	~ Disaster	Disaster
Turnout (%)	.668 .112	.676 .110	.662 .100	.661 .104	-.008 .100	-.028 .050
Absentee votes (%)	.189 .195	.053 .041	.187 .207	.053 .032	-.002 .070	.0003 .024
Early votes (%)	.142 .213	.055 .099	.161 .162	.072 .106	.019 .190	.017 .052
Number of observations	2781	223	2781	223	2781	223

Source: EAC, 2008, 2012 *Election Administration and Voting Survey*

Turnout declined on average 2.8% (T-value=4.8, P< .000) between 2008 and 2012 in counties in which disaster declarations were declared for Hurricane Sandy. Voter turnout declined only .8% in all other U.S. counties. We do not observe a significant change in mail-in absentee voting in either counties adversely affected by Hurricane Sandy or those counties not severely impacted by

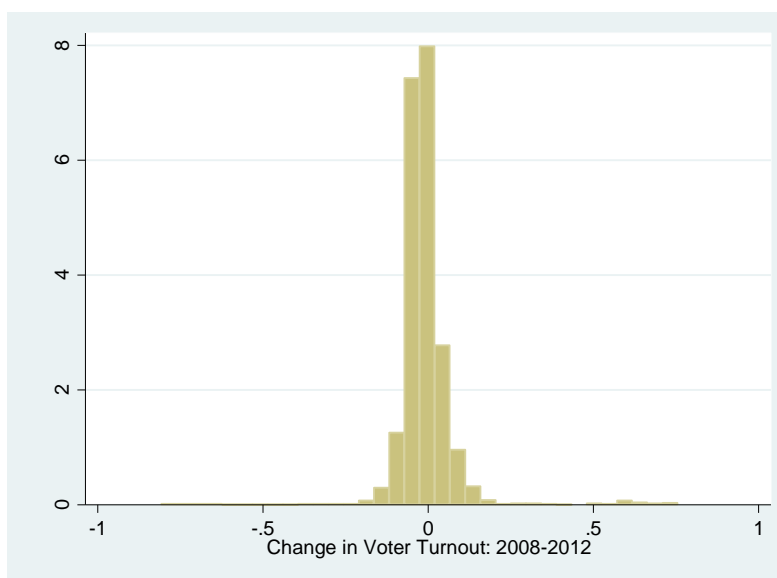
by county for Georgia. In 2008 New York State did not provide county level responses to the EAC's *Election Administration and Voting Survey*. Data on voter turnout and registration in 2008 for New York State counties are available from the New York State Board of Elections' website <http://www.elections.ny.gov/>. Other measures of electoral performance reported in the EAC's survey are not available for New York State Counties in 2008. I have used 2010 measures of electoral performance in place of 2008 measures for New York State Counties (N=62), available from the 2010 EAC's *Election Administration and Voting Survey*.

the Hurricane. Moreover, it is noteworthy that absentee voting is considerably lower in counties adversely affected by the Hurricane (5%) compared to all other counties (18%). This finding is largely due to the absence of no-excuse absentee mail-in voting in most states impacted by Hurricane Sandy (see table 2).

The proportion of vote cast in-person early exhibits some variation across presidential elections and between counties affected and unaffected by Hurricane Sandy. Early voting increased significantly in unaffected counties between 2008 (14%) and 2012 (16%), while also increasing by 2% in counties most adversely affected by Hurricane Sandy. We suspect this latter change is related to the implementation of in-person early voting in Maryland for the 2012 Presidential election, the only state among those affected by Hurricane Sandy to allow voters to ballot in-person early in the 2012 election (see table 2).

Among counties adversely affected by Hurricane Sandy there is considerable variation in the change in voter participation between 2008 and 2012. In the same counties there is a limited incidence and variation in balloting before Election Day, a possible antidote for the decline in voter turnout between the two Presidential elections.

Figure 1. Change in voter turnout between 2008-2012 among counties that received a disaster declaration in 2012



Source: EAC, 2008, 2012 *Election Administration and Voting Survey*

Table 2: Laws regulating absentee and early voting among states with one or more counties that received a disaster declaration in 2012

State	No-excuse absentee mail-in	In-person early voting
Conn.	No	No
Del.	No	No
MD	Yes	Yes
NH	No	No
NJ	Yes	No
NY	No	No
PA	No	No
RI	No	No
VA	No	No
WV	Yes	No

Source: National Conference of State Legislatures, <http://www.ncsl.org/legislatures-elections/elections/absentee-and-early-voting.aspx>

4.2 Provisional voting

One means for accommodating the disruptions to the 2012 election brought about by Hurricane Sandy may have been provisional voting. Local elections officials in counties affected by the Hurricane may have exercised greater flexibility in allowing voters to cast a provisional and in their counting of provisional votes by voters unable to ballot at their designated voting place or who did not present sufficient identification at their polling place. The proportion of ballots cast provisionally and the proportion of provisional ballots counted is expected to have increased in counties adversely affected by Hurricane Sandy. There is some evidence for this expectation. In 2012 the proportion of ballots cast in counties adversely affected by Hurricane Sandy was greater (.008) than in unaffected counties (.006). On average the proportion of provisional ballots counted in 2012 was greater in affected (.551) than in unaffected counties (.288). The share of provisional ballots counted on average increased slightly in counties affected by Hurricane Sandy (.550 in 2008 versus .551 in 2012), while the average share of provisional votes counted declined significantly between elections in counties spared severe damage from Hurricane Sandy.

Table 3. Mean and *Standard Deviation* values for county level measures of provisional voting in 2008 and 2012 by Hurricane Sandy disaster declaration coverage

	2008		2012		Change '08-'12	
	~ Disaster	Disaster	~ Disaster	Disaster	~ Disaster	Disaster
Provisional votes cast (%)	0.004 <i>0.009</i>	0.005 <i>0.007</i>	0.006 <i>0.013</i>	0.008 <i>0.01</i>	0.002 <i>0.011</i>	0.002 <i>0.007</i>
Number of observations	2783	223	2783	223	2783	223
Provisional votes counted (%) ⁷	0.329 <i>0.014</i>	0.550 <i>0.036</i>	0.288 <i>0.015</i>	0.551 <i>0.040</i>	-0.041 <i>0.010</i>	0.001 <i>0.036</i>
Number of observations	543	64	543	64	543	64

Source: EAC, 2008, 2012 *Election Administration and Voting Survey*

4.2 Polling place operations

As was expected the number of polling places declined in counties most adversely affected by Hurricane Sandy. In 2008 these counties operated 1.1 polling places per 1,000 registered voters; in 2012 this figure declined to 1.0 polling places per 1,000 registered voters, a statistically significant change in the number of polling places ($P < .05$). Whether intentional or forced, counties in which Hurricane Sandy inflicted its greater damage experienced a significant consolidation of voting place locations. Counties unaffected by Hurricane Sandy operated 1.1 and 1.1 polling places per 1,000 registered voters in 2008 and 2012 respectively.

The number of poll workers per polling place increased in all counties between 2008 and 2012, but this increase was significantly greater in counties adversely affected by Hurricane Sandy. In these counties the number of poll workers per polling place grew from 4 to 4.6, compared to a .42 increase among all other U.S. counties. The increase in poll workers per polling place in counties that received a disaster declaration is statistically significant ($P < .05$). We suspect this increase was due in part to the consolidation of polling places in counties under a disaster declaration. Polling place operations changed in disaster counties in a manner that might have mitigated the decline in voter turnout observed in these counties between the two Presidential elections.

⁷ Only counties in which a provisional ballot was cast are included in the proportion of provisional ballots fully counted.

Table 4. Mean and *Standard Deviation* values for county level measures of polling place operations in 2008 and 2012 by Hurricane Sandy disaster declaration coverage

	2008		2012		Change '08-'12	
	~ Disaster	Disaster	~ Disaster	Disaster	~ Disaster	Disaster
Poll places (per 1K voters)	1.1 <i>0</i>	1.1 <i>0</i>	1.1 <i>0</i>	1.0 <i>0</i>	0 <i>0</i>	-.1 <i>0</i>
Poll workers per place	7.1 <i>.21</i>	4.0 <i>.37</i>	7.5 <i>.25</i>	4.6 <i>.49</i>	.42 <i>.20</i>	.60 <i>.34</i>
Number of observations	2760	220	2760	220	2760	220

Source: EAC, 2008, 2012 *Election Administration and Voting Survey*

4.3 Explaining voter turnout in 2012

The evidence from the 2008 and 2012 Presidential elections points to a consequential effect for Hurricane Sandy on voter turnout in 2012. Moreover, there is some, albeit limited evidence to suggest factors that may have mitigated the negative affect Hurricane Sandy had on voter participation were in place in some of the jurisdictions most adversely affected by the Hurricane. To test the efficacy of these mitigating actions on election performance in 2012 I estimated a model of voter participation in the 2012 Presidential election that allows me to isolate the effects of Hurricane Sandy and other determinants of turnout including early voting, absentee voting, provisional voting, the number of polling places and poll workers. The estimates of turnout in the 2012 Presidential election include terms for the interaction between each determinant and a county's location inside and outside an area severely affected by Hurricane Sandy. In addition, dummy variables for each county's state location are included in the model (i.e., a fixed-effects model) to control for a number of omitted state level factors that might account for turnout (e.g., the state's electoral competitiveness). I also weighted each observation by the number of ballots cast, counting each vote equally, preventing the results from being skewed by a larger number of smaller jurisdictions with a few voters.

Table 5. Regression estimates for 2012 voter turnout (%) ⁸

Turnout 2008 (%)	0.274*** (0.0591)
Disaster declaration (0,1)	-0.223* (0.118)
<i>Effects in non-disaster counties</i>	
Early vote (%)	0.0298 (0.0520)
Absentee vote (%)	0.127* (0.0759)
Provisional vote (%)	-0.276 (0.534)
Log of Poll places per vote	-0.00721# (0.00531)
<i>Effects in disaster counties</i>	
Early vote * Disaster (%)	0.238** (0.0983)
Absentee vote * Disaster (%)	-1.229*** (0.525)
Provisional vote * Disaster (%)	-1.879*** (0.712)
Log of Poll places per vote * Disaster	-0.0475** (0.0186)
Constant	0.413*** (0.0443)
Observations	2,670
R-squared	0.663
*** p<0.01, ** p<0.05, * p<0.1 # p<.1 (one-tailed)	

Table 5 reports the regression estimates for voter turnout in 2012 (coefficients for state dummies are not reported). The estimates for the interaction terms identify the effects of each determinant - early voting, absentee voting, provisional voting and polling place practices - on turnout in counties that received a disaster declaration from FEMA. The main effects for these variables represent their impact on voter turnout in counties that did not receive a FEMA disaster declaration for Hurricane Sandy. The fixed effects model accounts for 66% of variation in county level voter turnout in the 2012 Presidential election. As expected voter turnout in the 2008 Presidential election is strong predictor of 2012 turnout. Both elections featured a competitive Presidential contest with Barack Obama as a candidate in both elections. The effect of Hurricane Sandy on voter turnout is expectedly negative but modest in significance ($P < .1$)

⁸ A fixed effects model was estimated. Coefficients for state dummy variables not reported and are available from the author.

Among counties not adversely affected by Hurricane Sandy absentee voting and number of polling places per vote cast has a significant effect on turnout. A one percent increase in the proportion of vote cast absentee by mail increases total voter turnout by 11.9%, evidence that this mode of voting has an appreciable effect on voter convenience counties in unaffected by the Hurricane.

Absentee mail-in voting had a significant and negative effect on voter turnout in counties impacted by Hurricane Sandy. As noted above absentee mail-in voting is restricted in seven of the ten states most severely affected by Hurricane Sandy. I suspect that any increase in absentee voting in these states was an indication that Election Day voting was problematic for many voters as they sought to obtain and cast a mail-in absentee ballot. In states with no-excuse absentee voting and with adequate time before Election Day to obtain an absentee ballot, a larger proportion of ballots cast by mail would predict a higher total vote turnout. This was clearly not the case in Hurricane impacted counties. In these jurisdictions there was neither sufficient time nor flexibility in the law to enable all those voters who wanted to vote by absentee mail-in ballot to do so.

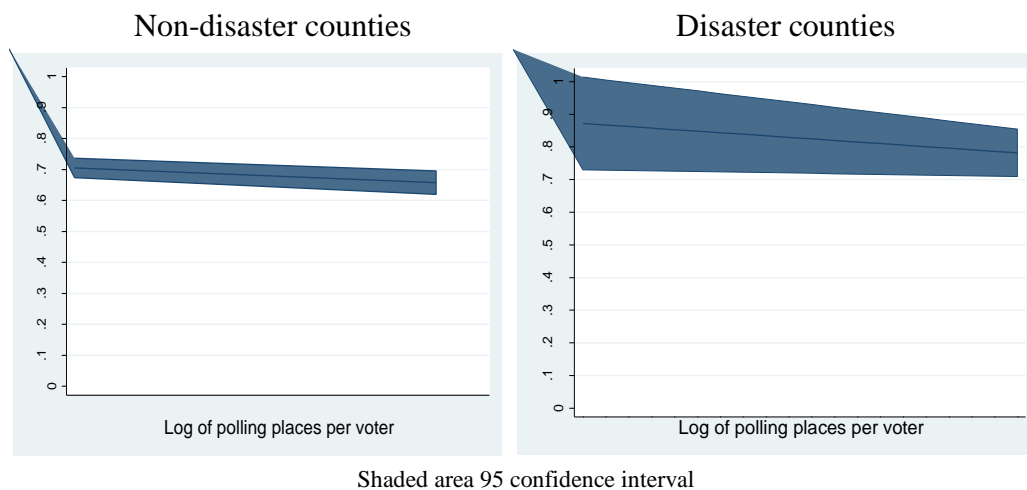
The proportion of the vote cast by in-person early voting had a significant and positive effect on voter turnout in counties most adversely affected Hurricane Sandy. A one percent increase in the vote cast early increased turnout by .23%. Of course, this effect is limited only to counties in Maryland, the only state that allowed in-person early voting in 2012. Maryland implemented in-person early voting for the first time in 2012. In states unaffected by Hurricane Sandy in-person early had a positive effect on turnout, but this affect is statistically insignificant.

Provisional voting is significantly related to lower voter turnout in counties most adversely affected by Hurricane Sandy. Recall these counties experienced a significant increase in the proportion of provisional ballots cast between 2008 and 2012, but not an accompanying increase in the proportion of provisional ballots counted between the two presidential elections. I suspect that many persons whose lives were disrupted by Hurricane Sandy were unable to vote at their designated Election Day polling place or lacked sufficient identification resulting in having to cast a provisional ballot that may not have been counted by election officials in counties affected by Hurricane Sandy.

The consolidation of polling places observed in counties adversely affected by Hurricane Sandy had a positive effect on voter turnout in these counties. Recall that there is evidence that a smaller number of larger polling places more centrally located where voters work, shop and travel enhances voter turnout. Though this relationship is observed in all counties, it is demonstrably stronger in those counties most severely affected by the Hurricane Sandy.

Figure 2 reports the expected proportion of voters who voted in the 2012 by the number (log) of polling places per voter, holding all other independent variables at their mean values for counties affected and unaffected by Hurricane Sandy. For both populations of counties polling place centralization has a significant, negative and linear effect on the proportion of registered voters who participated in the 2012 election. Counties where the Hurricane imposed its greatest damage have a steeper rise in turnout where there was the greatest concentration of voters per polling place. This effect may not have been intentional or orchestrated by local election officials in these counties. It is possible that the only facilities accessible to voters and with power were larger more centrally located polling places such as schools, government buildings and commercial/retail stores.

Figure 2
Predicted 2012 Voter Turnout (%)



5. Conclusions and generalizations

It is difficult to draw strong conclusions and generalizations for how local election officials should respond to and prepare for natural disasters from the study of a single election. In many respects the election of 2012 in those areas hit by Hurricane Sandy was a success; the election was held and there were no obvious doubts about its outcome arising from the Hurricane.

Many of the correctives for the disruptive affect Hurricane Sandy had on the 2012 election reside with individual state legislatures, not local election officials. Providing voters with greater flexibility when, where and how they cast their ballots (i.e., absentee mail-in voting, in-person early voting and Election Day vote centers) are choices only state legislatures can make, not county officials charged with conducting and administering elections. Moreover, many of these electoral reforms (e.g., in-person early voting) are the subject of recent and intense partisan debate and are not likely to be adopted in many states, even where their adoption might significantly mitigate the disruptive impact natural disasters can have on elections.

I did identify one practice that local election officials might readily adopt without much controversy as they prepare for and respond to the threat posed by natural disasters and emergencies. Polling place practices, specifically the number, staffing and location of where voters ballot on or before Election Day has been shown to have a positive effect on voter participation. A note of caution about this finding and the presumed recommendation for a smaller number of larger polling places. I have assumed a smaller number of larger polling places are also associated with their location in areas more central to where voters work, shop and travel; places that are more convenient and accessible than residentially proximate polling places. Moreover, I have assumed that a smaller number of larger polling places increases the efficiency of polling place operations, a finding reported in other studies.

In this study I do not report nor do I know the location of polling places, nor do I have data about polling place performance e.g., waiting time. Polling place locations are constrained by the availability of facilities and their cost. Not all of the most efficacious locations for polling places are available for use on or before Election Day. Future research needs to examine the location of polling places and their cost of operation before recommending consolidation of polling places as an antidote for the potential negative impact of natural disasters and emergencies on elections.

Bibliography.

- Berinsky, Adam 2005. "The Perverse Consequences of Electoral Reform in the United States," *American Politics Research* 33 (3):471-491.
- Berinsky, Adam, Nancy Burns and Michael Traugott. 2001. "Who Votes by Mail? A Dynamic Model of the Individual-Level Consequences of Vote-By-Mail Systems." *Public Opinion Quarterly* 65 (2): 178- 197.
- Brady, Henry E. and John E. McNulty. 2011. "Turnout out to vote: The costs of finding and getting to the polling places." *American Political Science Review* 105:115-134.
- Cemenska, Nathan, Jan E. Leighley, Jonathan Nagler and Daniel P. Tokaji. 2009 *Report on the 1972-2008 Early and Absentee Voting Dataset*. A report prepared for the Pew Charitable Trusts.
- Gimpel, James and Jason Schuknecht. 2003. "Political Participation and the Accessibility of the Ballot Box." *Political Geography* 22 (4): 471- 488.
- Gomez, Brad, Thomas G. Hansford and George A. Krause. 2007. "The Republicans Should Pray for Rain: Weather, Turnout, and Voting in U.S. Presidential Elections," *Journal of Politics* 69:649-663.
- Gronke, Paul; Eva Galanes-Rosenbaum; and Peter Miller. 2007. Early Voting and Turnout. *PS: Political Science and Politics* 40: 639-645.
- Hanmer, Michael and Michael Traugott. 2004. The Impact of Voting by Mail on Voter Behavior. *American Politics Research* 32 (4): 375-405.
- Haspel, Moshe and H. Gibbs Knotts. 2005. "Location, Location, Location: Precinct Placement and the Costs of Voting." *Journal of Politics* 67 (2): 560- 573.
- Karp, Jeffrey and Susan Banducci. 2001. Absentee Voting, Mobilization, and Participation. *American Politics Research* 29 (2): 183- 195.
- Kimball, David C., Chris T. Owens, and Katherine M. Keeney. 2004. Unrecorded Votes and Political Representation. In *Counting Votes: Lessons from the 2000 Presidential Election in Florida*, ed. Robert P. Watson, Gainesville: University Press of Florida, pp 135–50.
- Knack, Stephen and Martha Kropf. 2003. Voided Ballots in the 1996 Presidential Election: A County-Level Analysis. *Journal of Politics* 65:881–98.
- Kousser, Thad and Megan Mullin. 2007. Does Voting by Mail Increase Participation? Using Matching to Analyze a Natural Experiment. *Political Analysis* 15 (4): 428-445.
- Leighley Jan E. 2008. "Commentary on Attitudes, Opportunities and Incentives: A Field Essay on Political Participation," *Political Research Quarterly* 51:46-49

Laskowski, S. J., M. Autry, J. Cugini, W. Killam, & J. Yen. 2004. Improving the usability and accessibility of voting systems and products. NIST Special Publication 500-256.

McNulty, John, Conor Dowling, and Margaret Ariotti. 2009. Driving Saints to Sin: How Increasing the Difficulty of Voting Dissuades Even the Most Motivated Voters. *Political Analysis* 17 (4): 435-455.

Michael P. McDonald (2008) "The Return of the Voter: Voter Turnout in the 2008 Presidential Election," *The Forum*: 6 (4): 1-10.

National Conference of State Legislatures (NCSL), 2012. *Absentee and Early Voting*. <http://www.ncsl.org/legislatures-elections/elections/absentee-and-early-voting.aspx>

Neeley, Grant and Lilliard Richardson. 2001. Who is Early Voting? An Individual Level Examination. *Social Science Journal* 38 (3): 381- 392.

Oliver, J. Eric. 1996. "Who Votes at Home?: The Influence of State Law and Party Activity on Absentee Voting and Overall Turnout." *American Journal of Political Science* 40(2):498-513.

Richey, Sean. 2008. "Voting by Mail: Turnout and Institutional Reform in Oregon." *Social Science Quarterly*. 89:4:902-915.

Southwell, Priscilla and Justin Burchett. 2000. The Effect of All-Mail Elections on Voter Turnout. *American Politics Quarterly* 29 (1): 72- 80.

Southwell, Priscilla L. 2004. "Five Years Later: A Re-assessment of Oregon's Vote by Mail Electoral Process." *PS: Politics and Political Science* 98 (1): 89-93.

Stein, Robert. 1998. Early Voting. *Public Opinion Quarterly* 62 (1): 57- 70.

Stein, Robert and Patricia Garcia-Monet. 1997. "Voting Early, But Not Often." *Social Science Quarterly* 78: 657- 677.

Stein, Robert; Chris Owens; and Jan Leighley. 2003. Electoral Reform, Party Mobilization and Voter Turnout. Paper presented at the 61st Annual Meeting of the Midwest Political Science Association, Chicago, IL, April 3-6, 2003.

Stein, Robert and Greg Vonnahme. 2008. "Engaging the Unengaged Voter: Vote Centers and Voter Turnout." *Journal of Politics*. 70: 487-497.

Stein, Robert and Greg Vonnahme. 2010. The Cost of Elections. Working Paper.

Stein, Robert and Greg Vonnahme. 2012a. "The effect of Election Day vote centers on voter participation," *Election Law Journal*. 11:291-301.

Stein, Robert and Greg Vonnahme. 2012b. "When, Where, and How We Vote: Does It Matter?" *Social Science Quarterly*. 11:291-301.

Stein, Robert M., Greg Vonnahme, Michael Byrne and Dan Wallach. 2008. "Voting technology, election administration and voter performance." *Election Law Journal* 7:123-135.

Stein, Robert and Greg Vonnahme. "Polling place practices," Prepared for presentation at the Measure of Elections Conference, June 18-19, 2012, Massachusetts Institute of Technology, Boston, MA ,

White, John. 1960. *Voting Machines and the 1958 Defeat of Constitutional Revision in Michigan*. Ann Arbor: University of Michigan Press.