2021 NCSBN Scientific Symposium - Patient Outcomes, Inpatient Costs and Hospital Performance During a Disaster: The Implications for the Nurse Licensure Compact Video Transcript
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Presenter
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- [Woman] Jeannie Cimiotti is associate professor in the Nell Hodgson Woodruff School of Nursing at Emory University and associate program director, Atlanta VA Quality Scholars program. Her extensive research on the healthcare workforce and patient outcomes has been cited globally. She has been recognized as outstanding alumni at Columbia University School of Nursing and for publication excellence by the Association for Professionals in Infection Control and Epidemiology.

- [Dr. Cimiotti] So thank you for the opportunity to present this afternoon some of our preliminary research findings from our study that was funded through the National Council of State Boards of Nursing.

The title of our research project was Patient Outcomes, Inpatient Costs, and Hospital Performance During a Disaster: Implications for the Nurse Licensure Compact. So just some background, and it's a bit extensive because I think I really need to refresh your memory on what happened and what has been happening with storms in the United States. The U.S. has seen a great increase in the number of life-threatening storms.

Many are saying it's due to global warming. In 2020 alone, we had 25 named storms. Six of them were major hurricanes. It's more than double than what we were seeing 10 years earlier. Severe storms disrupt the activities of daily living, and they affect people across age groups. But what we really don't know is how these storms impact the delivery of health care services.

So our storm of interest was Hurricane Sandy. It was one of the major hurricanes. It was the major hurricane in October 2012, and it began as a tropical storm really on October 22nd in the Caribbean Sea.

On the 24th, Sandy was upgraded to a Category 1 hurricane when it hit Jamaica with 80-mile-per-hour winds. A day later, Sandy was upgraded to a Category 2 hurricane when it hit Cuba with winds of 105

miles per hour. It then proceeded to hit Haiti, the Bahamas. It killed 54 in Haiti, 11 in the Dominican Republic, and 2 in the Bahamas.

The next day, the 26th and the 27th, this hurricane was alternating between Category 1 hurricane and a tropical storm and then back to Category 1. On the 28th of October, Sandy was a Category 1 hurricane and it skirted right up the eastern seaboard.

It was moving parallel to Georgia, South Carolina, and North Carolina. However, on the 29th, it began to move inward towards land on the East Coast of the U.S. as a Category 2 hurricane but then again it weakened to a post-tropical cyclone. So I think the important takeaway here with Sandy is, when it made landfall in the eastern United States on the 29th of October, it was huge.

It was massive, maybe one of the largest hurricanes recorded in U.S. history. And as it began to move into the northeast, at 2:30 that afternoon on the 29th, it hit into the Washington, D.C. area and started to move northward. At 8 p.m. on the 29th, that storm made landfall in Atlantic City, New Jersey with hurricane-force winds of 90 miles per hour.

Now, what some folks might fail to have realized, I know our meteorologists knew, but maybe laypersons didn't that… Well, it was a full moon. And when we have a full moon, the tides are significantly higher. So now we have a hurricane coming into New York Harbor at 90 miles per hour, and New York Harbor isn't that big if you're familiar with that area of the northeast.

With a full moon with high tide, there was a 14-foot wave surge that entered New York Harbor and then would proceed up the Hudson River. Now, the Hudson River is just that—it's not a large river but it's well-known—separates New York and New Jersey. So you had massive flooding on each side of that river, so it meant lower Manhattan and most of New Jersey, especially mid to northern New Jersey took a really severe hit when this hurricane made landfall.

Now, this image that's here, hopefully you can see it, this is the 1 train in New York City, the uptown to the Bronx. And if you're familiar with the underground rail, they have steep elevators that are really… I mean, you're going to the underground so they're really lengthy and at a significant incline or decline, depending on if you're going up or down.

But you could see here this whole train station was flooded. The water has already come up to the very top of the escalators and to the area where people would enter into the station. And like I had mentioned, it impacts populations. If you look at this image on the left, this man carrying his wife on his shoulders... When I first saw this image, I thought he was near the ocean.

He's walking down a street in Hoboken, New Jersey trying to take his wife to safety. And in the photo on the upper right, people being evacuated in boats, again, in Hoboken, New Jersey. The streets were that flooded that they needed to be evacuated via boat. And in the background of that photo, you can see there's an ambulance. That ambulance isn't going anywhere.

It's stranded. So EMS was at a standstill. And when we have disasters of any sort, we've seen this recently, there's a food famine. So people know when storms are coming, they typically go to the stores,

they buy all kinds of, you know, perishable and non-perishable items thinking that they might not be able to get to a store for several days.

So there was a huge food famine during Hurricane Sandy. But gratefully—you know, New Jersey residents were grateful as we all are in our time of need—the National Guard were available. And Gov. Chris Christie brought in the National Guard at the time saying this was the most devastation that had ever occurred in New Jersey.

He brought in the Guard. They had vehicles that they could travel and navigate the flooded streets and help where help was needed. In this case in this image, you see them transporting an elderly gentleman probably to a shelter or what could be a hospital because the ambulances were nonfunctional. They were taking people to the hospital also.

Now, when it came to the hospitals, there was also another dilemma. Hospitals lost power. The whole state lost power. And hospitals have generators and that's fine. But when the hospital started to flood, there was an issue. The generators failed. They couldn't have staff walking through several feet of water.

They had to get patients out. Three major hospitals closed in New Jersey during this time—Jersey City Medical Center, Palisades Medical Center, Hoboken Medical Center. These are large hospitals. Patients had to be put somewhere. There was no way for us to maneuver staff. They couldn't get staff home. They couldn't bring relief staff in if they were available.

People didn't want to leave their homes, whether they were nurses or physicians. They might have had small children at home or other family or elderly to care for. They weren't going to leave in this time of desperation to go to the hospitals even though the National Guard could have brought them in if need be, but they definitely were… These hospitals were challenged probably like no other time in the state.

This is just an image that shows you a map that was provided by FEMA. You see New Jersey. Right here, New Jersey is very small, a small state, but it's densely populated. And the green areas are the low areas that had very little impact from the storm and none in New Jersey fell in the green area.

The purple areas were the highest impact. You can see that's along the coastline. You can see that there's a line on this map that shows you where the storm was traveling up the coast. It went right into that New York Harbor. You could see the purple area. New York City and Long Island is completely in the purple area. And then most of Central New Jersey was in the high impact area which is the red, and then the moderate impact area were some of those western counties.

Now, FEMA actually has definitions for storm surge, and we use these definitions in our analyses. You should also know that New Jersey being small only has 21 counties, and these counties were designated or categorized by their definition of storm severity.

So the very high areas of storm severity were those where greater than 10,000 people were exposed to the surge, and there were 9 counties in New Jersey that met those criteria, most of them right along the coastline. In fact, they were all along the coastline of some sort. On the high area of surge impact or storm severity were 5,000 to 10,000 people exposed to the storm surge with greater than $100 million in wind damage and over 8 inches of rain.

And, again, another nine counties in New Jersey were classified in the high-impact area. And then there's the moderate storm severity impact area where you have 100 to 500 people exposed to the surge, $10 to $100 million in damage, 4 to 8 inches of rain, and there were 3 counties in New Jersey that fell into that category.

So the overall study aims for this presentation and for our project were to determine if the supply of nurses in New Jersey hospitals were adequate to meet the demands for patients during Hurricane Sandy and to determine if patient outcomes would have been improved if additional resources, if they could have brought nurses in from other states to practice in the storm surge areas.

So, our methods, it was a cross-sectional analysis of secondary data. We used primarily data from the fourth quarter of 2011 as a comparison, and the fourth quarter of 2012 which was when Hurricane Sandy struck.

Our patient claims data were from the state in-patient database. Those were available through the Agency for Healthcare Research and Quality, their Healthcare Cost and Utilization Project. Hospital characteristics were obtained from the American Hospital Association Annual Survey, and New Jersey staffing was available from the New Jersey Department of Health.

New Jersey only has 72 acute care hospitals. Again, it's a small hospital. Sixty-six hospitals were included in our analyses because those were the hospitals that had sufficient data available on their staffing. So our variables and measures of interest were the hospital characteristics, bed size. We categorized that into three categories—teaching status or whether hospitals had medical residents, whether they were members of the Council of Teaching Hospitals, high technology.

Don't forget this was 2012. So we looked to see if hospitals had implemented the electronic medical record or not. Magnet accreditation. If hospitals had been accreditated as a Magnet hospital, it's interesting to note that New Jersey has always had the largest percent of Magnet hospitals, and it had the first Magnet hospital, Hackensack Medical Center.

And we also categorized hospitals based on the fact if they were designated as a safety-net hospital. Nurse staffing. They used two measures—the full-time equivalent of RNs and the patient to nurse ratio. We had unit types. We had several unit types. Most of our analysis, we collapsed them into ICU or non-ICU.

The patient data, we actually had data available on 87,701 patients. We had their demographic information, age, gender, race, ethnicity, and categories of economic status, comorbidities. These were potentially 29.

They were based on the Elixhauser Comorbidity Index. We had unit type, and we had admission and discharge month. Our patient outcomes of interest for this presentation were transfer out or transfer status. Did a hospital have to transfer their patients out? And that's to another facility, not the home, but did they transfer them out?

Patient mortality, patient readmission, and patient length of stay. Our statistical analyses were descriptive and inferential. We examined continuous variables and presented their means and standard deviations. Categorical variables as numbers and percents. We used linear and logistic regression models.

We conducted univariate, multivariate analysis. For this presentation, we presented the robust multivariate analysis. And we also projected the need for nurse staffing as the observed minus the expected FTEs, and we based this on the work of [inaudible] and colleagues. So when we looked at hospital characteristics by storm impact area, and again if you recall, we're limited to 66 hospitals.

We found that 39 of those hospitals were in the high-impact area. The majority of them 67% were large hospitals. Roughly a third were moderate. There were no small hospitals in the high-impact area. 62% were teaching hospitals, 85% did have an electronic medical record in place, 28% were our safety-net hospitals, and 44% were Magnet hospitals.

In the high-impact area, the distribution was quite similar with hospitals impacted on bed size, but we did see 9% of the smaller hospitals. Again, 61% were teaching hospitals. Again, high technology at 78%. The safety-net hospitals again impacted 30% of them, and 35% were Magnet hospitals.

Very few hospitals again wherein, if you remember, it was only three counties in the moderate area of storm impact and we saw 100% of those hospitals, though the number was small, they were moderately sized.

50% of them were teaching hospitals, 75% high technology, and 25% were Magnet hospitals. When we looked at the overall characteristics of the patients, the 87,701, on average, they were 50 years of age. Slightly more female at 57%. 62% of them were white, 17% African-American, 21% other.

13% were Hispanic. And when we looked at the income brackets, we see that the majority of them were in a very high-income quartile, and the next [inaudible 00:15:43] the 51% to 75%. I think you should probably know that New Jersey is a very wealthy state.

The people that live in New Jersey, due to the cost of living there, often have a substantial income. So that's most likely the reason why we see that the higher-income populations were impacted. When we looked at nurse staffing, we compared it to the quarter before. So we took the third quarter of 2012 and compared it to the fourth quarter of 2012 to just see if there was any shift in the number of nurses that might have been brought in to work during Hurricane Sandy, and we saw very little difference in staffing.

None of it was significantly different. Tiny little uptick in ICU staffing and intermediate units which included not only intermediate adult but pediatric and some of the specialty units. Med-surg, a slight decrease in the staffing but overall it was such a minimal increase in the staffing from that quarter prior to the storm and during the storm.

When we looked at patient outcomes in the fourth quarter 2012, we found on average the patient length of stay was roughly 5 days. 6% of the patients were readmitted. 2% of them died. The table on the lower part of this slide shows the results from our multivariate analysis.

These were linear or logistic regression models but the complete set of controls of patient and hospital characteristics. We found that for each additional patient added to a nurse's workload resulted in a higher likelihood and a significant likelihood that patients would be transferred out of the ICU and the intermediate units.

We also saw that significantly less likely to be transferred out of a med-surg. There were no significant differences in mortality so that's kind of a moot point, but we've included it in the table. When we looked at readmission, we see that there was a statistically significant relationship there between staffing so for, you know, each additional patient added to the nurse's workload resulted in the decrease in readmissions.

A higher likelihood of that happening in the ICU but across all units. So the patients weren't being readmitted, and the length of stay, the only significant finding was that it was slightly increased in length of stay in the intermediate units. Then we estimated the shortage of RN FTEs by county for the fourth quarter of 2012.

The map on the left represents the intensive care units. The map on the right, the non-intensive care units. What's of concern here or all the areas of concern because they all represent shortages, but the darker blue areas are where the severe shortage was.

And you can see in the intensive care units, you had four counties that really had a 75% to 100% shortage of RNs in their ICUs which is substantial. But when you look at the right, the non-intensive care units, you see a much larger number of counties in those dark blue areas, meaning 75% to 100% shortage of RNs.

And even the next lighter shade is 50% to 75%. So almost the entire state of New Jersey, they all had a shortage of some sort during Hurricane Sandy.

We'd looked at a couple different models, 10%, 20% increases, and we found out that, if you increased the number of RN FTEs by 20%, New Jersey would have been able to eliminate the shortage in all counties state-wide. So our study did have limitations.

Nurse staffing data are collected on a monthly basis, and they are reported quarterly. There were no other metrics of nurse staffing available to us despite our pleas with the New Jersey State Department of Health. So we do acknowledge that if we would have had nurse staffing at least a monthly, a weekly, or a daily level, we would have had maybe more robust findings. Nurse data were reported as a number of patients per RN and lack details on the employment status of RNs.

We do not know if the RNs were full-time, part-time, per diem, or supplied by a supplemental staffing agency. And our findings were limited to the hospitals in New Jersey. So these findings might not have been generalizable to hospitals in other states or in other settings.

So in conclusion, our estimates show that the supply of RNs in New Jersey was not sufficient during Hurricane Sandy to meet that demand of the patient demand. There was a significant association

between RN staffing and patient outcomes. States need to be more proactive in their efforts to ensure that they have an adequate and flexible nurse workforce.

If we don't know that now during the current COVID-19 pandemic, I don't think we'll ever learn. And the nurse licensure compact model should be adopted by states nationwide to allow for easy transition of state of nurses across geographic areas. Hospitals were struggling, still are, during COVID-19 where they were trying to issue emergent licenses, you know, agencies trying to help with the effort.

But if we hadn't had the compact in place, it would have been so much more easier for nurses to travel from one state to another to help during not only storms that are occurring every year but during our global pandemic. At this time, I'd like to acknowledge my collaborators, Dr. Yin Li who's an assistant professor at Emory University.

She was actually my co-PI and was responsible for a lot of analyses. Dr. Jason Hockenberry was a co-investigator. He's a professor at Yale University. And a special thanks to NCSBN for their ongoing support of nursing research and all of their efforts in practice, regulation, and helping to ensure that we have a healthy and substantial workforce in the United States.

Thank you very much for your time, and all questions are appreciated. Thank you.

- [Dr. Li] Hello, everyone. Thank you very much for watching our presentation, and I'm the co-PI on this project.

And Jeannie can't make it today so I'm here to answer your questions. So let's just give a couple of minutes, and let's see what kind of questions we're looking at. Just so you'll know before any questions, yeah, so I just want to let you know that what we're presenting here today are some preliminary analyses from these projects.

And this is [inaudible] project, and we will have more analyses, results published soon. Let's see. Okay.

Here's your question. "Very interesting use of the data and a creative approach." Thank you. "Do you have intention to apply this approach?" Well, the first approach that we used in this analysis are to calculate the RN FTEs, which is a very traditional or a very commonly used approach to examine the supply of nurses and also the demand of nurses.

And this approach actually is commonly used in projecting nurse supply and the demand. In the second approach that we used in this study is actually to examine the association between their staffing and patient outcomes. And also something that we have not presented here but is still under the preparation for manuscript is that we're going to predict how the patient outcomes will be changed or will be improved if we have additional nurse staffing available during Hurricane Sandy.

And I believe that because this is a very interesting project because it's for examining nurse staffing during a disaster, and so we believe that this will have some comments or some overlaps for any other types of disaster where nurses are in high demand.

And also... I see another comment on, "Having weathered the hurricane and now COVID, do you think public health..." Yeah, so that's something that we can imply or inform the future studies and COVID in terms of how nurse staffing can play a critical role during this COVID pandemic.

And another question asked, "Do you think public health nursing will be a higher priority in the future?" We believe so. We do believe so, but public health nursing is actually now the focus for our study because we were specifically focused on acute care hospitals.

But public health nursing, I believe that is very important, play a very critical role during a pandemic like COVID. Yeah, that is really great question. And then we believe that public health nurses, that they also served very important services during this pandemic like preventive care and testing services, and they are very important in controlling and ending this pandemic.

Another question. [inaudible] storm evaluation. I wonder Dr. Tchenkov [SP] can elaborate this question a little bit more.

So if there's no questions, then we would really like to thank the support from NCSBN and thank you for their funding support and also all of their support on this project. And more paper will come in from this project.

Thank you very much.