

RESEARCH

Assessment of Experiences and Impact of Hurricane Maria in Perceived Academic Performance of Student Pharmacists

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Objective. To assess the self-reported impact of Hurricane Maria in the perceived academic performance among Nova Southeastern University's (NSU) Puerto Rico Regional Campus student pharmacists.

Methods. A 37-item electronic Hurricane Impact Survey was created and sent by email to all student pharmacists ≥ 21 years old enrolled at NSU-COP Puerto Rico Campus during the Fall 2017 semester. The electronic survey was available through Redcap platform during four-weeks. Descriptive statistics, bivariate analysis and logistic regression were used to analyze the responses. Qualitative analysis was used to identify emerging themes in the open-ended comments.

Results. More than 70% perceived that their academic performance was affected after the Hurricane. About one third of students reported not being able to function mentally at the same level as prior to the storm ($n=53$, 35%) and reported sleeping difficulties ($n=54$, 36%). Females were more likely to report not being able to function mentally at the same level as they did before the Hurricane than males (41% vs 17%). In the multivariate analysis the underclassmen (P1-P2) were more likely to perceive negative impact in their academic performance compared to upperclassmen. Lack of preparedness, gratefulness, and campus management were the themes that emerged from the qualitative analysis.

Conclusion. Hurricane Maria had a significant impact in the lives of student pharmacists in Puerto Rico. This led to a perception of diminished academic performance, especially among underclassmen. The results can be used to guide to preparedness and response to natural disasters in academic settings.

Keywords: Hurricane Maria, pharmacy school, students, Puerto Rico, academic performance

INTRODUCTION

Hurricane Maria made landfall in Puerto Rico on September 2017 and the resulting damages were unprecedented. Puerto Rico had not faced a storm with sustained winds of 155 mph since 1928.^{1,2} Hurricane Maria is considered one of the costliest hurricanes in U.S. history.³ There were many challenges in the immediate aftermath including lack of power and potable water, scarcity of food and gasoline, and lack of communication.³ Since Hurricane Maria came at the beginning of the fall semester, all academic institutions were affected, including Nova Southeastern University's College of Pharmacy (NSU-COP) Regional Campus in Puerto Rico. In the aftermath of Hurricane Maria, the College was faced not only with a lack of resources as a battered island, but also with significant obstacles to complete the 2017 Fall semester.

Numerous hurricanes have impacted the mainland US with significant aftermath affecting academic institutions. Hurricane Ike struck Galveston Island, location of the University of Texas Medical Branch, in 2008. They conducted a hurricane needs survey post storm and found that students experienced significant distress and faced academic performance issues.⁴ In 2012, Superstorm Sandy hit the coast of New Jersey affecting Monmouth University students. Researchers found that headaches and loss of academic motivation affected their grade point average, but displacement and loss of power did not have the same effect.⁵ Perhaps of most significance have been the studies describing the effects of Hurricane Katrina in 2005. A survey conducted among Louisiana State University students found that displaced

students experienced more trauma exposure, distress, symptoms of post-traumatic stress disorder, and symptoms of depression.⁶

As a College and as a distant site, one of our main priorities was to allow our students to successfully complete the Fall semester. NSU-COP in Puerto Rico functions mainly by live broadcasting of lectures in addition to local faculty courses and labs. Due to campus closure during Hurricanes Irma and Maria, Puerto Rico students were behind five weeks in the academic calendar. The Campus was completely closed for 20 days, followed with a period of two weeks of partial closing or diminished hours of operation. Unfortunately, we were no longer able to catch up with the main campus schedule. In addition, due to unstable power and lack of broadcasting capabilities, we were faced with the need to provide classes locally. A local adaptation of the curriculum was implemented. Courses were assigned based on the expertise of each faculty and educators from other institutions were contacted to assist in the delivery of specialty topics. Despite this and the emotional distress faced by students, faculty and staff, our students were able to complete their fall semester. After this experience we developed a study to assess the impact of Hurricane Maria in the lives of student pharmacists. Our overarching goal was to reflect on this life-changing experience, to identify lessons learned as a College, and improve preparedness plans for future events.

METHODS

The primary objective of this study was to assess the self-reported impact of Hurricane Maria in the lives of NSU student pharmacists in economic and health-related domains and their perceived impact in academic performance. In addition, we aimed to evaluate student pharmacists' satisfaction with NSU's response to Hurricane Maria. This study consists of a cross sectional survey. All student pharmacists ≥ 21 years old enrolled at the NSU-COP Puerto Rico Regional Campus who were taking classes during the Fall 2017 were invited to participate in the survey.

A 37-item Hurricane Impact Survey (HIS) was created by adapting a 26-item questionnaire administered by Watson and colleagues at the University of Texas Medical Branch.⁴ The primary author of this study was contacted for permission to use and adapt their survey instrument. This validated instrument included questions from six different domains: (1) evacuation process, (2) communication, (3) access to services on other university campuses, (4) financial impact, property loss, and expenses incurred, (5) health-related matters, and (6) post storm access to on-campus university services. Each question was evaluated and the 21 that were found appropriate were kept or modified. Sixteen additional questions were created to assess impact on academic performance and some local campus responses. All questions were closed-ended with an open-ended comment section at the end. Prior to dissemination, the modified HIS instrument was completed by five students who assessed the survey's questions for clarity. Recommendations were used to update the final survey.

An invitation to participate in the survey was sent via e-mail to all NSU COP Puerto Rico Regional Campus students who were 21 years old or older and were taking classes during Fall 2017. This e-mail contained a link to the study survey that was available through the RedCap platform during a four-week period from May to June 2018. Reminders to complete the questionnaire were sent via e-mail on a weekly basis in order to stimulate participation and increase the response rate. The email sent contained an explanation of the survey, its purpose, and the subject's rights. It also specified it was both confidential and voluntary, and that the answers were not linked to the email. Only one survey response per student was requested. The RedCap Software was used to administer the survey. This study was evaluated by NSU's Institutional Review Board and was considered exempt.

Descriptive statistics included frequencies and percentages for categorical variables and means/standard deviation for continuous variables. Bivariate analysis was performed using chi square or Fisher's exact tests. A multiple logistic regression model was used to assess which variables were associated with self-reported affected perception of academic performance, and to estimate the odds ratios and their 95% confidence intervals. Included in the model were gender, age, school year, and all the variables that were statistically significant in the bivariate analysis. Significance was defined as an $\alpha < 0.05$. Data analysis was conducted using SPSS version 17.

RESULTS

A total of 150 students completed the survey for a response rate of 69% (150/215). The average age was 26 years (SD 3.4) years and most (74%) were female. Over half (52%) of the respondents were upperclassmen (P3 and P4). Most socio-demographic, economic, and health-related characteristics were statistically similar by gender and school year. Females were more likely to report not being able to function mentally at the same level as they did before the hurricane than males (41% vs 17%, $p=.01$). In addition, upperclassmen were more likely to report sleeping problems (44% vs. 27%,

$p=.03$) and fatigue (23% vs. 9%, $p=.03$) than underclassmen (P1 and P2). No other significant differences were found when compared by gender or school year.

In terms of academic performance, most respondents believed or perceived that their performance had been negatively affected to some extent by their disaster experience (74%). Almost half of the students (45%) reported being somewhat affected, 19% were likely, and only 9% were very much affected. However, about a quarter of the students (26%) reported not being affected at all.

Gender, age, school year, and hometown location were not significantly associated with self-reported negative academic performance (Table 1). A higher proportion of females believed or perceived that their academic performance had been negatively affected by the disaster experience compared to males (77% vs. 64%, $p=.10$). In addition, more underclassmen than upperclassmen (80% vs. 67%) believed or perceived that their academic performance was affected, although this difference was also not statistically significant.

Most respondents reported suffering material losses to some extent due to Hurricane Maria. At least three students indicated major damages to their homes. An increased worry about financing their college tuition was indicated by 60% of the students. About 78% of those who expressed financial worry also believed that their academic performance had been affected compared to 67% of those with no worries. However, these proportions were not statistically different. None of the variables in the economic domain were associated with their perception of academic performance.

In terms of health care, only a few students reported seeking out health provider services due to the storm (7%). They did report difficulty with access to both health care providers (26%) and getting prescription medications at a pharmacy (43%). Having difficulties accessing health care providers was significantly associated with perceived academic performance compared to those who had no difficulties (87% vs. 69% $p=.03$, Table 2).

About one third of students reported not being able to function mentally (35%) at the same level as prior to the storm and 16% were not able to function physically. Significantly more students (92%) who did not feel able to function physically also believed or perceived that their academic performance had been affected compared to only 70% of those who were able to function ($p=.03$). Not feeling able to function mentally was also significantly associated with perceived negative academic performance (84% vs. 68% $p=.02$).

The most prevalent physical symptoms reported as experienced more than usual since the hurricane included sleeping problems (36%), headaches (28%), and backaches (17%) (Table 2). Having headaches and having sleeping problems were significantly associated with perceived diminished academic performance. Most of the students with headaches perceived negative changes in academic performance compared to those who did not report headaches (85% vs. 69% $p=.04$). Also, most of those who had sleeping problems also perceived affected performance (83% vs. 68% $p=.04$).

In the multiple regression model only school year was significantly associated with students believing or perceiving that their academic performance had been affected negatively. Underclassmen were 3.48 times more likely (95% CI 1.3-9.4) to report a negatively affected academic performance than upperclassmen after adjusting for gender, age, having difficulties accessing health care providers, not feeling able to function physically or mentally, and having headaches, sleeping problems or other distress.

Open Comments Analysis:

In total, 48 students included additional comments. The following major themes emerged from the analysis of open-ended comments: (1) Lack of preparedness, (2) Gratefulness, and (3) Campus management.

Regarding lack of preparedness, some respondents (29%) stated feeling frustrated by the time it took to suspend classes in order to prepare for the event. They expressed dissatisfaction about not being notified with enough time prior to the storm. Students also expressed feeling like the university did not have an actual plan for this event. They recommended that the Puerto Rico Campus needed to implement a protocol for future storms. A total of eight students from the sample relocated to the main campus in Florida. These eight students also indicated the need for more guidance and assistance from the administration.

Forty percent of students reported being grateful to the local response. Since the Puerto Rico campus is a distant site, students felt that their semester would be compromised due to the event, leading to many worries. However, they expressed being thankful of the local faculty's response. Overall, the ratings students gave to the university's response to the hurricane was positive (this includes Florida): 43% of the students rated their response as excellent or good and vast majority (81%) gave the same rating to the local (Puerto Rico) faculty's response. Furthermore, students also expressed gratitude for the supplies and services provided after the event.

The most apparent issue stated was the campus management specifically the lengthy reconstruction process that the campus went through. The main issues presented by the students regarding the reconstruction process included unavailability of study rooms, the lack of potable water from fountains, and the conditions of the carpets which may have led to allergy problems.

In addition, Students felt that the campus should have been open for more hours since it was the safest and most accessible place, they had for studying. One month after the storm most students felt the campus was accessible (71%). Despite this, over half (54%) reported that the hours of operation after campus re-opening did not meet their needs.

Many students also reported facing communication problems with both the main campus and the Puerto Rico campus. During the storm, 87% did not have any communication capabilities and 26% remained without any communication service one month after the storm. Some respondents suggested implementing student-campus communication via radio to improve this area.

DISCUSSION

This study assessed the self-reported impact of Hurricane Maria in the lives of student pharmacists. A cross-sectional was used to assess academic, economic, and health related domains. Although to varying extent, student responses indicated that Hurricane Maria had an impact in all these domains. The feedback provided by students regarding issues with communication, campus access, and the contingency plans were also evident. Perhaps the most compelling result in this cohort is the negative impact of the storm in the students' mental health and their perceived negative academic performance, particularly among underclassmen.

The curriculum for the underclassmen was adjusted, and some courses were re-scheduled for the upcoming summer 2018. Due to this decreased academic load, we were not expecting their perception of being affected academically. However, a possible explanation of their perception is that during the first academic years in our doctorate program is where the foundational topics are taught. When Hurricane Maria hit Puerto Rico, first-year students (P-1s) had only completed three weeks of classes and had not taken their first exams. Similarly, second year students were being introduced to the pharmacotherapy sequence and patient care labs during this semester. Therefore, both classes may not have had enough time to completely adapt to the program. Despite having classes provided by local faculty and having both academic and emotional support, the uncertainty of their academic progression and development of the upcoming semesters could have possibly influenced their perception about their academic performance. Each year of pharmacy school has its own particularities and it is expected that the student experience with the impact of Hurricane Maria would be different. This was also evident among medical students from Puerto Rico who expressed diverse difficulties by school year, such as frustration with residency applications among fourth year students.⁷ Therefore, the students' academic school year should be taken into consideration when developing a contingency plan for natural disasters.

Various studies have reported the impact of natural disasters on students' academic performance. Watson and colleagues found that 47% (n=244) of the students reported that the storm negatively affected their academic performance and Doyle et al (2017) found that headaches and loss of academic motivation were factors associated with a reduction in student's GPA ($p<.05$). We had similar results in terms of headache, mental and physical function and their association with academic performance. Therefore, these symptoms must be evaluated and cared for in the aftermath of natural disasters.

A viewpoint article published in the Journal of Medical Association about the experiences of Puerto Rican medical students after Hurricane Maria, they reported similar troublesome experiences after the hurricane.⁸ The students struggled to study for courses, rotations and board examinations. They faced similar communication problems, unstable power, and they had missed three weeks of academic activities once classes resumed.⁸ We faced a more complex situation due to our reality of being a distant site that relies on advanced technology for the classes and for our daily operations. Due to Hurricane Irma our campus was closed for two weeks in early September and after Hurricane Maria, our campus remained closed for students three additional weeks. This put our students in a disadvantaged situation when compared to our campuses in the mainland. Despite the hardships of the situation that we were facing at the time, the classes resumed on October 16, 2017. Significant adjustments were made in the curriculum and we used our local faculty, personnel and resources to complete the semester.

According to the campus academic report, our student perception did not match their academic performance. Despite 45% and 28% of our students reported being somewhat and very much likely affected by the Hurricane their ability to comply with academic requirements was not affected after the Hurricane. In the Fall 2017 semester, all Puerto Rico Regional Campus students passed their courses and in Winter 2018 almost all students successfully completed the

semester except for two students who failed one course. The adjustments made to the curriculum, local adaptation, and courses rescheduling could have a potential influence on the positive performance of our students.

During the semester of hurricane Maria our underclassmen (P-1 & P-2) successful progression rate was 98%. For the third-year students the progression rate was 89% and 100% for the fourth-year students. By the winter semester we had all our underclassmen students had returned and 91% of the third-year students were on track for enrolling in fourth year rotations.

As an academic institution and a distant site campus, it was important for us to evaluate our response and make any necessary changes prior to future events. There was a campus Emergency and Continuity Plan, however, it was not widely known by our students. In addition, there was not a standard policy on when to close or not the campus in the advent of a hurricane. The feedback obtained from our students was instrumental in identifying our main areas for improvement: communication, campus closure, campus opening hours, and relocation guidance. Furthermore, due to the association of mental and physical health with self-reported academic performance, services to attend these conditions should be addressed. These results are used to guide an appropriate response in future natural disasters. Some of the actions that have been implemented or in progress are in the areas of communication, campus closure, mental health, and preparedness.

To address the issue of communication with the main campus in Florida, the College of Pharmacy now has satellite phones available with administrators in each campus. This should facilitate communication among campuses in future events, since all locations are at risk of hurricanes. In response to student concerns regarding the delayed closure of the campus the University has adopted a policy to close the regional campus as soon as the Puerto Rico government orders closure.

Mental health needs were a significant finding in our student responses. The University do not have mental health professionals located at the distant campuses, mental health services for all campuses is offered through teleconference and web assisted technologies. However, due to the lack of internet and communication capabilities these services were unavailable to Puerto Rico students in the aftermath of the storm. As a response, the semester following the storm, the University brought mental health services' personnel and they conducted group orientations about the services and how to access them remotely. These did not seem sufficient for students needing one-to-one or long-term services. In future events, identifying local providers or bringing personnel to provide these services to the island in the immediate aftermath should be considered.

In response to the experience of Hurricane Maria the regional campus disaster plan was re-evaluated, amended and aligned to the university wide response plan. This plan facilitates for unit and subunit as the College of Pharmacy, to develop a specific plan to address programmatic and academic particularities. The College of Pharmacy is in the process of creating this plan. Other colleges, including colleges of pharmacy, have adopted similar plans.⁹ Specific topics that need to be addressed in this plan include communication and student relocation. One of the greatest obstacles we faced in the island was the complete collapse of communications and power.¹⁰ The only available communication avenue for days after the storm was the radio.¹⁰ Hence, this and other platforms for keeping the students informed should be included in our College plan. The inability to communicate created anxiety among the students about their semester courses and clinical rotations. Therefore, some students relocated to campuses in Florida but as a College we did not have an established procedure. At the time, relocation had been an option only in special circumstances upon approval of the Dean. It has been found that relocation after a natural disaster is common and adjustments in the receiving school and academic services had to be made to meet the needs and assist those who relocate.¹¹ Therefore, a relocation protocol should be created to guide students and faculty during this process. It should contemplate guidance in terms of appropriate time limits for relocation and specific guidelines for administrators at each campus to receive relocated students. Following the example of other universities, we aim to include hurricane preparedness information during orientation week.⁴ This information will be redistributed each academic year and should contain guidance on the issues faced during Hurricane Maria.

Many of these lessons learned are very specific to our nature as a distant site campus. Therefore, it should be of interest and serve as guidance for other schools with distant site campuses who are in the process of creating or revising their natural disaster response.

CONCLUSION

Hurricane Maria had a significant impact in the lives of student pharmacists in Puerto Rico. These resulted in self-reported negative perception in their academic performance especially among those with health-related issues and among underclassmen. Areas identified for improvement based on student responses included: communication, campus closure,

campus opening hours, and relocation guidance. Each institution is unique and should conduct self-evaluations to improve their response to natural disasters. For our Puerto Rico students, Hurricane Maria will always be remembered. Their resilience has motivated us as a College to learn from their experience and to adapt in the face of adversity.

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