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# 'More stressful than cancer': treatment experiences lived during Hurricane Maria among breast and colorectal cancer patients in Puerto Rico

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## Abstract

**Background** In September 2017, Hurricane Maria, a Category 4 storm, struck Puerto Rico, causing widespread structural damage, prolonged power outages, and severe flooding. The devastation profoundly affected the island's infrastructure and population. Patients with chronic diseases, particularly cancer, face distinct challenges and healthcare needs during and after disasters. This study examined and documented the narratives of breast and colorectal cancer patients regarding their experiences with cancer care and treatment disruptions during Hurricanes Irma and Maria in Puerto Rico diagnosed six months before September 2017.

**Methods** A total of three focus groups were conducted in San Juan and Ponce. Colorectal and breast cancer patients were recruited in collaboration with the Puerto Rico Central Cancer Registry. The interviews were coded using a grounded theory approach.

**Results** 40% of the participants interviewed reported that their treatment was interrupted due to hurricane Maria. Focus groups narratives indicated that the most prevalent themes were (a) barriers and facilitators related to their cancer treatment, (b) experiences in treatment, and (c) stressors related to the hurricane. Participants discussed their struggles regarding their treatment experience, access to care during and after the hurricane and describe household challenges due to lack of electricity and water, which deter their intention to continue their treatment.

**Conclusion** Stressors directly linked with the disaster were most challenging to cope with. Our data highlights the impending need to address cancer patients in future emergency plans to minimize the delay in continuing cancer care.

**Keywords** Puerto Rico, Colorectal and breast cancer patients, Health services, Natural disasters, Emergency preparedness, Hurricane María, Qualitative study

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## Introduction

The impact of disasters in public health has resulted in physical injury, acute disease, and emotional trauma, along with an increase in morbidity and mortality [1]. Much of the research conducted in the aftermath of hurricanes and other natural disasters has focused on environmental risk factors, infectious diseases, physical hazards, and mental health. These studies have reported an increased risk of mortality, worsening of chronic diseases, adverse mental health effects, and heightened substance abuse, among other negative outcomes [2–8]. In September 2017, Hurricanes Irma and Maria devastated the Caribbean region, among them, the United States (US) territory of Puerto Rico (PR), with estimates between 800 and 8,500 excess deaths related to the hurricane through the end of December 2017, this added to massive resource and economics loss [9].

Patients with chronic diseases like cancer have unique challenges and needs during and after disasters [10]. Cancer patients are highly susceptible to disruptions caused by natural disasters, given that proper cancer treatment and follow-up involves communications with multiple healthcare providers [11] that extend from diagnosis through treatment to survivorship [12]. Additional challenges related to emergency preparedness planning often do not address cancer patients [13]. Cancer patients face a range of vulnerabilities that are not adequately addressed in conventional emergency planning [14]. These include the need for uninterrupted access to life-saving treatments such as chemotherapy, radiation therapy, and immunotherapy, as well as specialized medications that are often time-sensitive and require refrigeration or careful handling. Despite studies that have documented the impact of disasters on overall health and cancer [10, 14–22], few qualitative studies have been conducted to addressed questions regarding the impact of the hurricane in care [18] and to understand more deeply their views, opinions, and resilience stories from this experience. This qualitative study explores the narratives of cancer patients related to disruptions in cancer care and the time to care resumption following Hurricanes Irma and Maria in Puerto Rico, capturing patients' lived experiences and systemic challenges in the healthcare landscape. To achieve this aim, we partnered with the Puerto Rico Central Cancer Registry (PRCCR), one of the oldest registries in America [23]. A methodology for the recruitment of breast and colorectal cancer patients (case ascertainment protocol) was developed and implemented as part of this study. This approach ensured the identification and engagement of eligible participants while adhering to the study protocol and ethical guidelines.

## Methods

We used a qualitative design through focus groups to accomplish the proposed objective. Focus groups can provide an in-depth understanding of factors influencing health behaviors by encouraging open discussion and increasing participants' comfort level in disclosing personal opinions [24]. We used a modified grounded theory approach for data collection and analysis [25] To ensure the transparency and quality of qualitative research reporting, we used the Consolidated Criteria for Reporting Qualitative Research (COREQ) to guide the development of this report.

The inclusion criteria for participating in these focus groups were the following: [1] patients diagnosed with breast or colorectal cancer [2] older than 40 years old and being diagnosed between March 2017 and September 2017; [3] being under active cancer treatment before, during and after September 2017 and [4] lived and received treatment in PR during the aftermath of the events. We used data from the PRCCR to obtain a list of patients who met the inclusion criteria. A stratified random sampling method by malignancy was used to select participants from different geographical regions, ensuring the inclusion of 60 colorectal cancer (CRC) patients and 60 breast cancer (BC) patients who met the study's eligibility criteria from the total number of patients diagnosed with breast and colorectal cancer registered at the time in the registry. Geographical regions were stratified according to the Puerto Rico Department of Health Regions, which divides the island into eight health regions, each serving as a hub for public health services, resource allocation, and healthcare planning. These regions are designed to address the specific demographic and geographic needs of their respective areas and have been consistently utilized for research purposes [26].

Following the assessment of potential participants gathered from the PRCCR, our research staff followed the Case Ascertainment Protocol established by PRCCR and developed in collaboration with the Principals Investigators (PIs) of this study (VCL, KJOO, MSS) to contact potential participants (Fig. 1). Like most central cancer registries in the US [27, 28], protocols establish that our research staff cannot directly contact patients without consulting and receiving passive approval from their primary healthcare provider. The process for recruiting and engaging participants in this study, following the case ascertainment protocol from the PRCCR, involved the following steps: First, we contacted the patient's primary healthcare provider and allowed up to two weeks for them to inform us whether the patient should be contacted. After receiving passive approval, the research staff mailed invitation packages to potential participants. These packages included an informed consent form, a letter from the PIs and the PRCCR, and a brochure

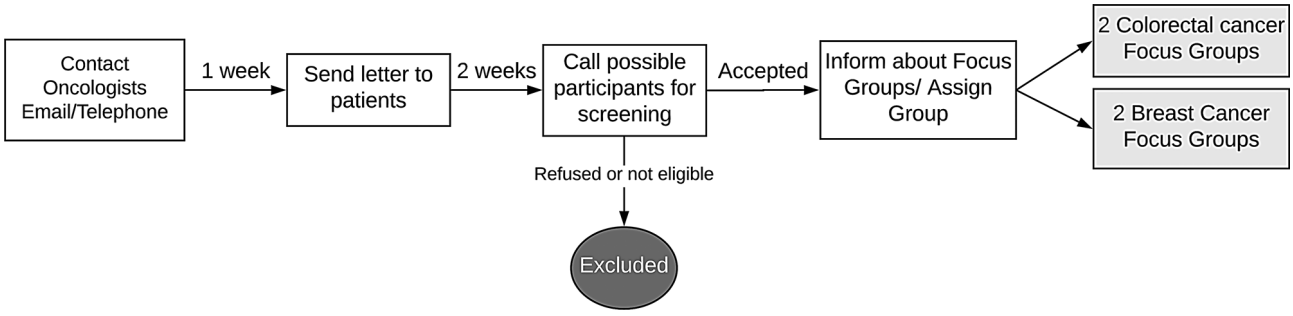


**Fig. 1** Case ascertainment protocol for population research provided by the Puerto Rico cancer registry

addressing frequently asked questions (FAQ) about cancer studies (e.g., 'Why are members of this research study contacting me?'). The letter explained the study's objectives and invited the participants to join the research.

The PRCCR letter addresses the purpose of this registry and explained to the potential participant how our research staff have this information. After two weeks of certified mail confirmation of receipt, we called the participants to discuss the study, assess their interest in participating in the study, and assess their eligibility. Research staff can attempt to contact potential participants up to a maximum of 8 times.

Three focus groups were conducted between May and June 2019. Two focus groups included colorectal cancer patients—one with four participants and another with three participants. The third focus group, consisting of breast cancer patients, included four participants. A participant was excluded from the transcript analysis as it emerged that their cancer diagnosis occurred outside of the specified period. In total, ten individuals participated in the focus groups. Taking into consideration the residence of some of these participants, research staff facilitated two settings to conduct the focus groups: [1] at the Metropolitan Area (the University of Puerto Rico Comprehensive Cancer Center (UPRCCC) in San Juan) and [2] South region of PR (UPR Ponce Campus). The study protocol was approved by the Institutional Review Board (IRB) of the IRB-UPRCCC (2018-09-03 B).

Research staff members explained the study and obtained informed consent from all participants. A screening form was administered to evaluate participants against the inclusion criteria, ensuring eligibility for the study. To capture participant profiles, all individuals completed a demographic questionnaire collecting key demographic information (e.g., sex, date of birth, marital status, educational attainment, and household income), as well as clinical information, including self-report of other comorbid chronic diseases, treatment related to chronic diseases diagnoses, and cancer medical history. For the chronic diseases reported as well for their cancer diagnosis, we explored in this survey if their treatment plan was interrupted due to the hurricanes. Finally, data were collected on the age at cancer diagnosis, the proposed cancer treatment plan, the expected initiation date, and the actual initiation date. These variables were analyzed to evaluate potential delays in treatment initiation. Focus group interviews were conducted in Spanish by female staff (VCL, KJOO, MSS, and YSC). Following the discussion, participants received educational materials about local organizations that offer services and support to cancer patients along with $35 as compensation. The study team developed a semi-structured interview guide. The focus group guide was developed through a comprehensive literature review and aligned with the study objectives (Table 1). Focus groups were audio-recorded, transcribed, and imported into *Atlas.ti* for analysis. The lead author and four coders read all transcripts and began coding using a constant comparison method, following the grounded theory approach. Each coder independently read and coded the same transcript, then discussed the identified themes to create a base set of codes for the remaining transcripts. The analysis team met weekly to review emerging themes, reach consensus on new codes, and resolve any coding discrepancies. After this revision, the research staff developed a focus group guide based on the findings.

*Focus group guide.* The most common codes were reviewed and grouped into key themes, are summarized below. The original focus group guide (in Spanish) is included as supplemental material to this manuscript.

## Results

Participants' mean age was 61.8 years (standard deviation [SD], ± 10.87) at the time of cancer diagnosis. Most participants (80%) were married, and 40% of the focus group participants reported being retired or physically impaired at the time of the interview. Half (50%) of the participants reported a family household income below $15,000 annually, and 40% of them with education higher than high school. The two most common chronic comorbidities reported were: hypertension (80%) and diabetes (40%). All participants who reported these conditions indicated that they had been diagnosed before the hurricanes. All participants began their cancer treatment before

**Table 1** Interview questions from focus groups conducted in Puerto Rico with breast and colorectal cancer patients

| Topic | Questions |
|---|---|
| Interruption and continuation of cancer treatments after hurricanes Irma and Maria | How many days after Hurricane Irma and Maria were you able to start or continue your cancer treatment? |
| Transportation Barriers | What challenges or barriers did you face in reaching the health organization or institution to receive your cancer treatment?<br>Did you have someone to drive you to your medical appointments? |
| Communication and coordination of services with doctors and/or health facilities | What challenges or barriers did you face…?<br>a. reschedule cancer treatments or other services after Hurricanes Irma and María?<br>b. contact your doctor or any health institution/organization staff for information on the reestablishment of medical services?<br>c. take or receive lab tests or results? |
| Physical and emotional stress during hurricanes Irma and María and its impact on the continuation of cancer treatment | Taking into consideration everything that happened with Hurricanes Irma and María, how stressful was your experience? |
| | If you had to choose just one thing, what would be the most stressful thing about Hurricane Maria? Example: Floods, relocating temporarily due to losses at home, poor access to roads, lack of communication, electricity and/or water, limited access to gasoline, loss of your job, etc.<br>Possibility of not receiving treatment for cancer or receiving it late? |
| | What do you consider to be the most stressful of handling your cancer condition during this period?<br>*Example*: Concerned that your health would get worse if your treatment were delayed.<br>Not having enough medications, not having contact with your doctor, not having means of transportation, changing clinic to continue treatment, etc.<br>Avoid public places for fear of contracting infections that will worsen your health. |

Hurricane Maria, with 40% reporting that their treatment was interrupted or delayed due to the hurricane.

Analysis of the focus group identified (a) barriers and facilitators related to their cancer treatment, (b) experiences in treatment during the disaster, and (c) stressors related to the hurricane, as the themes most emergent.

#### Barriers related to their cancer treatment

Difficulties in reaching healthcare providers or facilities, as well as limited or no access to basic needs at treatment sites or in their homes, were among the most common codes identified. Participants described the continuous calls and efforts they had to make to access care and resume treatment (particularly among participants from rural areas); to reach for sufficient phone coverage and contact their providers. It was also discussed how participants traveled to the metropolitan area to assess provider's and treatment facilities' availability or find out if drugstores were open. Participants mentioned how these barriers led to weeks (sometimes months) in determining and having plans regarding the next steps of their cancer care treatment. ***"chemotherapy was not available, and my physicians did not have their facilities ready for treatment." — CRC participant***.

The majority of the participants discussed how the hurricane delayed their scheduled mastectomies and other treatments (e.g., chemotherapy, radiotherapy), mainly due to lack of electricity in the institutions, which led to a postponement of their treatment by months. Some participants also discussed the potential impact of rescheduling their cancer treatment, as they show hesitation to initiate treatment due to their household situation (e.g., lack of electrical plant, lack of water). Participants also expressed fear due to the instability of the electric system at the provider's institution, which would affect their treatment. ***"Radiotherapy was then scheduled for October. It was the partial mastectomy in August, then in September, the ovaries [oophorectomy], and the radiotherapy in October. Everything was postponed. When [the institution] finally had electricity, they called me in October, and I said no, because I work in the metropolitan area and here half the island [shutdown] every day." — BC participant***.

The discontinuation of the special health coverage was another topic discussed with the participants related to economic availability. The government provides special health coverage to patients with specific complex diseases, such as cancer. This special coverage aims to facilitate the management and treatment of these conditions among the population with the government health plan. Special coverage under this provision begins upon confirming a cancer diagnosis and ends after cancer treatment is completed. Some participants argue that the discontinuation of the special coverage after completing the chemotherapy affected follow-up services. ***"I still haven't done the PET scan because right after [Hurricane] Maria it was my appointment, […] I finished the chemotherapy, but right after the same day that the last chemotherapy was administered, they removed the service (health coverage) of the catastrophic" — CRC participant***.

***I look for the referrals and even though, then, they called me about a month [later], this time it took a lot to get those referrals, [when] I delivered all the***

***referrals and they told me, you no longer have the catastrophic [special coverage], you do not have the coverage, I had to pay for it and since I didn't have the money, I didn't do it, and it's been a year and I haven't done it yet.* — CRC participant**.

#### Facilitators related to their cancer treatment

On September 28th, 2017, the Puerto Rican government announced a waiver for pre-authorizations and medical referrals due to the crisis through an executive order (*Carta Normativa* CN-2017-221-D) [29]. This executive order stated that patients could get access to health services before the emergency required referral or pre-authorizations, which expedited the access to services during the disaster. In regards to this order, participants agreed this was a facilitator for their access to care. More so, due to their need to continuously visit their primary care physicians for requesting referrals for needed follow-up treatment, medications, or lab tests. A participant indicated:

***"That [referral or pre-authorizations] should be removed. Leave it like that, that don't require (referral) because you have to get a referral to go to a colonoscopy, you had to look for a referral for … and sometimes it was not easy, and with this hurricane, one went and there was no problem."* — CRC participant**.

Also, participants expressed that access to their prescriptions during the hurricane was facilitated due to the opportunity to get their medications in advance (up to three months' supply). In most cases, expedite communication with their providers and drug stores before the hurricane hits the island facilitates the rapid dispatch of medications.

#### Treatment experiences during the disaster

Participants shared diverse experiences regarding delays in their cancer treatment, highlighting how they demonstrated resilience and adapted to the challenges associated with their care. Some of the experiences were inherently due to the disaster and the inability to perform surgeries of other treatments ***"I had surgery on January 20th, 2018. From there, I took 10 chemotherapy again and I am in treatment more or less."* — CRC participant.**

Challenges arose in the process of coordinating the supplementary device needed for chemotherapy treatment (e.g., port-a-cath or chemo-port). A participant described interruptions in their cancer treatment due to clinical complications ***'[…] On January 24th, I started chemotherapy, it was more or less 6 months that [then] turned into 9, because the moment came when the body could not resist the chemotherapy and instead of doing it every two weeks, I had to do it every three [weeks]. So, I came to finish almost in October or September 2018.'* — CRC participant.** These complications added further challenges to their treatment, which were intensified by the impact of the hurricane: ***'In the middle of the hurricane, my body began to turn red, red, completely red and I didn't know what to do, but luckily, they explain [me what to do], that [the device] had a little key that closes, and I closed it. But I was completely red. Then the hurricane happened, one laying down all day and without disposition to do anything.'* — CRC participant**. Despite these challenges, study participants overwhelmingly chose not to transfer to other hospitals or institutions in the US for their treatment. They expressed strong trust in their oncologists and medical team in Puerto Rico, which reinforced their decision to stay ***'but I didn't feel comfortable having to move farther, disarticulate the [established] medical team.'— BC participant.*** This sentiment was largely influenced by their understanding and acceptance of the disaster's magnitude and its role in causing the delays and complications in their treatment. ***'No, because my chemo was every 3 weeks. Every 3 weeks I would take my chemo. It took a few days, but we must understand that it was because of the hurricane.' — BC participant***.

In contrast, some participants reported no significant complications and described their treatment experience during the hurricane as normal. A key factor that may have contributed to this positive experience was the social support received during the emergency, particularly assistance with storing medications and transportation to healthcare facilities: '***my sister had an electric generator, what she did was she took my insulin and put it in the fridge and I kept the bottle [insulin] I was using at the time.'***, other participant shared ***'my daughter was staying at home, so there were 3 cars, there was gasoline. If I had to go get the [chemotherapy] my daughter would take me […], thank God.' — CRC Participant***.

A group of participants expressed that their experience with cancer treatment during the hurricane was lessened due to their persistence, resilience and thrive ***'Yes, in September was the hurricane, I had therapy the day before the hurricane and in October well I was taking my chemo again. Because I am persistent - BC participant.***

#### Hurricane-related stressors

Focus group participants identified multiple stressors related to Hurricane Maria, with a major concern being the prolonged lack of water and electricity. Due to the lack of electricity, participants described enduring long and exhausting lines to obtain gas for generators—an experience reported only by those who had access to such devices during the disaster. The economic burden that the patients overcome due to price increases in food

and supplies was also mentioned. This was heightened by the limitation to use the Food Stamp Program card, as lack of communications impeded the use of the Electronic Benefit Transfer (EBT) cards system.

A surge in the prices of the generators resulted in additional financial strain:***"[I] bought a small electric generator, that now cost 3 or 4 hundred dollars, but at that moment (hurricane aftermath) we had to pay 2 thousand dollars, only to used it to keep the refrigerator on." — CRC participant.***

Not having electricity or a generator was more difficult for those who needed to keep their medications refrigerated (for example, insulin). Even the heat and mosquitos was described as a stressful environment when particips described not having at least a fan in their houses for ventilation. Moreover, overcoming this catastrophe been a cancer patient brought many limitations. Household chores can be overwhelming. It can be particularly challenging to obtain food and supplies needed to maintain specific diets or provide meals for their families.

Participants also shared the challenges and restrictions they encountered while preparing for the hurricane including difficulties in placing the shutters, making the long gas lines and going back to work.

### Preparation

The study participants frequently emphasized their lack of preparedness for the hurricane, as their primary focus was on managing their diagnosis. Most of them only were prepared with canned food and water, some of them had a gas stove, and very few had electric generators or water cisterns.

***"As for my condition well that caught us by surprise, because after the operation, remember that I got operated on September 8th. During Maria, I was discharged from [hospital] the same day that Maria [hurricane] came. The only thing that had to be done differently was waiting for Hurricane Maria to pass and, more or less work with the products that were at home."*** **– BC participant**.

**Reflexions.** Study participants recommended that Puerto Rico has to be more prepared in terms of electricity, switching to renewable energy or other options. Participants also emphasized the need for health institutions on the island to be prepared with cisterns and generators, as well as to implement mitigation plans and establish collaborative committees. Even discussed there is little information on how to prepare for a hurricane, particularly educational materials targeting those patients with a cancer diagnosis. A participant mentioned: ***"But there's no type of education in terms of the condition (disease)"*** **— BC participant**.

When participants were asked about their reflections about the things most stressful about the hurricanes and its aftermath, participants reflect how the delay of treatment for their diagnosis was not stressful, as it was the stressors associated with the hurricane itself. ***"I would say that, comparatively, the most stressful for me, but has nothing to do with me, the most stressful was the impact of the hurricane on the island and seen other families without homes…"***— CRC participant.

When a participant was asked if the possibility of a delay in the treatment was stressful, she answered: ***"No, because I had lengthy conversations with the doctors. I just said, "a bit more waiting," because with the hurricane, there was nothing I could do. The delay in treatment wasn't stressful; it was the hurricane and its aftermath that were" — BC participant.***

## Discussion

This study examined the experiences of cancer patients with breast and colorectal cancer in active treatment during and after Hurricane Maria in Puerto Rico. Due to the high prevalence of chronic diseases, most study participants had comorbidities alongside their cancer diagnosis. Hypertension and diabetes were the most prevalent conditions. Although most participants started their cancer treatment before the disaster, 40% indicated that their cancer treatment was interrupted or delayed due to Hurricane Maria. Similar to a focus group conducted in the aftermath of Hurricane Katrina [30], our focus groups highlighted that the island's weak infrastructure system added to the stressors related to the disaster and the need to obtain basic household necessities. These issues affected the population at large and impacted cancer patients in their initiation or continuation of cancer treatment. These barriers also limited patient's confidence in the continuation due to electric/water system frailty. These stressors were often mentioned as a more negative experience than the cancer diagnosis itself. These findings are consistent with studies indicating that the prior weaknesses of the island's infrastructure intensified vulnerability making the reconstruction more challenging [31].

A commonly reported barrier, both in the United States and internationally, is the difficulty in establishing effective communication with healthcare providers and facilities [32–36]. This barrier emerged as one of the most significant barriers in this study. This factor has also been acknowledged previously as one of the most influential service disruptions affecting the reestablishment of Public Health Laboratory activities in Puerto Rico after Hurricane Maria [37, 38]. Despite being a primary barrier discussed, participants shared that moving to the US for the reinstatement of their treatment was not an option for them, although evidence shows that this humanitarian assistance also benefited other cancer patients on the island [39]. Age and stage at diagnosis may explain

differences in the narratives observed in this focus group. However, participants consistently expressed trust in their local physicians and medical teams, despite the disruptions in communication and delays in follow-up care caused by the hurricane.

It is important to highlight that despite the gradual reinstatement of health institutions, patients discussed their understanding in their treatment delay. According to information from the PR Electric Public Authority (PREPA), it took 11 months to restore power in Puerto Rico after Hurricane Maria [40]. A shorter yet still significant amount of time was required to restore water in the most rural areas of the island. Social support in the household was limited due to the lack of fuel for transportation and accessibility barriers. Some neighborhoods limited visits to family members to provide care and support. Therefore, it is understandable the narratives of delay in initiating their treatment due to their household status. The effects of mastectomy surgery and chemotherapy for either breast or colorectal cancer might be uncomfortable to manage without power (for ventilation, for example) and clean water (for cleaning their wounds, bathing). This observation is important to emphasize as future estimates using the cancer registry, medical claims, and data conducted by our team might reflect a delay in treatment that was influenced by the state of the medical facilities on the island [36]. In the context of Hurricane Maria and Puerto Rico, these differences might vary by rural/urban neighborhoods.

Economic barriers, such as the cancelation of the Special Coverage for high-risk conditions like cancer during their treatment exacerbated the challenges faced among patients enrolled in Medicaid. However, this barrier is not directly related to an economic obstacle due to the hurricane. Nevertheless, it is still a major limitation among cancer patients who receive this special health coverage. On the other hand, follow-up and referrals for these patients were alleviated by an executive order in the aftermath of the hurricane that allowed patients of government healthcare to receive treatment and services without a prior authorization approval [41] In the context of studying the impact of Hurricane Maria on cancer, future studies need to explore how this policy facilitates (or deter) health services utilization (cancer screening, follow-up, referrals, and treatment) as well as morbidity, mortality, and survival.

Moreover, throughout the focus groups, a main factor emerged from their narrative: their resilient nature. Resilience has been discussed in Hurricane Maria and cancer patients [16] and historically documented among vulnerable populations. Studies on Hurricane Katrina [42, 43] have shown how low resilience and low social support were associated with avoidant coping in Hurricane Harvey [44, 45].

In summary, participants in our focus groups highlighted experiences during the hurricane that contributed to delays or postponements in treatment. Even though most clinical institutions remained open for service, factors related to the poor infrastructure of the island (electricity and water outage) and lack of communications limited their willingness to initiate or continue their cancer treatment. The experience of living in the disaster while recently diagnosed with cancer was more stressful than the diagnosis itself.

This study has some strengths, including the use of the PRCCR as a tool for population-based research and cancer patient recruitment. The development and implementation of a case ascertainment protocol offer an opportunity to conduct this research in patients recently diagnosed prior the hurricanes. This effort may facilitate the implementation of similar methodologies to examine barriers faced by cancer patients across the cancer continuum. Additionally, it could contribute to healthcare delivery research in collaboration with PRCCR partners, offering insights into outcomes that may be exacerbated by disasters [46].

Limitations of this study using the case ascertainment protocol included the lack of updated contact information of the potential participants from the PRCCR or the physician, returned letters due to unclaimed or incorrect address, and lastly, the ineligibility of some patients (mostly CRC patients) who were not in active treatment during or after the hurricane. Another limitation of the study was the limited sites in which the focus groups were conducted since some of the participants found them too far from their homes. Also, while there is a potential for recall bias due to the time elapsed since the events. We recognize the lasting impacts of the disaster on participants' lives, which may influence their narratives and perceptions shared with the research team during the focus group discussions.

Despite these limitations, this study provides valuable insights for researchers and clinicians by identifying key factors contributing to cancer care disruptions and the time required for patients to resume treatment. By exploring the experiences of cancer patients in the aftermath of Hurricanes Irma and Maria, the study highlights systemic vulnerabilities, logistical barriers, and patient-level challenges that impact continuity of care. These findings can inform the development of targeted interventions, policy recommendations, and disaster preparedness strategies targeted to cancer patients to minimize care disruptions and improve resilience within healthcare systems.

These findings should guide disaster planners, emergency responders, and cancer care providers in enhancing service continuity and informing policy development. Specifically, these efforts can help refine disaster

preparedness strategies and cancer center protocols in areas most affected by hurricanes, flood, and electric and power outage, to ensure timely reentry and access to cancer care while mitigating the impact of future disruptions on vulnerable patient populations, particularly in areas most affected by hurricanes, flooding, and power outages.

**Abbreviations**

| | |
|---|---|
| BC | Breast cancer |
| CRC | Colorectal cancer |
| IRB | Institutional Review Board |
| PR | Puerto Rico |
| PRCCR | Puerto Rico Central Cancer Registry |
| UPRCCC | University of Puerto Rico Comprehensive Cancer Center |

## Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-22772-7.

Supplementary Material 1

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**Author contributions**

VCL, MSS, and KJOO contributed to the conceptualization. VCL, MSS, KJOO, TQ, MEF, and YSC designed the study and instruments. YS recruited participants; collected and transcribed data. VCL, MSS, KJOO, and YSC analyzed and interpreted the data; translated illustrative quotes. VCL, MSS, KJOO, TQ, MEF, and YSC drafted the manuscript and review different versions of the manuscript. All authors read and approved the final manuscript.

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**Data availability**

Not applicable.

## Declarations

**Ethics approval and consent to participate**

This study protocol has been approved by UPRCCC IRB (2018-09-03 B). After receiving information of the study, participants gave their consent to participate in the focus groups and to be audio recorded.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare no competing interests.

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