



The Vital Role of Large Health Systems in Disaster Recovery: Lessons from Helene

How a Nationally Leading Health System's Innovations in
Mobile Care and Critical Resource Management Helped
Mitigate the Impact of Hurricane Helene

Executive Summary

In September 2024, Hurricane Helene caused widespread damage across the southeastern United States, including the mountainous areas of North Carolina, South Carolina, Tennessee and Virginia, blocking health care access for many residents and interrupting the supply of necessary intravenous (IV) fluids to hospitals nationwide. In response to the storm, Charlotte, North Carolina-based Advocate Health quickly implemented disaster response strategies to ensure timely patient care and delivery of essential supplies to communities in need. The health system's response included deploying a wide range of air- and ground-based health care services to affected communities, coordinating closely with local, state and federal disaster response agencies and developing innovative resource management solutions that minimized the impact of the national IV fluid shortage. Advocate Health's multifaceted response to Helene demonstrated how a large-scale health system can effectively leverage its extensive resources to address critical needs in communities affected by natural disasters.

Helene's Impact

When Hurricane Helene hit North Carolina on Sept. 27, 2024, it brought unprecedented rainfall, winds, tornadoes and landslides. Thirty-nine counties in the state were declared major disaster areas. An estimated 73,700 homes were damaged, and 900,000 homes and businesses in the state were without electricity following the storm. Many residents also faced interruptions in water, sewage and cellular communications services. Utility infrastructure in some parts of the region was totally destroyed. Outages stretched for weeks and, in some areas, months.¹

The impact of the extreme weather presented multiple challenges for health care systems. The record-breaking amounts of rainfall from Helene damaged thousands of miles of roads and bridges in North Carolina and neighboring states, blocking easy access to health care facilities for millions of people. The storm also flooded the Baxter International factory in Marion, North Carolina, which supplies 60% of the IV fluids used in the United States.² The plant closed for production in late September and did not return to pre-hurricane production levels until early 2025.³

Advocate Health, the third-largest nonprofit health system in the United States, mounted a comprehensive response to Helene that brought much-needed medical care and supplies to people in the hardest-hit regions of North Carolina. The organization, which was created from the 2022 combination of Advocate Aurora Health in the Midwest and Atrium Health in the Southeast, serves nearly 6 million patients in six states at 69 hospitals and over 1,000 care locations. Advocate Health's comprehensive collection of air- and ground-based mobile care services – coupled with a nimble incident command structure that promotes quick decision-making in emergencies – facilitated a rapid, effective response to Helene.

“With our size and scale, we had the opportunity to do what we needed to and could do for the impacted communities, from getting additional staff to impacted hospitals, to deploying our mobile hospital, to flying patients out of affected areas and supplies in,” said Advocate Health's vice president of security, Dr. Jason Stopyra, who oversees the system's emergency management team. “In a time of crisis, the power and resources of a large health care system offer those opportunities, and we are at

the ready when those times of need come calling.”

Providing Care on the Ground and by Air

Advocate Health's southeast care delivery brand, Atrium Health, has extensive mobile care capabilities, including a wide range of ground and air assets that can be mobilized to respond to natural disasters. They include:

- Atrium Health MED-1 mobile hospital, developed in 2000 as an emergency department on wheels that includes 14 acute care beds and a two-bed operating room, as well as pharmacy, imaging and lab services
- Atrium Health MedCenter Air, which has grown from a single helicopter that began service in 1986 to a collection of four fixed-wing jets, six helicopters across four different bases and a fleet of 30 ground ambulances offering emergency and critical-care patient transports
- Atrium Health Wake Forest Baptist AirCare, which was launched in 1986 with a single helicopter and now encompasses four helicopters across three different bases and a fleet of 10 ground ambulances
- Atrium Health Mobile Integrated Health, a team of over 80 paramedics who receive advanced specialty training that allows them to provide at-home care to patients in the Carolinas, with virtual support from physicians, advanced practice professionals and nurses



Atrium Health's mobile care capabilities, including Atrium Health MedCenter Air, provided critical medical care and supplies to affected communities.

In the days following Helene, Atrium Health implemented its incident command system, appointing local and regional teammates to coordinate the response to Helene, which included managing hospital staffing needs and ensuring the safety of teammates and patients. Incident commanders collaborated with county, state and federal emergency-management agencies to establish a plan for deploying Atrium Health's mobile assets to best serve communities affected by the storm.

Atrium Health's incident commanders evolved their strategy for the air fleet in response to community needs. Between Sept. 27 - Oct. 7, Atrium Health Wake Forest Baptist AirCare and Atrium Health MedCenter Air transported 53 patients by ground and 63 by air from North Carolina's hard-hit western counties to medical facilities.

For many, timely medical care was essential. Traumatic injuries required urgent attention. Surgical patients needed emergency services. Heart and stroke patients needed higher levels of care than could be made available to them locally, given the effects of the storm. The system's medical teams were also able to transport an organ donor patient from western North Carolina to Atrium Health's Level I trauma center in Charlotte, so the organs could extend and improve life for five other people.

Shortly after the flights started, Atrium Health's pilots and teams began reporting a need for critical supplies in many of the communities where they were picking up patients for transport. Advocate Health teammates across the country collected donated supplies – including food, bottled water, diapers and medicines – as well as generators and satellite communications equipment. Under the direction of Martin Fisher, director of aviation for Atrium Health, they deployed a helicopter

dedicated to transporting supplies, flying up to five such missions per day to western North Carolina communities.

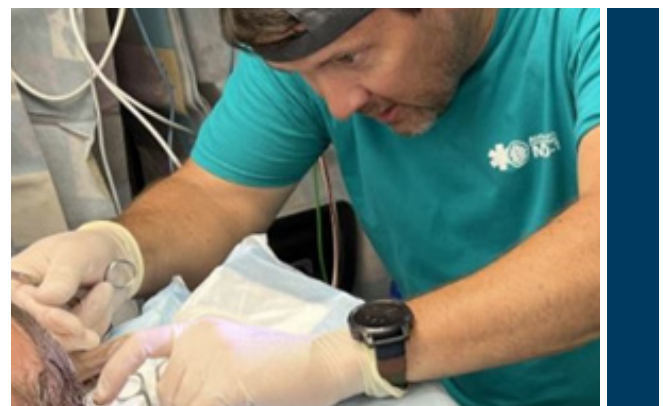
Atrium Health flew 19 resupply missions from Sept. 30 - Oct. 8, providing a total of 14,500 pounds of critical resources to the western counties. For Fisher, a former U.S. Marine Corps pilot who joined the health care industry in 2008, it was gratifying to see how pilots and volunteers came together to help communities in need.

Atrium Health's pilots joined those from more than a dozen other helicopters, with volunteers working out of Hickory Regional Airport to support communities with supply runs.

"This was exciting to see the community come together," said Fisher. "Our people and helicopter pilots worked closely with dozens of volunteers who were helping make a difference. One of the drop-offs we did was shovels, picks and brooms for a fire department that had been inundated with mud and needed those tools so they could get to their vehicles."

Atrium Health personnel also rescued a man who stumbled across their helicopter while they were dropping off supplies.

"His house had been washed away and he had



Dr. John Green, associate trauma medical director at Atrium Health Carolinas Medical Center, the region's only level I trauma center, treats a patient in the Atrium Health MED-1 mobile hospital following Hurricane Helene.

been wandering around for the better part of two days,” noted Fisher. “The helicopter brought him to a hospital where he could start his recovery. He was just so happy to be alive and grateful for the help.”

For some of those supporting the post-hurricane efforts, the passion to help and care for patients outweighed their own personal difficulties. Zach Brown, a flight nurse, and Nate McCoy, a flight paramedic, both work on the MedCenter Air helicopters. Despite their homes being damaged and unlivable because of the storm, both continued to work, helping others in need. Their passion for the impacted communities and their ties to local emergency medical services further fueled their desire to serve in a time of great difficulty.

The ability to pivot the air service in response to local needs was a result of Advocate Health’s decentralized control structure, which allowed Fisher to start the supply missions without having to wait for approvals from incident command.

“Mission one was evacuating patients from an overstressed health system,” said Dr. David Callaway, chief of crisis operations and sustainability for Advocate Health. “Mission two, dropping off needed supplies, was totally spontaneous. It was innovation and leadership from our helicopter team and exactly the type of quick, entrepreneurial approach we want in our teams.”

Deploying its proprietary MED-1 mobile hospital to a remote area of western North Carolina was another element of Advocate Health’s response to Helene. The state of North Carolina requested MED-1 and its support teams set up in Tryon, North Carolina. For 12 days following the storm,



Atrium Health MED-1 mobile hospital, developed in 2000 as an emergency department on wheels, includes 14 acute care beds and a two-bed operating room, as well as pharmacy, imaging and lab services.

Atrium Health provided transitional care to patients and transfers to nearby medical centers. During that time, an on-site team of physicians, nurses, paramedics and support staff provided care to 116 patients in the vehicle, which is self-sustaining with generators, a water purifier and a satellite communications system. The federal government also dispatched a disaster medical assistance team (DMAT) to Tryon to provide back-up care, and a representative from the Federal Emergency Management Agency (FEMA) set up an office in an adjacent trailer.

“It’s amazing to me how quickly it became its own little town,” said Wendy Henson, one of the clinical nurse leaders for MED-1. “We became very close with everyone because we all ate together and we had daily meetings. MED-1 was the center of the compound, but bringing every agency together is what made it function well.”

Through its Atrium Health Wake Forest Baptist Regional Operations Center and Charlotte Capacity Command Center, Atrium Health offered much-needed patient coordination services in western North Carolina. In the two weeks following the storm, it facilitated 296 patient transfers and 104 patient consults.

Atrium Health provided supplementary, on-the-ground services through its Mobile Integrated Health (MIH) program, which consists of paramedics who travel to patients’ homes after they’ve been discharged from hospitals and use virtual technology to facilitate communication with physicians. MIH supplemented Atrium Health’s nationally leading hospital-at-home program, expanding the number of patients who could receive health care at home from 60 per day prior to Helene to as many as 75. By expanding its mobile health care services, Atrium Health was able to free up hospital beds needed for critically ill patients.

Atrium Health’s mobile services proved critical in remote regions of North Carolina, where damaged roads made traveling to health care facilities challenging. For example, the organization sent a paramedic and disaster medicine fellow to the mountainous community of Pensacola, North Carolina, for two days following the storm, during which time they treated 12 patients. It also dispatched its Women’s Care “Drive to Thrive” mobile unit to communities in need of care for pregnant women and new mothers.

Partnering with volunteer organizations was critical to Advocate Health's response following the storm, said Jonathan Collier, vice president of mobile medicine for Atrium Health. Specifically, partnering with an international relief organization, Samaritan's Purse, and organizations like the Yancey County sheriff's department, the health system helped accelerate the effort to get care to patients who needed it.

"Volunteers were checking on people in their homes, so we started sending our paramedics with them on those visits," Collier said. "Because we were traveling with satellite communications equipment, we were able to connect with our hospital-at-home physicians so they could check on those patients. Our paramedics also coordinated additional support, including securing needed medications or evacuating patients to hospitals, if necessary."

With its wide network of acute and post-acute health care facilities, Advocate Health can efficiently manage patient transfers during emergencies, ensuring no single site will be overwhelmed and that any patients in need of specialty care are brought to the hospitals that are best equipped to provide it. The ability to manage patient transfers improved after COVID-19, when North Carolina set up an online system that allows every hospital in the state to list patients that need to be transferred.

That system proved vital after Helene, said Dr. Gary Little, chief medical officer for Atrium Health and the Helene incident commander for the Southeast region.

"When hospitals in western North Carolina needed to evacuate patients, instead of them having to call around looking for hospitals that could take them, they just put them on the list," Little said. "Then we could look at the list, decide who we could take and arrange the transfer. It was a much more coordinated effort, and it took the burden off hospitals that were overwhelmed by the storm."

Advocate Health is now taking the lessons learned from Helene to enhance its future disaster response plans. One priority is to improve communications channels between affected communities, Advocate Health and its partners. Expanding the availability of satellite communications equipment will help ensure that requests for medicines and other supplies

can be communicated to pharmacies and other suppliers, even if cellular service is knocked out, Fisher said.

Advocate Health is also planning to pilot test a drone service that could deliver essential medicines and medical equipment directly to the homes of patients located in remote regions. The initiative would build on a successful drone-delivery service piloted at Atrium Health Wake Forest Baptist Health in 2020, which provided rapid delivery of specialty medicines, personal protective equipment and COVID-19 vaccines.

Fisher added that Helene spotlighted the need for statewide coordination on a plan to ease helicopter access to communities affected by natural disasters.

"We spent a lot of time flying around looking for suitable places to land, which was very difficult," Fisher said. "This experience highlighted an opportunity to collaborate with the state to enhance future emergency responses by designating landing zones in every community, potentially co-located with police or fire departments."

The bottom line, said Callaway, is that strengthening public-private partnerships will be crucial to improving disaster responses.

"The government can't do this alone. They need large health systems that know their communities and are flexible enough to respond to high-intensity pockets of need," said Callaway. "We need this new type of public-private partnership in order to be more effective."



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Vice president of mobile
medicine at Atrium Health

Stepping Up for a Child in Need



Atrium Health Levine Children's Hospital provided medical treatment, supplies and food for Charles Sims, a 2-year-old with cri-du-chat syndrome, after Hurricane Helene.

When Meaghan Duffy and Chris Sims lost power and water in their Asheville, North Carolina, apartment following Hurricane Helene, they knew they needed immediate help for their 2-year-old son, Charles. He has cri-du-chat syndrome, a rare genetic disorder that causes low muscle tone. The condition interferes with Charles' ability to swallow and eat normally, so he needs a suctioning machine to clear his airway and a feeding pump. The machinery requires continuous access to fresh water and electricity for charging.

Duffy and Sims went to their local hospital, but they were denied care because Charles was not facing an immediate emergency. FEMA, a local disability shelter and several national nonprofits also turned down the family's request for assistance.

"We had no cell service, so I couldn't contact his doctors or medical supply company," Duffy said. "It was a scary situation."

The family got by with bottled water until power and water were restored a few days after the storm, but they were still struggling to get the medical care and supplies Charles needed.

Ten days after Helene, they traveled to Charlotte for a previously scheduled appointment with Charles' specialist, who referred them to Atrium Health Levine

Children's Hospital. Duffy and Sims were relieved when two nurses met them at the door of the hospital and quickly summoned an emergency department doctor to examine Charles. The doctor detected an infection developing around Charles' feeding tube, so he checked the family in immediately, finding a room where all three of them could sleep comfortably.

Then a Levine Children's Hospital case manager went to work, ordering Charles' medical supplies and food, which were delivered the next day. A specialist stopped by to check Charles' swallowing ability. Once Charles was stabilized, the case manager found a spot for the family at the Ronald McDonald House in Winston-Salem, North Carolina, where they stayed until they were able to find a new apartment.

The care they received at Levine Children's Hospital was "outstanding," Duffy said. "They did a really good job making us feel at home in a hospital environment. And that's something that we've never experienced."

During their stay at Levine Children's Hospital, Sims noticed the hospital's mission painted on a wall: "To improve health, elevate hope and advance healing – for ALL." After everything the family had endured, he thought it was a perfect reflection of the care that Levine Children's teammates provided for Charles.

"They definitely accomplished their mission," Sims said. "Healing for all."



Charles with his father, Chris Sims, who said the compassionate care and swift response of Atrium Health Levine Children's Hospital made all the difference during a challenging time.

Managing the IV Fluid Shortage

The flooding of the Baxter plant during Helene presented an unprecedented challenge for numerous health systems across the country that rely on IV fluids produced at the facility. Many hospital systems, large and small, began cancelling or postponing non-emergency surgeries.^{4,5,6} In a national survey of 257 hospitals conducted by health care technology supplier Premier in early October 2024, nearly 17% of respondents reported that they had canceled surgeries.⁷

Advocate Health, which obtained the majority of its IV fluids from Baxter, managed the crisis such that no procedures had to be canceled. Five days after the storm, Advocate Health opened an enterprise-wide incident command system to manage the reduced supply of IV fluids in all regions due to the Baxter plant closure.



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Enterprise vice president
of supply chain management
at Advocate Health

Led by a team of senior physicians, pharmacists and supply chain personnel, the team within Advocate Health worked together to ensure patients continued to receive safe, high-quality care during the shortage. Their focus was on making coordinated decisions using supply and demand data and implementing necessary changes across care sites and specific clinical specialties.

A key initial task was to develop a real-time dashboard that showed the amount of IV fluid at each location across Advocate Health's six-state network of hospitals and clinics. The

dashboard provided accurate information about how many days the supply was expected to last in each location, based on real-time utilization. This allowed the health system's supply chain and pharmacy teams to continually balance inventory between sites to make certain that every location had adequate inventory on hand.

The data dashboard helped facilitate some urgent transfers of IV fluids, said William Brewer, enterprise vice president of supply chain management at Advocate Health. One night, the incident command team received an urgent call from Aurora Health Care St. Luke's Medical Center, in Milwaukee, which needed a bulk supply of 3-liter irrigation solution for a urological procedure.

"They were burning through fluid and could not find any in the facility," Brewer recalled.

Using the data dashboard, the supply chain team was able to locate the needed product in another Wisconsin facility and arranged to have it quickly transported to St. Luke's.

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Advocate Health's large geographic footprint helped its incident commanders identify the regions and clinical practices that would be most deeply impacted by the IV fluid shortage and then develop strategies to mitigate potential impacts.

"The most crucial step we took was to approach this from an enterprise-wide perspective," said Kersten Weber Tatarelis, vice president of enterprise clinical pharmacy operations for Advocate Health. "By collaborating with our clinical teams, we pinpointed the areas with the highest utilization and identified opportunities to redistribute IV fluids effectively, focusing on the areas with the biggest gaps. Then, we met with clinicians in the highest-impact areas to come up with practical ways to use less IV fluid while still delivering exceptional care. It was all about teamwork and sharing best practices to make sure we managed the situation effectively."

Advocate Health's clinical and pharmacy leaders made more than 75 recommendations in over 13 clinical specialties that were communicated to

clinicians across the Advocate Health network, resulting in a 55% decrease in IV fluid use in less than two weeks. General conservation measures included:

- Administering some medications as injections instead of mixing them with IV fluids
- Administering the smallest volume fluid bags available to reduce waste from larger bags that would only be partially used
- Treating dehydrated patients in the emergency room with an oral alternative to IV fluids, e.g., drinks made from powdered electrolyte solutions that are mixed with water
- Using oral potassium products in place of IV potassium in all patients who could tolerate the switch



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Senior vice president and
chief medical officer at
Advocate Health

“Clinicians were quick to implement the conservation measures, even though it required a change of mindset,” said Dr. Betty Chu, senior vice president and chief medical officer for Advocate Health and the enterprise’s incident commander. “A urologist doing surgery with a 3-liter bag doesn’t have any delays, whereas they now have to

wait for 1-liter bags to be rotated in and out.”

Still, they came around to the idea, “because they could see that, sometimes, the entire three liters does not need to be used,” she said.

Advocate Health teammates across the system came together to implement the clinical changes. Several teammates volunteered their time to drive to big-box retailers, buy truckloads of powdered electrolyte products and deliver them to hospitals that were running low on IV fluids. They secured 250,000 packets in just 24 hours and nearly 150,000 more in the days to follow, distributing them across Advocate Health’s network.

Nurse managers developed protocols for using oral hydration products and worked with patient-experience specialists to train nurses on how best to explain to the choice to patients in a way that centered on both comfort and safety.

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The real-time data dashboard proved critical for perfecting conservation methods throughout the IV shortage.

“It allowed us to have a better understanding of the days-on-hand supply of all these critical products and, because we could break it down by region and market, we could see who was doing a great job adopting conservation methods,” said Vincent Jackson, senior vice president and chief pharmacy officer of Advocate Health. “Then we could find out what they were doing, so we could apply lessons learned in other regions.”

Simultaneous to the clinical practice changes, incident command teammates worked quickly to source alternative IV fluid supplies. The effort included quickly vetting third-party distributors



Advocate Health teammates secured nearly 400,000 packets of powdered electrolyte products to help conserve IV fluids during the shortage after the storm.

to ensure the quality of the supplies they offered was comparable to the Baxter products, using a rapid-checklist system that Advocate Health fine-tuned during the COVID pandemic shutdowns. They also worked with the American Hospital Association, the Food and Drug Administration and other regulatory agencies to accelerate emergency procedures. They included:

- Licensing compounding pharmacies to produce IV fluids during the shortage
- Extending expiration dates on existing IV fluid supplies
- Permitting Baxter to ship product to the U.S. from overseas manufacturing plants

Advocate Health's size and large presence in the areas affected by Helene was critical to facilitating those conversations, said Conrad Emmerich, chief procurement officer for Advocate Health.



It started with leadership and coming together in a way that we never had to as a full enterprise before. We brought the people together, we engaged, we worked through consistent communication and we were logical in our thinking to make the right decisions.

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Our extensive network and established relationships with suppliers and regulatory agencies helped us to swiftly navigate the complexities of the IV fluid shortage," said Emmerich. "Together, all of these efforts ensured that we could maintain the highest standard of care even in the face of considerable challenges.

Even though Advocate Health's incident command team had developed a plan for delaying elective surgeries until IV fluid supplies returned to normal, the impact to scheduled procedures was minimal.

"With the analytical tools we developed, we were able to forecast quantity-on-hand based on

changes in utilization," Brewer said. "We were able to provide accurate data to our incident command team about our current inventory as well as where we would be days or weeks out."

Now Advocate Health is embarking on a review of the clinical changes that were made during the IV fluid shortage to determine which measures could be adopted as the standard of care going forward. The organization assembled a group of clinicians to study the long-term impact of reduced IV fluid use on patient outcomes. Shortly after implementing the changes post-Helene, they added a field to Advocate Health's safety-reporting platform that allows teammates to flag any events that they believe are related to the reduction in IV fluid use. As of January 2025, there had been no increase in safety events or reductions in quality of care as a result of the practice changes, Chu said.

Permanently adopting many of the IV conservation measures could benefit Advocate Health in many ways. Prior to the shortage, Advocate Health was spending about \$30 million annually on IV fluids – a cost that will no doubt fall. Using fewer IV bags will also reduce the amount of plastic waste the health system generates, helping it achieve its sustainability goals.

Brewer said Advocate Health's success in responding to Hurricane Helene can be summed up in five key strategies:

- Engaged clinical and operational leadership to drive accountability and guide teams effectively during critical moments
- Cross-functional collaboration and enterprise-wide coordination, without conditions, to ensure an integrated response
- Data-driven decision-making to guide calm, logical action plans with real-time insights and analysis
- Effective communication to maintain clarity and consistency across all stakeholders
- Commitment to outcomes to keep efforts centered on achieving the best possible results

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Conclusion

Hurricane Helene caused major destruction throughout portions of North Carolina and its neighboring states, blocking access to health care facilities and burdening residents with extended outages of water, electricity and cellular service. The flooding of the Baxter International factory in Marion, North Carolina, caused an immediate, nationwide shortage of IV fluids.

In response to the storm, Advocate Health leveraged two of its greatest strengths – its expertise and its size. It mobilized its incident command system, which managed the deployment of air and ground health care units to provide urgently needed care in the hardest hit communities, while at the same time implementing clinical practice changes across the entirety of its six-state footprint to minimize the impact of the national IV fluid shortage. Advocate Health’s decentralized management structure allowed teammates on the ground to quickly implement innovative solutions, including helicopter supply runs that optimized the use of vital resources to aid communities in their storm recovery efforts and IV-conservation measures that preserved supplies without sacrificing patient safety and comfort. The health system’s scale offered many advantages, including the ability to rapidly move its regulatory mitigation recommendations to federal decision-makers to more expeditiously alleviate the IV fluid shortage.

Advocate Health clinical leaders believe their response to Helene provides a blueprint that other large health systems can follow in responding to natural disasters. Its quick mobilization of resources – combined with its close collaboration with local, state and federal disaster response agencies – provided an effective public-private partnership model that can be applied to future recovery efforts.



For 12 days following the storm, Atrium Health MED-1 mobile hospital provided transitional care to patients and transfers to nearby medical centers. During that time, an on-site team of physicians, nurses, paramedics and support staff provided care to 116 patients in the vehicle.

References

Front page photo: Dr. John Green, associate trauma medical director, Atrium Health Carolinas Medical Center, and Kassi Huffman, adult emergency department nurse, tend to a patient in the Atrium Health MED-1 mobile hospital after Hurricane Helene.

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