ASPR TRACIE Webinar Transcript
Healthcare Facility Extreme Weather Resilience and Mitigation
June 5, 2024

PowerPoint Presentation: https://files.asprtracie.hhs.gov/documents/aspr-tracie-healthcare-facility-resilience-webinar-ppt.pdf

Link to recording: https://attendee.gotowebinar.com/recording/2700212981037313024

Rachel Lehman (RL): On behalf of the U.S. Department of Health and Human Services, Administration for Strategic Preparedness and Response, I'd like to welcome you to ask for technical resources, assistance center and information exchange webinar titled, Healthcare Facility Extreme Weather Resilience and Mitigation.

Before we begin today, we have a few housekeeping items to note. First, the webinar is being recorded. To ensure a clear recording, everyone has been muted. However, we encourage you to ask questions throughout the webinar.

If you have a question, please type it into the question section of the GoToWebinar console, and during the question-and-answer portion of the webinar, we will ask the questions we receive through the console.

Questions we are unable to answer due to time constraints will be followed up directly via email after the webinar.

To help you see the presentation better, you can minimize the GoToWebinar console by clicking on the orange arrow.

Lastly, today's slides and speaker bios, which I highly recommend you review, I will provide in the handout section of the GoToWebinar console and will be posted along with the recording of the webinar within 24 hours on the ASPR TRACIE website.

Next slide.

RL: The opinions expressed in this presentation and on the following slides by non-federal government employees are solely those of the presenter and not necessarily those of the U.S. government. The accuracy or reliability of the information provided is the opinion of the individual organization or presenter represented.

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My name is Rachel Lehman, and I'm the Acting Director of ASPR TRACIE, and I want to thank you for taking time out of your busy schedules to join us today. I also want to thank you for what you do daily to enhance the preparedness, response, and recovery activities of your healthcare entities and communities. Your role is vital to addressing the daily and arduous challenges being presented, so your willingness to spend the next 60 minutes with us to further advance your knowledge is noteworthy.

I also want to convey my heartfelt thanks to our amazing line of panelists for this webinar. Dr. Aparna Bole (AB): from the HHS Office of Climate Change and Health Equity, Jenna Agans (JA): from NYU Langone Health, and David Burson (DB): from Mass General Brigham. Your willingness to lend your precious time and share your substantive expertise so others might benefit is commendable.

Lastly, many thanks to the astounding ASPR TRACIE team for coordinating this session.

Next slide.

RL: To ensure ASPR is meeting the nation's medical and public health needs before, during, and after disaster or public health emergency, we're focusing on four key areas, preparedness, response, partnerships, and workforce readiness.

Next slide.

RL: For our new friends to ASPR TRACIE on the webinar today, this slide depicts the three domains of ASPR TRACIE, technical resources, assistance center, and information exchange. If you need technical assistance or you cannot find the resources you are looking for on the ASPR TRACIE website, please do not hesitate to reach out. Simply email, call, or complete an online form and we will promptly respond to your inquiry.

Next slide.

RL: Much of the U.S. has experienced severe and devastating weather this spring, so I wanted to quickly remind you of the wide variety of resources ASPR TRACIE has to assist with your developing of plans to prepare your facility for extreme weather.

Please review both our natural disaster topic collection and our climate change and healthcare system considerations topic collection.

Also, it is June, so we are officially in hurricane season. Remember to utilize our hurricane resource page, which highlights resources ASPR TRACIE developed to help our stakeholders prepare for, respond to, and recover from hurricanes and flooding.

Lastly, keep an eye for issue 19 of the exchange, which will focus on extreme weather, and it will be released later this month. It features articles from our Office of Climate Change and Health Equity, our OSHI colleagues, including our moderator for today, Dr. Aparna Bole.

Next slide.

RL: With that, it is now my pleasure to turn it over to Dr. Bole, a special expert in the Office of the Director at the Agency for Healthcare Research and Quality and a senior consultant in HHS's Office of Climate Change and Health Equity. Over to you, Dr. Bole.

AB: Thank you very much, Rachel.

Thank you to the entire ASPR TRACIE team for the opportunity to participate in this important discussion and to our panelists, and especially to all our participants here today.

Again, I'm Aparna Bole, in addition to being part of the Office of Climate Change and Health Equity Leadership Team at HHS, I'm also a pediatrician by training and practice. As your moderator today I will lead us off by doing a little level setting about what we mean by climate

resilience in healthcare and to share a little bit about some upcoming resources from the Office of Climate Change and Health Equity that we hope will provide support to healthcare organizations in this space.

Next slide, please.

AB: By way of introduction, our Office of Climate Change and Health Equity is part of the Office of the Assistant Secretary of Health. We were created by executive order in 2021 by President Biden.

There you see Admiral Levine, the Assistant Secretary for Health. Our office's director, Dr. John Balbus, is pictured on the right.

And the Office of Environmental Justice is also part of our office. You can see the interim director, Dr. Buchanan, pictured there.

Together with the Office of Environmental Justice, the Office of Climate Change and Health Equity coordinates climate and health equity related activities across the Department of Health and Human Services in partnership with colleagues across the department and beyond.

We truly appreciate the partnership between ASPR and ASPR TRACIE as well as many others.

Next slide, please.

AB: What brings us here today is to talk about how healthcare organizations can build a culture of resilience and prepare for the potential stressors and disruptions related to climate change on health and healthcare delivery. Those disruptions come from a couple of different dimensions.

One, the impacts that climate change has on the health of the populations we serve. As many of you know, those health impacts are wide ranging from exacerbation of chronic medical conditions like asthma and cardiovascular disease to changes in patterns of infectious diseases to displacement and impacts on mental health.

In addition to those impacts on health, climate change-related extreme weather events and disasters can disrupt critical infrastructure, including healthcare infrastructure and community infrastructure that supports our operations.

This just illustrates the pattern of billion-dollar disaster events over the past couple of decades, which, if anything, is an underestimate because health impacts are not included here.

You can see that the severity and incidence of these disasters has really been increasing. And that's something I think we've all experienced on the front lines.

Next slide, please.

AB: We've seen this play out in real time. Last summer, we experienced the hottest summer on record. We know extreme heat is the leading cause of weather-related morbidity and mortality in the United States.

We've also seen increased frequency and severity of like hurricanes and other storms, flooding. And we also saw impacts of impaired air quality from wildfire smoke last summer.

We're gearing up for some similar challenges in the summer to come. And I want to underscore that in the setting of climate change, we're not only seeing changes in the frequency and severity of these extreme weather events, but we're also seeing changes in the geography of some of these extreme events. For example, wildfire smoke is not something we're used to dealing with in the upper Midwest or in the Northeast, and we did have to deal with that last summer.

There are areas of the United States that are contending with extreme heat events that they have not historically been prepared for. So, we are in a situation where we're thinking differently.

We need to be prepared for a future that might look different from the past when it comes to some of these extreme events and disasters.

Next slide, please.

AB: To that end, what does it mean to build a climate resilient health system?

How does climate resilience fit in with the work we already do in health care around emergency preparedness?

Those concepts are aligned and one place we can look for what this connection looks like is the World Health Organization's operational framework for building climate resilient health systems.

In this framework, a climate resilient health system is described as one that's able to anticipate, respond to, cope with, recover from, and adapt to climate-related shocks and stress.

And there are very, as you can see in the wheel to the right, different dimensions of what that looks like.

While this framework is intended for governments and public health organizations, I think this framework is very useful for us in healthcare delivery as well.

Next slide, please.

AB: Last year our office published a description of what we identify as the key elements of climate resilience planning for healthcare, drawing on the WHO's framework as a foundational resource.

Those elements include prospective risk assessment, acknowledging that the next 50 years will not necessarily look like the last 50 years, health equity and community engagement, understanding that we really need to look outward at partners in the community and collaborate with other healthcare organizations, really leaning into our role as essential institutions that can be anchors for community resilience for the populations that we serve.

Assessing and remediating vulnerabilities in infrastructure and operations, future-proofing our healthcare facilities in light of some of these evolving threats and hazards, and then a foundational principle of interdisciplinary planning, oversight, and evaluation is essential for building this culture of resilience.

Often the shorthand response that I'll give when people ask me about how climate resilience relates to emergency preparedness or kind of what does that lens look like?

I say in addition to looking inward at our operations within our four walls and retrospectively or backward at retrospective patterns of risk, we really need to be looking forward and outward to build a culture of resilience in our organizations.

Next slide.

AB: Our office is updating a toolkit to help health care organizations understand how to develop climate resilience plans. This toolkit, originally called the Sustainable and Climate Resilient Health Care Facilities Toolkit, was published about a decade ago. It is now going to be substantially updated and rebooted and will be called the Climate Resilience for Health Care Toolkit in its new form. We anticipate that this will be published in the fall of 2024, and we are looking forward to its alignment with other HHS emergency preparedness tools and guidance.

The primary audience for this updated toolkit is really the healthcare emergency management professional and anyone else engaged in emergency management and resilience in healthcare organizations. The updated toolkit will be more modular and user-friendly and easier to navigate and will also feature an updated library of case studies reflecting a diversity of facility types. It will be housed within the NOAA Climate Resilience Toolkit site. The link here is to the original toolkit, and, again, we anticipate the relaunch to be coming out later this year.

Next slide, please.

AB: This is just a snapshot of what the resilience strategies and the guidance within this toolkit will look like. I mentioned that it'll be sort of modular, and what I mean by that is users can navigate by climate-related hazard and can see that the resilience strategies will be categorized according to those five elements of resilience plans that I described before.

So, here's an example of resilience strategies that point to how to integrate prospective risk assessment into resilience to extreme heat.

We really appreciate our collaboration with ASPR in this space.

We collaborated with ASPR to align this toolkit's framing and organization with the updated risk identification and site criticality toolkit, and to update the climate change questions in that risk toolkit.

Our toolkit will consist of introductory information and resilience strategies organized as I've described, along with some links to relevant tools and resources. Again, this library of case studies is aligned with the resilience strategies described in the toolkit.

The toolkit will be founded on an all-hazards approach to emergency preparedness and resilience, but again, the content will be organized around specific hazards that are organized similarly to the risk toolkit.

Next slide, please.

AB: I also want to mention something that's relevant and timely in this space. There are resources funded by the Inflation Reduction Act that are potentially game changers for healthcare to be able to invest in efficiency and resilience, promoting interventions like energy efficiency, renewable energy, and other resilience interventions.

Our office has published this quick finder to help healthcare organizations learn more about which of those programs, resources, and dollars apply in health care.

Before I close, I'll just mention that our panelists for today, going back to the toolkit I just described, both represent organizations whose case studies will be featured in our updated Climate Resilience for Health Care toolkit. I'm looking forward to hearing from them and how some of the principles I just described show up for them on the front lines.

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AB: I'll conclude my introduction there and invite anyone who is interested in reaching out to us or learning more to stay connected on the OCHI website or via this email address.

At this point I will turn it over to Jenna Agins (JA).

JA: Thank you, Aparna, and good afternoon, everyone. I'm excited to be here and to share a little bit about NYU Langone Health sustainability and resiliency journey.

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JA: I'll kick it off with a quick look at NYU Langone Health, if you're not familiar with us, we are a premier academic health system based in the New York City metro region.

We have about 13.5 million square feet of space, mostly across that metro area with six inpatient facilities, over 2 ,000 beds, or about 12 billion in hospital revenue.

We have 49 ,000 employees, 544 MD candidates as part of our Grossman's School of Medicine and the Long Island School of Medicine, and we recently even had some expansion in Florida, which continues to grow.

So, with that brings a whole new set of climate-related issues to tend with.

Next slide please.

JA: So, we have been recognized for the work that we do. We've achieved over 84 environmental excellence awards since 2010.

In 2019, we became the first campus in the world to achieve both peer and lead certifications from the U.S. Green Building Council at the highest platinum level, which I'm going to talk about in more detail later as both of those certifications are industry standards on energy, green building design, and resiliency.

We've committed to goals on many levels but most paramount being taking the HHS health sector pledge in 2022 with a goal of achieving carbon neutrality by 2050.

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JA: I want to take a step back to 2012 and the impact of Hurricane Sandy on our main East River campus.

It was our main campus at the time, we were a smaller organization at that point in time, and if you look at old maps before infill projects in New York City, that campus is essentially situated almost half in what is the East River.

So severe, and as we know, unprecedented weather during Hurricane Sandy actually inundated our campus with 15 million gallons of water. Our utility services were disrupted and we were forced to evacuate more than 300 patients mid-storm.

Thanks to the heroic efforts of our staff and emergency responders, all of those patients were evacuated without injury, but there were many other major impacts.

Equipment and facilities were destroyed, our employees were dislocated, our reputation was impacted, and often overlooked fact, we are a major academic medical research institution and our researchers' lost years of medical research, what could have been the next cure for cancer, who knows?

And the hospital closed for two months, leading to serious revenue loss.

So all in all, an estimated $1.4 billion total loss, but that figure does not account for the many other side effects of experiencing this kind of trauma But what I want to really concentrate on from here on out is to speak to you all about what has come in the 12 years Since Sandy, you know, we really embraced that moment as an opportunity to change to change as an organization and to pivot the way in which we address resiliency as an organization today, these are what we consider some of our core values as an organization when it comes to resiliency planning.

We have expanded, as I said, our definition of resiliency and what it means to be a resilient healthcare organization.

We have a focus now on scientific approaches to predicting sea level rise and climate impacts, a much more robust set of standards than what at the time was required post Sandy or even today and we'll get into some of those details in a minute.

We completely overhauled our master planning process to design for resiliency and we doubled down on our energy and carbon reduction commitments. We truly believe that sustainability and resiliency go hand in hand, and we are dedicated to building a culture of resiliency and emergency preparedness among our workforce.

Next slide, please.

JA: So, how does this sort of new culture of resiliency, these core values, translate into an approach to design specifically?

It changes how we run, what we run, what we build, what kind of technology we use.

Post-Sandy, we, as I said, increased our carbon reduction goals at the time from 30% to 50% now to carbon neutrality because not only is the cheapest kilowatt hour the one you don't use, each kilowatt hour demand that we do reduce, we are also then reducing our exposure, our risk.

We make major investments in infrastructure for resiliency, for sustainability, and energy efficiency.

We build better, greener buildings with much more flexibility built in so that we can handle the next unexpected disaster or pandemic, for example, we install resiliency infrastructure and distributed energy resources, things like combined heat and power, make sure all critical infrastructure and support systems are on emergency power.

We built green infrastructure.

We have a large amount of open space, especially on this campus, a green roof that helps us manage stormwater runoff and protects our waterways.

We harden our campuses, look for areas of risk, install passive and active flood mitigation measures and protect all perimeters We've raised and protected all of the utility infrastructure in particular, but also all of our critical care critical patient care communications and command centers for emergencies and fire chilled water emergency generation and IT and this is important because reliance on technology to operate our hospitals has grown and continues to grow exponentially.

IT infrastructure must be resilient beyond just the power supplying it, and we know that all of these measures do cost a lot of money but for us, just as we use total lifecycle costing for equipment and supplies, resiliency for infrastructure requires that you think about the return for the period of the total life cycle, the probability that something will occur within the lifetime of the building.

So, in real life, failure to mitigate risks can cause losses, as we experience in the billions of dollars with associated loss of life and reputational risk, and all of the other impacts that I mentioned previously.

Even if mitigation measures are very costly, the economics of expected return may actually be very good. You really must find the right balance for you, and that IRA money that Aparna mentioned can go a long way to helping tip the balance appropriately.

Next slide, please.

JA: So, all of this is really nothing though without our people.

I mentioned we are committed to building that culture of resiliency, and that is what we did.

In the aftermath of Sandy, we formed the Emergency Management and Enterprise Resiliency or EMER department, and we hired a senior executive to oversee it. This department has grown and changed over the years, but its mission at the very most essential core is to ensure uninterrupted access to NYU Langone Health Services across all areas during all times including acute care research and the School of Medicine.

In addition, the scope now includes a full portfolio of locations, whether that's one of our main hospitals or research campuses or an off-site facility, it really encompasses everything.

We have upped the scope and rigorousness of our hazard vulnerability assessments, and we brought in new hazards as well as sources for risk measurement.

Our environment of care committee helps oversee the process alongside the EMER department and brings in all relevant stakeholders from across the organization and externally so that the strategies and assessments are comprehensive, and then they get senior level buy-in, which is important.

About two to three years ago, we added a dedicated section to the HVA for climate change, identifying it as a force multiplier of all other hazards.

And we're right now in the process of working to expand that section to integrate climate risk into other relevant hazards and to create a scoring method for it.

And we're going to slowly integrate community resiliency to climate change in the long term.

Something Aparna mentioned is at the forefront of what's next.

Everyone plays a part in emergency preparedness.

We have comprehensive written protocols that go through annual review, and we conduct training and exercises regularly where we test everything, and I mean everything. Every flood mitigation measure, every protocol, every communication tool. We test all of it regularly because you want to know that it's going to work when you need it.

We make sure that all the right teams that need to be a part of that process are always involved.

We have integrated things for our research folks, we have a temperature sensor for the freezers and refrigerators that they use to send alerts back to a central location to let people know when something's gone out of range.

So, in people's own work areas, pieces of this resiliency plan are in place, and they have to play a part in making sure that all of it is correct.

Next slide please.

JA: Okay, so I'm going to cap this off with a look, a deeper dive into that East River campus that I've been talking about, our sort of main campus. It brings together all these things that I've been talking about, how they've come to fruition.

This was essentially 10 years' worth of campus transformation that started prior to Sandy, received some major overhauls post-Sandy, and then really came to fruition over those many years.

Simultaneously, while we were doing this, we were building up all those internal technical teams and operations, including our energy and sustainability program.

What I think is important here is, you really need to involve everyone to get this level of comprehensive resiliency in place, it requires every part of the organization to be contributing to that sort of overall picture. When I mean everyone, I mean everyone.

So, I think something interesting.

It took 10 years for us to get to our current state on this campus. We were building a brand-new hospital and a brand-new research facility at the same time, well over a million square feet of space on the campus. We had G.C. Turner who lived on our campus during that time, and they became a part of our overall flood mitigation and emergency management planning during that time frame because we needed every hand on deck when we were experiencing a potential threat.

I'm not going to go through every piece of this campus, but if you move to the **next slide**, I'm going to kind of highlight some of the key components here.

This is a view of our campus from the East River. As you can see, we're essentially in the river.

You'll see how we did our assessment of flood risk. We reestablished our flood elevation at Sandy High Watermark plus two feet.

We raised all our infrastructure. So, as I said, we're energy independent.

So, we have a black start capable 13-megawatt cogeneration set of systems.

All that infrastructure is raised along with emergency generators, our switch gear and some of our critical patient equipment. Our utility service is on a roof and is redundant, fed by two separate power plants. And then we've installed infrastructure to protect the perimeter.

This is a picture of a loading dock. It's one of the largest floodgates on the East Coast, and that's just one of many, many floodgates and flood walls.

We've compartmentalized every single building to protect spaces, even if there was an inundation of water.

We recycle water on campus through a gray water system in our new research facility.

I mentioned the green roof infrastructure.

All together, these have come together in forming, what we feel like is really world-class when it comes to sustainability and to resiliency.

That pure platinum certification is really focused on resilient power infrastructure as well as operations, and I think that's what we're most proud of, is that we scored a 22 out of 23 in operations management and safety.

So, it's really a testament to our people and how far we've come since Sandy.

So, with that, I will turn it back over to Aparna to move forward with our next speaker.

AB: Thank you so much, Jenna, for your informative presentation. I'm glad now to turn it over to David Burson (DB).

DB: Hello, good afternoon, everybody.

Jenna, very informative and inspiring overview, thank you for sharing that.

I'm going to try to step through a somewhat larger array of slides to give you at least a sense of how Mass General Brigham has addressed our move towards resiliency and sustainability across our campuses.

Next slide, please.

DB: So, a quick overview of Mass General Brigham (MGB).

Realizing the slide is a little bit dated now, I think we're essentially 12 acute and specialty hospitals and a range of other rehab ASCs, community health centers and urgent care centers around Massachusetts and Eastern New England.

I think we see about 2.6 million patients and are now at about 82 ,000 employees overall.

So that's our regional footprint, **next slide.**

Our CREO here, which has been our North Star for some years now, is creating and promoting a healthy environment, both for our patients and employees, and conserving resources as we do it.

A national regimen cannot be viewed as contributing to the health problems manifested in the patients we're treating.

As we know, I think the healthcare sector nationally contributes about 8.5% to carbon emissions. And as Jen has noted, there are significant public health consequences of that.

So, try not to be part of the problem working with this range of organizations and others on this journey.

Next slide, please.

DB: I'll start with the Spalding Rehabilitation Hospital Boston in the Charlestown Navy Yard.

You see in the foreground here, we embarked on relocation of an existing hospital from up the Charles River out to this incredibly beautiful, but also rather vulnerable, site on the edge of Boston Harbor.

We needed to do this in a way that both protected patients, visitors, and community while taking advantage of all the amenities of the Harborfront site, including our adaptive sports on the water program, which has been enormously successful.

Next slide, please.

DB: In a nutshell, nine stories, 132 acute rehabilitation beds. This is sort of the flagship of our whole post-acute care operation.

We opened in April 2013 and achieved LEED Gold certification.

Next slide.

DB: But again, the history of Boston Harbor, as many of you may know, is one of reclaimed land.

You can see in the upper portion of the slide where the Spalding site is located, it is vulnerable, filled-tide land, and many folks will say that the future of Boston Harbor is going to look a lot like history did as the sea reclaims that which was was taken away from it.

Next slide please.

DB: It was an active U.S. Navy site up through the 70s. World War II shot here. Actually, I think it was after World War II.

A very active naval site left behind quite a legacy of contaminants and pollutants. So the first thing we had to do was a major cleanup of this TOSC-administered EPA site.

Next slide, please.

DB: Site rehabilitation was sort of prelude to patient rehabilitation.

Next slide.

DB: We started planning and designing the Spalding in the wake of Hurricane Katrina in 2005-2006. We saw what happened to the VA charity and Mercy hospitals in New Orleans as they evacuated and those that couldn't evacuate were sort of trapped in overheated sealed units. Many deaths resulted. We didn't want to replicate those mistakes.

Next slide please.

DB: So, we adopted a range of what we think of today as common-sense resilience and sustainability strategies. Designing buildings to address both known and anticipated climate impacts. Locating critical systems in ways that are protected from major weather events. Maintaining livable conditions, as I say, throughout major extreme storm or flood events. Keeping controls manageable with manual overrides in case of systems malfunctions and looking at vernacular design principles.

We talked about passive survivability, which has a number of components, to shelter in place in the event of extended power outages, maintain livable temperatures, enhancing building closures to reduce heat gains, heat loss, daylighting throughout so we're not completely dependent on electricity, artificial lighting, operable windows in this case of the spalding to mitigate overheating in the event of all systems being down and the importance of maintaining potable water and sewage conveyance.

Those are some of the passive strategies that we've looked at here.

Next slide, please.

DB: We went through a pretty rigorous strategy, evaluation, and decision-making process looking at a range of criteria listed here.

I won't go through them all, but essentially optimizing what we thought were the most effective, cost-effective, and long-term effective strategies.

Next slide.

DB: Yeah, this just kind of identifies the decision-making process.

Next slide here, looking in this case at the wall assembly and the criteria that it hit.

Next slide, please.

DB: In summary, with Spalding, the big moves were elevating what Jenna was talking about, the critical mechanical, electrical, and communications infrastructure to upper levels.

It was a year-long discussion with our local utility to let us put the electrical substation primary power source up in the penthouse rather than out on the street where they traditionally located.

We finally got there, opera windows throughout patient rooms and activity spaces, all critical programs above the ground floor, patient safety being the driver here, elevating the site, elevating the base of the building 30 inches above what we at that time had, you know, the data point, the FEMA 500-year flood level, and developing a landscape strategy with using salvaged granite seawall block, actually, to develop a series of berms, essentially building an artificial reef around the site as a storm surge protection.

Next slide.

DB: Again, 2.5 feet above the 500-year elevation, 3.5 feet above the 100-year floodplain elevation at that time.

But we also did quite a lot of climate research or climate assessment as to what the likely sea level rise and other climate-driven changes might be over the, let's say, 75-years that this building might be.

Next slide.

DB: Some of the lessons learned from this is the importance of training staff to the operational responses that are required. It's not all about the design.

The design features need to be understood and implemented in the event of major storm events.

We did not elevate the kitchen and food service, so that remains a point of vulnerability. There would need to be stockpiling done in anticipation of a major flooding event.

We looked at grey water systems but could not make the financial case for that in Boston.

What we did do well was integrating the site and the ground floor with the community. This was in part a result of Chapter 91 regulations, filled timely and developed in Massachusetts. It needed to be developed to accommodate and welcome the community in. And we've done that. An upshot is that a children's playground, designed for kids with disabilities, was developed by the city as our forecourt, essentially, working with the Spalding pediatricians to design specially adapted play equipment.

So, Spalding really does act as a catalyst for social resilience in the neighborhood and the community.

Next slide, please.

DB: This was high tide during Hurricane Sandy, I was standing out on the dry dock in front of our building. It did not overtop the wall. So, so far so good.

We have not seen flooding on this site, but we think it's probably not long before we're going to see it, and we need to be prepared for it.

Next slide.

DB: So, Aparna talked about the case study with HHS, so I won't go into this but to say that we typically look for a five-to-eight-year payback. Our CFO wants to see that any investments in high performance or energy efficiency are going to have a reasonable return.

So, we don't have a free hand with this, but as I said about a million times, we estimate out of $160 million in construction costs at the time, we put into resiliency measures about half of what we recovered through utilities incentives.

And a lot of what we did like the landscape and operable windows, we think provides amenity to patients and families. They're not strictly resiliency features, they also enhance the care and treatment at the site.

Next slide.

DB: Again, the case study I won't go into here, but we are happy to work on the updating of this and providing the lessons that we've learned forward for future reference by health systems across the country.

Again stressing, I think it's the fourth point, playing key role in community resilience, six point community engagement.

We found that that's been an important aspect of the success of the Spalding project.

Next slide.

DB: Moving forward from Spalding, we went on to develop an administrative central campus for Mass General Brigham in Somerville's assembly road development, not on the harbor, but on a riverine vulnerable to flooding site in Somerville. So many of the same lessons learned we brought forward here to Somerville.

Next slide.

DB: Including granular survey of the sort of flood pathway vulnerabilities around our site and what we might anticipate under future storm scenarios.

Again, looking at the best available future data, not just historical data, for sea level rise below the dam you see on the right there, the Amelia Earhart Dam just above our site, and extreme storm events above the dam.

Next slide.

DB: Developing storm water management landscape treatment so we can accommodate extreme flows and not overwhelm the municipal storm system, again, elevating the site, elevating the critical infrastructure to ensure that we would be able to continue to use this building through the 2070's and beyond.

Next slide, please.

DB: And this is a shot I took a few years ago from the building looking out at the Amelia Earhart dam during a major storm event. The dam was not overtopped, but this is the one piece that we identified in our due diligence that was a critical vulnerability for our site that we could not control.

We understood at the time that the dam was going to be improved through some sort of coalition among the municipalities, the state, the feds, and the property owners in the region. And that's what has had another, I would say, sort of form of community engagement resilience.

Next slide, please.

DB: So, through our work in Somerville, we've become an organizer of what's called the Resilient Mystic Collaborative. It's an affiliate of the Mystic River Watershed Association, who have identified, and quite successfully pursued local state federal funding for municipal vulnerability preparedness grants to communities, including improvements to the dam.

We're pursuing something like $35 million for improvements to the dam, hardening of the dam, raising, adding a fourth pump.

Next slide.

DB: The adjacent Draw Seven Park, another $14 million.

RMC is pursuing the 9 Acre Park, one of 10 critical flood pathways in the Lower Mystic, that's identified so this you know is obviously in the interest of our immediate property there in assembly row. Also, in the interest of the communities that we serve in the lower mystic, **next slide please,** including the island and river. Here again, chasing about 67 million. In this case it's the location of the new england produce center, a regional major source of of food for Miami that

generates about $7 billion a year in revenues. There are about 15,000 folk and environmental justice communities largely living in this immediate vicinity.

It also includes one of our key community health centers, the Mass General Hospital Chelsea CHC in that area.

So, this work, again, is an offshoot or spinoff of what we've done for our facilities that also benefits the communities that we serve.

And I think to date, the RMC has successfully obtained about $120 million in grants for these surrounding communities for resilience work. They're targeting about $100 million a year over the next five years. So we'll see how that goes.

Next slide.

DB: So, from here, we move on to the system-wide resiliency assessment that we initiated several years ago.

You can see both the Spalding and the Summerville site on the upper left there and our Mass General Hospital main campus on the lower portion of the slide.

One of our two founding academic medical centers Harvard Medical School affiliate teaching hospitals.

Next slide.

DB: We followed the facilities toolkit that Aparna's talked about, the five elements.

I won't go into this here.

Next slide.

DB: Working with Arab consultants, we went through a three-phase program across all of our sites, starting with individualized hazard assessments for each of our campuses and facilities, looking at phase two at vulnerabilities based on prioritization of critical operations using the five-elements checklist, and then finally, phase three, developing a capital program to implement this work, which is now being carried out through our Deferred Maintenance Program at Mass General Brigham.

Next slide.

DB: Again, looking at both short-range near-term 2030 and longer-term 2070 improvements and using that sort of a timeframe as one of the criteria for where we make these investments.

Next slide.

DB: So, the deliverables from this study, as I mentioned, individual scenarios for each campus, standardizing vulnerability assessment across the board, compilation of vulnerabilities by campus, by facility, by building, then rolling that up into a system-wide risk assessment and also identifying the key external dependencies.

As with the Amelia Earhart dam, we can only control so much within our own parcel boundaries and we are ultimately at risk from regional threats to infrastructure and insurance implications as well.

Next slide, please.

DB: Just to give you a snapshot of how hazards were considered for each of our major campuses here, you know, across sea level rise, surge, precipitation, temperature, wind, and seismic, what applied most acutely at each location.

Next slide.

DB: And then prioritizing by location based on the type of service being provided, our number one priority being inpatients and data center.

The second tier would be community health centers and research.

The third tier would be medical offices and administrative buildings, and then fourth is essentially everything else, all of which helped inform how we developed the capital program to implement.

Next slide.

DB: I mentioned regional vulnerabilities. Again, we can only do so much within our own boundaries.

Looking at regional transportation, energy, communication, infrastructure, and where those vulnerabilities are, we work actively with our regional, private, and public partners to look at regional resilience development overall, which ultimately, we need to consider in order to fulfill our mission of providing world-class health care to all of our patient populations.

Next slide.

DB: This identifies some of the critical infrastructure vulnerabilities and flood vulnerabilities around Greater Boston.

Next slide.

DB: Zeroing in on the Mass General Hospital campus, I talked about it as a vulnerable site on the Charles River, 2030 on the left, 2070 probability-based flooding on the right.

Using future forward data points rather than historical data to understand that the MGH has significant vulnerabilities over the decades to come.

Next slide.

DB: To that end, we are currently now in construction, a major capital expansion at Mass General Hospital.

It's a major inpatient center with six levels of underground parking and developed with all the principles that I've been talking about in mind.

Next slide.

And it's being built as a place of refuge for patients and staff across this historically vulnerable campus with capacity to shelter in place for up to four days.

All rooms, I believe, are being designed to accommodate surge, double occupancy, and major flood proofing of the existing buildings and infrastructure around them.

So that's where we are on the journey at this point, and I'm happy to get into this in the Q &A.

AB: Thank you. Thank you, Jenna and David.

I am about to dive into some questions.

I think our next slide is just the Q &A slide, but before I do that, I want to check with Jenna and David, do you have a few minutes past the hour to stay on if we go like five minutes over?

Will that work for you?

DB: Sure.

AB: Okay, just as I think about managing our time and the questions for the participants, if anyone must drop off, I'll just remind you that the recording will be posted. So, if there are questions that you miss, they'll be in the recording and there will be some that we don't get to that we will follow up as Audrey mentioned, or as Rachel mentioned earlier on.

So let me start here. I have a couple of questions first for Jenna.

One question, Jenna, is about if you are doing hazard and vulnerability assessment as a system or for each of your sites, so that's part one.

And then part two, this question is about reflecting on the fact that NYU Langone had the experience of evacuating high-risk and ICU patients during Superstorm Sandy.

This question is about if you can speak a little bit more about how some of the mitigation efforts you described can protect against future risk of that type of evacuation, which I think is such a costly, concerning, disruptive outcome with disasters.

If you could speak specifically to how the learnings from that experience have informed some of the mitigation you described and the mitigation that you have implemented will help to protect against that in the future.

So, kind of a two-part question.

JA: All right, I'll try to cover all of that.

Sorry, what was the first part again?

AB: The first one was just if you're doing a system wide HVA or by facility.

JA: It’s for our entire health system. It drills down to each individual campus though and does assessment on a campus or building by building level.

So, it's both.

AB: Yeah, that's great, thank you.

The second part is just about this mitigation of evacuation risk which is something that I think is top of mind for so many of us.

JA: Right, so I think, when Sandy hit, we experienced utility disruption alongside flooding. So many of the things were below grade.

For our elevators, for example, elevator rooms, like a lot of our distribution, electrical vault, fuel vaults, all of that was in flood waters, essentially.

And so many of the things that we've done, as I mentioned, and you can see it in the slide, is to protect the campus, to make sure and harden the campus, and then to make sure that we can maintain critical components for a long duration, right?

And so, elevating whatever we can, we protect. And that's with, as Dave mentioned, both passive and active measures.

So, it can be difficult, you know, let's say you're in a five-day hurricane cone, you have to start implementing things days in advance to be prepared for, let's say, landfall.

So having those passive measures already in place means that people have to do less in order to be prepared for an emergency situation.

So, like up and over stairs or having permanent piping in which you can then connect deployable pumping, having floating flood walls that rise with the water level. Those are all passive measures.

So, it's important that those are in place.

And then, like I said, we are energy independent, at least on this campus, and we've since installed cogeneration systems on many of our campuses.

We have very ample backup emergency generation, but what I think is also important is that we have the operation side of things. We also have a huge demand response program.

We're able to drop the level of power needed on campus while still maintaining all critical functions and making sure all that critical function is connected to emergency power. So that's another piece of it.

We're able to maintain that and use our operations to actually make that more feasible for a longer period of time as an example of some of the things that we've worked on that marry the infrastructure and the operations. So hopefully that answers some of that question.

Again, there's thousands of measures that we've implemented on this campus specifically. Some big and small, it's hard to get into all of them but hopefully that helps eliminate a little bit.

AB: It does, thank you, and I think it's related to another question that came through around how we think about the return on investment for resilience.

David, you mentioned that a little bit in your remarks with some of the specific investments and I think about that sort of avoided costly disruption of evacuation as being related to how we think about return on investment, but it does exemplify how sometimes it's hard to quantify.

DB: Sometimes we don't have great data and evidence to draw upon in doing a great job of articulating a return on investment when it comes to resilience measures. So many of us are in this kind of break-fix cycle in health care. It can be challenging for us to take this truly prospective approach that you've described.

AB: I'm curious if maybe both of you could say a little bit more about how you've approached this issue of making a business case for building the culture of resilience that you have done in your organizations.

DB: Sure.

DB: I think I may have touched on this a bit in that we can often make the case that investments in resilience are also investments in quality of patient care and environment. So, it's not necessarily a sort of singular case to be made, and that's worked well for us.

But again, we are on a fairly, I would say, short leash in terms of limited finances. We can't do everything we wanna do.

We could not make the case for gray water systems. We could not make the case, and the case is falling.

We couldn't make the case for a ground water heat exchange; the numbers just weren't there.

So, we can't do everything we do, as I hopefully illustrated, and go through a pretty rigorous process to try to prioritize those strategies that are going to yield both the most resilience and the best patient environment that we can build.

JA: Yeah, I think I would just echo that.

I think that the easiest case to make is energy efficiency. So, I will say it again, sustainability and energy efficiency and resiliency go hand in hand. The less power that you're using, the less risk you have.

And most of those paybacks are very good.

They get harder and harder the more you try to squeeze out. But we've gone and sought outside funding.

We can make the business case for many of the measures that have efficiency as either the main product or the byproduct of an infrastructure project.

As Dave said, many of these things are also to provide better and more comfortable environments for our patients and our staff. Even the green roof is associated with better mental health for our employees and less healing time for our patients with views of nature.

There can be many value streams provided by a lot of these measures. At the end of the day, we know what it's like to lose billions of dollars from an event like Sandy. So it makes it a little bit easier to make some of those arguments, but hopefully you can just hold us up as an example of what you don't want to happen, which we have put a lot of effort in to making sure never happens again.

Yeah, fair to say, we dodged a bullet with Sandy up in Boston. It did not hit the degree that it hit New York and you guys there.

So, we learned from what you have gone through and what we expect we'll be going through at some point in the future as well.

DB: I'll just second the importance of carbon emissions reduction as a long-term mitigation strategy, greenhouse gas reductions. We've seen some 58 percent reduction since we started our strategic energy master plan 15-some years ago.

We are signatory to the U.S. health sector climate pledge scope one and two emissions and we're looking for 50 percent reduction by 2030 and 100 percent by 2050.

We're completely on board with this.

AB: Thank you so much. I really appreciate both your clarity and articulating that relationship between efficiency and sustainability and resilience.

I don't hear articulated as often as I think it ought to be. And you make a great case for that connection. I really appreciate that.

We've talked a lot about how building a culture of resilience requires a very multidisciplinary approach. And in health care systems, often we are quite siloed in the way that we approach a lot of our operations, including emergency preparedness.

I wonder if you could each give an example from your own experience of how either a novel or different or new interdisciplinary connection or collaboration helped to accomplish what you've described today.

DB: I'm happy to start.

As is probably evident from the presentation, I'm really coming at this more from the design and development side but working closely with our emergency preparedness colleagues at Mass General Brigham.

Couple of examples, I think of multidisciplinary approaches on the preparedness side, outreach to patient communities and anticipation of major storm or extreme weather events, providing medical guidance for those with conditions that would be vulnerable and making resources available such as cooling strategies, et cetera. That work is being done in collaboration with our equity and facilities and community health communications and medical care delivery teams at MGB.

So, it is very much a multidisciplinary approach.

On the response side, for instance, would be a major event associated with a marathon in Cambridge, one of our communities that we serve.

Back in November 22, extreme heat, hyperthermic patient surge coming into Mass General Hospital.

There was a major multidisciplinary rally to support those and address those conditions.

Again, early 2023, an extremely cold event, and similarly, in this case, infrastructure impacts.

We had a multidisciplinary approach to move in very quickly and rapidly and address some significant infrastructure damage that we're experiencing.

So, a couple of examples there.

JA: Yeah, so I think as I probably stressed throughout mine, it really is a collaborative effort to build that culture of resiliency.

I think a good example, I mentioned it, was our research laboratory resiliency planning.

With Sandy, we lost millions of dollars in research, animals, and grant funding during that time.

And creating a lab resiliency plan required collaboration amongst many groups.

So, its facilities and operations teams, it was our real estate team, because many of our sites are in our larger portfolio.

The Office of Science and Research and the leadership and operations there, our emergency management team.

We made a lot of changes to protect our vivarium, our BSL-3 labs from an infrastructure standpoint, backup powers, and physically raising locations.

We want to know if something is going wrong in the lab so that we know about it right away.

And this is year-round and not just during an emergency, but it's all the time.

That's one of the side benefits of focusing on resiliency.

We created extensive building automation and trends and reporting with smart alarming so that we know when labs are experiencing a temperature pressure, humidity, some other reading that's out of a required range, that we rolled out that temperature sensor monitoring program I mentioned for the ultra-low temp freezers and refrigerators that has centralized alarming within facilities operations locations across the system.

It sets off like a phone tree alert system and we have our teams outlined as to who needs to be alerted to what incident, who's going to respond when and how, right?

What vendors are on standby for when we need to support OSR, Office of Science and Research, leadership is involved and activated, et cetera.

The emergency management team then conducts annual lab resiliency assessments for every lab to understand; are things functioning as intended, what is new and needs to be protected, what critical equipment needs to be emergency power, that they have up-to-date continuity planning.

Then we obviously do continuous testing and process reinforcement through training and stuff of that nature and communication.

So, communication is involved. I think that's a great example of a truly collaborative approach because you've got all those groups working together to create this one encompassing resiliency framework for this particularly vulnerable part of our business.

AB: Thank you.

That's such a great example, and it illustrates how the relationship sustained over time is so important, not just in the moment of a crisis exactly.

I want to ask one more question and ask for brief responses, because I know we need to turn it over to Rachel to close, but we've had a few similar questions, so I just want to get a sentence or two on this issue of how to take a more community-based approach to resilience, we've had a

couple of questions like how do we as a healthcare facility encourage a more expansive community-oriented approach to resiliency that is not so facility-focused, but really is doing things like addressing the needs of vulnerable populations and building the resilience of the entire community we serve?

I know that's a big question, and to ask you to do that in a few seconds is a lot, but if you could provide just maybe a sentence or two about how of an example or how you think about that in your organization.

DB: I mentioned the vulnerability of some of our community health centers which really are the front lines out there and we certainly are addressing those vulnerabilities to the extent we can on a facilities basis, but we're also doing more and more outreach to communities, health care at home, hospitals at home, promoting wellness, promoting healthy nutrition, trying to get at the causes of disease rather than just reacting to the manifestation of illness, working in particular with our most vulnerable communities.

I think I've touched on some of the other strategies we've expanded into as a result of some of our regional facility development.

So, a very important question and probably worth a webinar unto itself.

AB: Yeah, I would agree.

JA: I mean, I think it's an area that is a little bit more nascent and something that we are actively developing and working on.

I think the CHNA process is one area in which there's a lot of potential for essentially including climate change as a social determinant of health and thinking about how to incorporate that into our approach to care for the community.

We have very large federally qualified health centers, set of locations in Sunset Park, Brooklyn. They've been doing a lot of work at the cross section of these sort of vulnerabilities. So, I think there's more to come on that front.

It is really challenging to understand what you do outside your four walls and how does that impact what's inside your four walls and what is our role in all of that. I think it’s something that's going to change over time, but as the impacts of climate change increase on our patient populations, we are the critical infrastructure for our communities.

So, we are going to have to figure out how to play a role in decreasing that vulnerability and at the same time, building up our resiliency so that we can be there when we are needed most.

AB: That's so well said, and for everybody on the call, CHNA (Community Health Needs Assessments), and I’ll also underscore that everything you said aligns with what we were talking about in terms of multidisciplinary collaboration.

You named some more disciplines just then, Jenna, and as a clinician myself, I definitely applaud the connection back to addressing social drivers of health, which I think brings in our clinical activities into our resilience planning in a different way.

I really appreciate you both, especially for being so generous to spend some extra minutes with us today to address all these rich questions.

Again, a big thank you to Jenna and David for sharing their expertise with us.

Thank you to the ASPR TRACIE team.

I will turn it back over to Rachel to close us out.

RL: Thank you so much to Aparna, Jenna, and David. What fantastic presentations, I really appreciate the valuable discussion at the end there. We greatly appreciate you just sharing your best practices.

And a big thank you to everyone for joining today's webinar. If you have any questions about the webinar, please reach out to ASPR TRACIE. Our contact information is on the slide right there.

Next slide.

RL: The recording of this webinar will also be online on the ASPR TRACIE website in the next 24 hours. Keep an eye out for Issue 19 of the Exchange and remember to follow ASPR online. Thank you all.