

DELAWARE Beach Life

HISTORY | PEOPLE | HOMES | ARTS | NATURE

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INSIDE

Shock Waves

Study of 'surf-zone' injuries identifies risk factors, both human and environmental **page 48**

Suits and Sensibility

Rehoboth officials once took a prudish view of ladies' swimwear — but no longer **page 56**

Medicine on the Move

Population growth has led to new health care facilities in coastal Delaware **page 61**



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SHOCK

Dr. Paul Cowan wades sideways into shallow waves near the Naval Jetty at Cape Henlopen State Park, one of five Delaware beach sites featured in a study that counted more than 2,000 surf-zone injuries since 2010.



WAVES



Study of 'surf-zone' injuries identifies risk factors
— and getting caught by surprise tops the list

BY CHRIS BEAKEY | PHOTOGRAPH BY SCOTT NATHAN | ILLUSTRATIONS BY LAURA NAVARRI

Ask Dr. Paul Cowan what prompted him to study injuries caused by waves slamming beachgoers into the sand, and he'll cite a moment in 2002 when the emergency room at Beebe Medical Center (now Beebe Healthcare) looked and smelled like a day at the ocean. >

The boy at right is at greater risk than the man at left, according to research done over an eight-year period along Delaware beaches. The study showed that about 18 percent of surf-zone injuries occur while bodyboarding, but the far greater danger is turning your back to a breaking wave — that's when 72 percent of injuries occur to people wading in just a few feet of water.



TOTAL SURF-ZONE INJURIES RECORDED DURING THE EIGHT-YEAR STUDY

“Everyone who’s been in a hospital knows that distinctive antiseptic smell,” he says. “But I remember walking in at about 2 p.m. on this one hot July day to the strong smell of suntan oil overpowering everything else. I looked out and saw sand on the tile floor and a room full of people in swimsuits, barefoot or in flip-flops, who’d obviously come there straight from the beach.”

The stories told by these patients had a surreal quality. Many described an ordinary day, with waves neither large nor small — the kind of day when you might venture up to your thighs in the water and feel completely safe.

But turn your back on that ocean and the dynamics can change. The result: backwash from a retreating wave sucks the sand from beneath your feet an instant before an incoming wave topples you forward, slamming you down so hard it’s difficult to get back up before the next wave hits.

Cowan has listened to hundreds of similar accounts during the past 16 years. He hears them while treating injuries ranging from ankle sprains and dislocated shoulders to ruptured spleens and cervical spinal cord injuries. More than 2,000 of these injuries have

occurred in relatively shallow water at five Delaware beaches just since 2010. At least three people have died as a result.

“If you look out at people on the beach you’ll see most of them standing in the water as opposed to riding the waves,” Cowan says. “The most common thing people say is that they had their backs to the ocean when they got knocked over into hard, wet sand. You only need to add lime to sand to make cement. That’s what it feels like if you’re knocked down with enough force.”

Cowan talked at length about these injuries in a 2009 presentation he made at the Delaware Trauma Symposium in Wilmington. The invitation to speak had come with a special request: Tell us about a type of trauma that’s completely unique to your hospital. Cowan chose to talk about those days when the emergency room filled with people injured in the “surf zone” between the water’s edge and the place where the waves break.

Shortly afterward, he set out to study the factors behind this oft-repeated summer scene.

A groundbreaking study

In 2010, Cowan contacted Wendy Carey, who was then a coastal hazards and resiliency specialist in the Delaware Sea Grant College Program at the University of Delaware’s Hugh R. Sharp campus. Together, they designed a study to learn why surf-zone injuries hap-



DO BEACH INJURIES COME IN WAVES?
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pen and to develop a model for forecasting days and times when they are most likely to occur.

The study was a unique collaboration between Beebe's Department of Emergency Medicine, Delaware Sea Grant, the state Department of Natural Resources and Environmental Control, the University of Delaware's Center for Applied Coastal Research, and local paramedics and beach patrols. The researchers' findings were published in the *American Journal of Emergency Medicine*.

“You only need to add lime to sand to make cement. That's what it feels like if you're knocked down with enough force.”

“It's a cool study because you usually do environmental studies or medical studies but you don't do both,” Cowan notes. “I would talk about stuff their researchers wouldn't understand and vice versa.”

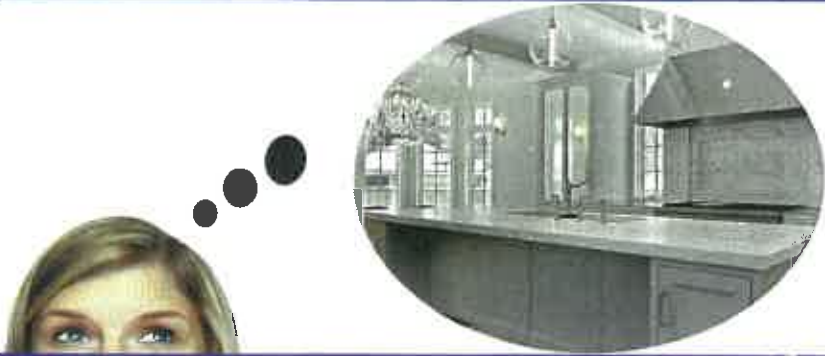
For their part, Cowan and his trauma registrar, Michelle Arford-Granholm, recorded data on the injuries they saw at Beebe's emergency departments in Lewes and Millville. With guidance from Jack Puleo, an environmental engineering professor at the University of Delaware, and his graduate assistant, Matt Doelp, researchers spent time on the beaches noting conditions there. These included the time between waves, water temperature, types of injuries reported and the time of day they occurred.

The study was conducted from Memorial Day weekend until Labor Day every summer between 2010 and 2017. It collected data on visitors to Cape Henlopen State Park, Rehoboth Beach, Dewey Beach, Delaware Seashore State Park and Bethany Beach.

It wasn't the first study of surf-zone injuries. Hoag Hospital in Orange County, Calif., has 30 years of data on injuries from shallow water diving, surfing, bodyboarding, windsurfing, and skimboarding. That study is limited, however, to spinal column and cord injuries. The Delaware team examined the full range of injuries Cowan was seeing — those to the upper and lower extremities, the torso, head, neck and spine.

The researchers also looked at characteristics of the victims such as age, gender

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and whether they were from the area. Doug Miller, an associate professor at the University of Delaware School of Marine Science & Policy, synthesized the statistics.

The study was also unique in that it did *not* focus on a well-known phenomenon that stirs fear among swimmers — the rip currents that lead to about 80 percent of beach-related rescues in the U.S. These are already monitored through a variety of sources, including drone data and visual reports from mid-Atlantic beach patrols, who collaborate with the National Weather Service. In fact, every day between the weekend before Memorial Day and Sept. 30, beachgoers can go to the weather service website for a forecast of rip currents at beaches throughout the nation. (Information on Delaware's beaches is available at weather.gov/phi/surfrfp4.)

Forecasting the possibility of surf-zone injuries involves far more considerations.

"Identifying the environmental factors behind a spike in injuries is harder because there's a human factor," Cowan notes. "Everyone's stepped onto the beach on days when it's really loud and you can see the waves crashing down hard." But typi-

cally, he adds, "those are the days when people don't go in the water."

That said, the research team was able to come up with a tool for forecasting the likelihood of injuries at any given hour, based on the surf-zone conditions.

"While the model wasn't perfect, it gave good indications of the conditions in which injuries were more likely to happen," Doelp says. Somewhat counterintuitively, the study found the largest number of injuries occur on days when the waves are moderate, under sunny skies and without a lot of wind, and when the beaches are the most crowded.

Myths and truths

In recent years, both local residents and frequent visitors have increasingly come to believe that beach replenishment efforts laid the groundwork for more surf-zone injuries. This thinking has been especially prevalent since 2005, when Rehoboth Beach was replenished with sand pumped from an offshore area that was heavy with gravel. Surfers and others argued that the material, which was coars-



PERCENTAGE OF ALL INJURIES THAT INVOLVE NON-LOCAL BEACHGOERS

er than the sand it replaced, caused steep drop-offs a few feet from shore. They also asserted that when beaches become higher as a result of replenishment, there is more danger from waves breaking closer to shore.

To date, however, these beliefs haven't been scientifically substantiated. One reason is that there is no data on injuries prior to the start of the surf-zone study, which means researchers can't compare recent injuries with those that occurred before the replenishment era. Another reason, according to Stephen Rochette, a public affairs officer with the Army Corps of Engineers' Philadelphia office, is the range of variables affecting beach conditions. >

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Turning into and swimming underneath a breaking wave is usually safer than allowing it to hit you in the back.

Tips for Staying Safe

For a doctor who's spent 16 years treating patients with surf-zone injuries, Beebe Healthcare's Dr. Paul Cowan has a remarkably upbeat forecast for anyone looking to spend a day at the beach.

"Statistically, our beaches are very safe if you use common sense and don't turn your back to the waves," he says. "My job is to prevent injuries. At the end of the day we're going to do that by increasing public awareness."

Cowan and his fellow researchers would like to see extensive public education campaigns to spotlight simple ways beachgoers can stay safe in the surf zone. They're urging beach communities to create signs describing the dangers and how to respond to them, and pamphlets with safety tips that can be offered through coastal realty agents, along with other strategies.

Their recommendations emphasize their biggest challenge: the counterintuitive realities of "risk perception." Simply put, when you head out for the fun of board or bodysurfing on big waves, you're more apt to be aware of the risks involved, but most people don't see any danger when they step onto the warm sand and look out at what appears to be gentle or moderate surf.

Researcher Dr. Paul Cowan and Capt. Kent Buckson of the Rehoboth Beach Patrol encourage beachgoers to recognize the danger, and offer a handful of simple safety guidelines:

❖ **Swim within sight of lifeguards, and check the daily beach forecast.** "Lifeguards are aware of the dangers of the surf zone because they have the training and experience and are out there every day," Buckson says. "We use flags to post conditions throughout the day. Green means you don't have a dangerous shore break. You've got gentle surf and small waves so you're less susceptible to rip currents and surf-zone injuries. Yellow means there's more moderate danger. Red is for the most dangerous conditions."

On those red-flag days, Buckson says, the lifeguards strongly advise people not to enter the water.

(The National Weather Service elaborates on these points by noting that rip currents can still happen even on calm days, particularly near jetties and other structures out in the water.)

❖ **Don't dive.** As the waves rise and fall, it's very difficult to determine how deep the water is. Heading into the water feet first is the smart way to go.

❖ **When a big wave is coming, duck and cover.** Trying to outrun a large wave is one way to get injured, Buckson says, but standing your ground and bracing yourself can be just as dangerous because your body will tighten up and probably still get knocked down. "You're better off turning into the wave and going under it," Buckson says, so that it passes over you.

❖ **Don't ever turn your back on the waves.** The surf-zone study found most people had their backs to the ocean when they were swept off their feet and injured. As Cowan says, "You wouldn't close your eyes and walk across several lanes of traffic on Route 1 with cars roaring by at 50 miles an hour." That's the analogy he wants beachgoers to keep in mind as they're working their way through the surf zone. "Keeping an eye on the waves, and entering and exiting the water at an angle, will help you see the dangers in front of you and behind you as well."

"The message is not that it's unsafe," he says. "It's that there is a risk there, and you have to be safe." ■





“The energy from a 3- or 4-foot wave is similar to the energy from getting hit by a small compact car moving at 20 or 30 miles an hour.”

“The shore is a very dynamic environment — one where the beach profile is continually self-adjusting to its natural equilibrium through changing tides, waves and currents,” he notes.

Edward Voigt, another Army Corps spokesman, noted in a 2013 interview with *Scientific American*: “We don’t have any data showing us a correlation or relationship between beach nourishment and spinal injuries. There are so many factors that come into play with injuries: Was it high tide? Low tide? What time of year was it? Were there storms? If someone had information like that — not anecdotal but some kind of data or analysis — that would give us something to look at.”

Lifeguards and scientists nevertheless agree that steep drop-offs created in part by replenishment can make wading and swimming more dangerous. Waves that travel over a gentle slope toward the shore are slower, and easier for body and board surfers to ride. But “if the beach drops off steeply, it affects how the waves change as they come into shore,” Puleo says. “This causes all of the wave’s energy to be released in a narrow location,

The surf-zone study found the greatest number of injuries among those aged 11 to 20, many of whom were hit from behind by waves and knocked into the sand while wading in just a few feet of water.

which we hypothesize may contribute to injuries.”

That steepness also makes it more difficult for a wader to get out of the water when trouble is coming.

“I’ve seen it hundreds of times — people

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PERCENTAGE OF ALL WADING INJURIES THAT OCCUR WHEN PEOPLE TURN THEIR BACKS TO THE WAVES

72%

getting clobbered by a wave,” says Capt. Kent Buckson, the head of the Rehoboth Beach Patrol who has been a lifeguard since 1987. “It happens a lot to people who wade out to waist-deep level. They see a giant wave coming and their automatic reaction is to turn and try to run. But you can’t outrun a wave, especially when you’re halfway underwater and running up a slope. It’ll catch you from behind and propel you into the sand.”

Cowan seconds that warning, and adds: “The energy from a 3- or 4-foot wave is similar to the energy from getting hit by a small compact car moving at 20 or 30 miles an hour.”

Beachgoers may also assume that they’re more apt to be injured when they’re engaged in activities such as bodysurfing or skimboarding. According to the surf-zone study, however, the opposite is true. About 50 percent of the injuries recorded occurred to people who were simply wading in a few feet of water. For bodyboarding and bodysurfing, the numbers were 18.4 percent and 13.3 percent, respectively. For skimboarding, it was just 5.6 percent.

Turning your back on the ocean is apparently the most risky thing one can do. Data from 2015 to 2017 shows that 72 percent of wading injuries happened when people were facing the shore.

Middle-schoolers and teens constitute the age group suffering the most hits, as injuries among beachgoers 11 to 20 years old represent about 28 percent of those treated at the Beebe and Millville emergency rooms.

As a side note, parents and grandparents might be interested to know that most of the injured individuals between the ages of 41 and 60 — a range that includes the groups with the second- and third-highest number of injuries — came to the beach with

children. One possible upshot of that, the researchers say, is that those high injury rates could be due in part to adults paying more attention to their kids than to the waves.

The study also found about 62 percent of the injuries happened to men

and boys, who were also more likely than girls and women to be injured while engaged in more vigorous activities such as skimboarding and board- and body-surfing.

It also found the number of injuries sustained by out-of-towners was more than six times higher than those sustained by locals, who were identified through surveys as living in ZIP codes that begin with 199. The researchers suggest this could be because vacationers to area beaches are less familiar with the challenges of swimming or wading in the ocean. They also point to the fact that only about 16 percent of those visiting beachgoers said they had seen any warnings of shore-break dangers.

Upper extremity injuries, such as shoulder dislocations, are the most common. The second most common are injuries to the lower extremities, which range from hip, foot and leg fractures to dislocations of the knee. Lower extremity injuries frequently happen to people whose feet have sunken into the sand, which plants the person in a fixed position when the wave hits, twisting them violently. Something — often it’s ligaments, muscles, tendons or bones — has to give. ■

CHRIS BEAKEY is a regular contributor to Delaware Beach Life. His thriller novel, “Fatal Option,” was published by Simon & Schuster in 2017.

11-20



AGE GROUP MOST AFFECTED BY SURF-ZONE INJURIES

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