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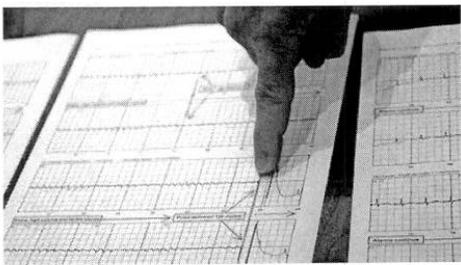
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Back from the brink: A vest that can prevent sudden cardiac arrest

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Pam Panichak / Post-Gazette

The printout of the ECG recorded by the LiveVest during Jack Neilson's cardiac event showing weakening heart then points to the shock administered by the LiveVest and then heart returning to his normal rhythm.

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By David Templeton Pittsburgh Post-Gazette

Last spring Jack Neilson survived sudden cardiac arrests one month apart, inspiring his recent visit to an O'Hara company with gratitude for saving his life during the second brush with death.

The first one -- a right-place-right-time circumstance -- occurred in an Elk County emergency room, where a defibrillator was used to resuscitate him.

The second time he was inside his Johnsonburg, Elk County, home -- a place where odds are high that a person won't survive a cardiac arrest because few homes have defibrillators or people trained to use them.

But he was wearing a Zoll LifeVest, a system developed, produced and monitored at the company at the RIDC Park near Blawnox. The wearable defibrillator monitors heart rhythms 24 hours a day and automatically activates a defibrillator to shock the heart back to normal rhythm during serious arrhythmia or a cardiac arrest. On Aug. 16, Mr. Neilson, his wife Juanita, daughter Victoria and 6-year-old grandson Thomas visited the Zoll facility to say thanks for the LifeVest technology and share his story of survival. He said he also wants to convince others to don the vest if prescribed by a doctor. The device has two parts, straps with sensors and shock-delivering panels (worn under regular clothes) and the monitor/battery pack worn in a holster at the waist or on a shoulder strap.

"It's a great little invention," the 57-year-old former paper-mill worker said. "I'm living proof that it works."

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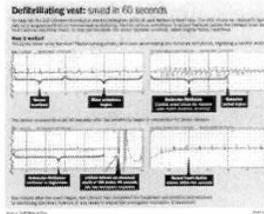
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Zoll LifeVest data confirm its success.

To date, 75,000 people have used the LifeVest that, on average, is saving one life a day. With 980 lives saved by LifeVest, the 1,000th is expected soon.

"We're getting ready for a big celebration," said Marshal Linder, Zoll LifeVest president and chief operating officer.



PG graphic: Defibrillating vest
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When the heart's rhythm is so irregular the heart stops beating, a person must receive an electrical shock within five to 10 minutes to prevent death or brain damage. Those whose experience one outside a hospital have less than a 10-percent chance of good survival, with the rate generally related to how long it takes a paramedic or trained individual to arrive with a defibrillator and use it, said Norman C. Wang, the UPMC cardiac electrophysiologist who's treating Mr. Neilson.

Studies show that those who suffer a sudden cardiac arrest in airports, casinos or other crowded venues that have readily available automated external defibrillators have a survival rate of about 50 percent, Dr. Wang said.

But Zoll cites a 98-percent "first-treatment shock success rate" for resuscitating patients with the vest that doesn't require bystander intervention. When one is under way, the LifeVest not only issues a shock but transmits heart-rate details to the O'Hara facility that uses a secure online patient-management system to provide physicians with information or alerts whenever arrhythmia or a cardiac arrest occurs.

Cardiac arrest caused by arrhythmia involves a disruption in the electrical impulses that cause the heart to beat. It is different from a heart attack, which involves disrupted blood flow to the heart.

One person wearing a LifeVest, Mr. Linder said, collapsed from a cardiac arrest while on a walk but a timely treatment shock restored consciousness, allowing the person to walk home. Another person wearing a LifeVest awoke one morning to discover bedclothes covered with the blue gel that the vest released to increase conductivity for the electrical pads before the shock occurs. The gel often serves as the only proof a patient has that he or she had received a life-saving shock.

Invented in the 1986 by Stephen Heilman, the LifeVest developed through his company, Lifecor, received approval in 2001 from the U.S. Food and Drug Administration followed in 2005 by Medicare's approval for reimbursement. That led to soaring sales, Mr. Linder said. Zoll Medical purchased the company in 2006, with Zoll LifeVest experiencing revenue growth of 60 percent a year with its O'Hara workforce doubling over the past two years to more than 500 employees. The full rental price is \$3,200 a month, which can be offset by insurance.

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brought him back from the brink.

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On April 18, when Mr. Neilson began feeling ill, his wife took him to the Elk Regional Health Center in St. Marys, where he suffered a cardiac arrest. After his resuscitation, he was sent to UPMC Presbyterian on a medical helicopter.

A patient of Dr. Wang, Mr. Neilson was an ideal candidate for an implantable cardioverter defibrillator, or ICD, that's surgically implanted in the chest to monitor heart rhythms and provide electrical shocks to correct serious arrhythmia or counter a cardiac arrest.

But an active blood infection prevented Mr. Neilson from receiving an ICD at the time. So Dr. Wang prescribed a LifeVest, a temporary device that provides time to determine whether a patient's condition can be treated better with medications or heart surgery or allow a patient to overcome other medical problems that prevent the surgery to implant an ICD, as occurred with Mr. Neilson.

Returning home, he wore the LifeVest 24 hours a day for several weeks.

On May 18, Mr. Neilson was resting in his recliner and watching the 5 p.m. news when he fell unconscious seven minutes into the newscast. The electrocardiograph the vest recorded tells the tale of what happened during the minute-long cardiac arrest.

Prior to the attack, Mr. Neilson's heart was beating normally for him, about once per second. But then the rhythms turned erratic, soon deteriorating into full-scale arrhythmia signifying a cardiac arrest. For the next 14 seconds, the LifeVest monitored chaotic arrhythmia before initiating a "treatment sequence." Low- then high-level alerts were sounded, along with tactile alarms to provide a patient, if still conscious, a chance to stop the painful electrical shock.

But Mr. Neilson was unconscious, his eyes rolling back into his head.

The device released the blue gel 35 seconds after the arrhythmia began. Chaotic rhythms began dropping in amplitude, indicating that the heart was quivering rather than beating and not pumping blood. In the following seconds his heart rate on the ECG had reduced to a wiggly line, almost a flat line.

Then it happened. Forty-five seconds into his cardiac arrest, the LifeVest sent a 150-joules shock, a pronounced jolt, from the vest's front panel through his heart to two receiving panels on his back.

In another amazing sequence, the ECG showed that within two seconds, the shock reset Mr. Neilson's misfiring heartbeat, causing it return to a normal heartbeat, albeit one now beating twice rather than once a second. Save for a flutter or two, that trend continued until the LifeVest sensed a restored heart rhythm, prompting it to discontinue the emergency sequence. One minute after the event began, the LifeVest had completed the treatment successfully and returned to monitoring the heart rhythms. It was ready to repeat the emergency sequence, if necessary.

When Mr. Neilson awoke and recovered his senses, he heard his daughter Victoria calling 911. The blue gel smeared on his shirt made it clear to him he'd suffered a cardiac arrest. Zoll soon alerted Dr. Wang with the details of what had happened.

An ambulance rushed Mr. Neilson to the Elk Regional Health Center and soon after he was flown once again to UPMC, where this time he was able to have the ICD implanted. He hasn't had a cardiac arrest since May 18.

"He almost certainly would have died at home" without the LifeVest, Dr. Wang said.

And that's why Mr. Neilson was sitting with a broad smile on a recent day inside the Zoll LifeVest building.

"It's the greatest invention I've ever come across, living in rural Pennsylvania," he said. "This is modern technology. If someone wears one after this interview and it saves a life, it's worth it."

"It definitely saved my life."

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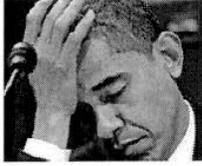
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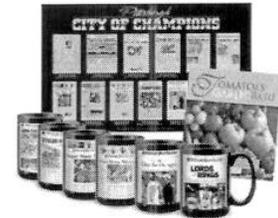
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