



# Making Limb-Saving Alliances

David G. Armstrong, DPM is redefining diabetic wound care with his precedent-setting toe-and-flow approach.

BY JOLYNN TUMOLO

It's Monday morning, and David G. Armstrong, DPM, PhD, hours ago returned from an overseas trip to Poland and Macedonia. While in Krakow, he delivered a keynote address on the diabetic foot and amputation prevention at the annual meeting of the European Wound Management Association. Now back at the Keck School of Medicine at the University of Southern California (USC), Los Angeles, where he serves as professor of surgery and director of the Southwestern Academic Limb Salvage Alliance (SALSA), he's putting his words to action. He finishes up final discussions with col-

leagues on the morning's surgical case: a woman who has flown in from Mexico for a procedure to help her avoid the full amputation other doctors recommended she receive. Downstairs, a group of physicians from Finland waits in a conference room to observe the surgery. They hope to establish a SALSA-like team in Helsinki. "It is profoundly life-affirming," said Dr. Armstrong, referring both to the Finnish doctors he will greet momentarily as well as the other alliances he has spent his career forming. His emphasis on interdisciplinary teamwork—at the core, a podiatric physician and a vascular surgeon—in the treatment of patients with diabetic foot wounds has disrupted conventional siloed models of care. Dr. Armstrong calls the foot-vascular specialist team approach "toe and flow." For countless patients who have received care under the innovative model at USC

Stephanie Wu, DPM, MSc, FACFAS, director of the Center for Lower Extremity Ambulatory Research (CLEAR) at the Dr. William M. Scholl College of Podiatric Medicine and Science in Chicago. Dr. Armstrong founded CLEAR in 2004.



Dr. Armstrong

"The concept has made a significant difference in patients with diabetic foot wounds as it helps ensure assessment and treatment of adequate blood flow as well as pedal assessment and treatment," she said. "One patient presented with gangrene of the digits and was told that a below-knee amputation was his only option. Following assessment with the toe-and-flow model, a below-the-ankle arthroplasty allowed for a successful transmetatarsal amputation. The smile on the patient knowing that his foot was saved is priceless," said Armstrong.

Thanks to such outcomes, the toe-and-flow approach is proliferating across the country and around the world. Like the physicians from Finland aspire to do, others have trained with Dr. Armstrong (or, at this point, have trained with specialists who have trained with Dr. Armstrong) and set up toe-and-flow diabetic limb salvage teams of their own. The University of New Mexico has CHILE (Center for Healing in the Lower Extremity). Baylor College of Medicine

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### Simplified Success

"The toe-and-flow approach has been extremely effective because of its simplistic approach to the fundamentals of diabetic limb salvage, vascular and podiatric surgery," said



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has STEP (Save the Extremity Program). Harbor UCLA Medical Center has HULA (Harbor UCLA Limb Alliance). And the list goes on.

Indeed, before heading up the SALSA program at USC, Dr. Armstrong founded along with vascular surgeon Joseph Mills, MD, another SALSA program (this one, the Southern Arizona Limb Salvage Alliance) at the University of Arizona, Tucson. “We’ve been working in this area for a very long time, actually, my whole career,” Dr. Armstrong said. “We’re always trying to refine it to get better and better.”

## Podiatry’s Progression

Dr. Armstrong was born into podiatry. His father, Leo N. Armstrong, DPM, was a noted California podiatrist in the 1970s, ‘80s, and ‘90s. Before becoming a Dr. Armstrong himself, the son spent years sweeping up, making orthotics, working over treatment rooms, and studying the profession as an observer. (Dr. Leo Armstrong passed away in 2004.)

“I grew up with the specialty, and I’ve been really lucky in so many ways. I’ve been able to both passion-

ulate—he’s heartened by the profession’s progress. “It has evolved into a surgical specialty,” he said. “If you want to talk about it at its highest level of evolution, it is really kind of like a high-risk limb specialty if you will. When you’re practicing to the

dent believer in the difference close collaboration and interdisciplinary plans can make in improving wound outcomes, he encourages podiatrists to bridge the gaps that separate them from other specialists.

“It takes a lot of energy to build

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fullest extent of your training, that’s really where things have progressed.”

Dr. Armstrong believes an argument can be made that the rise in podiatric surgery and its equivalent around the world has had a direct effect on the decreasing incidence in amputation since the late ‘90s. Still, updates to the definition of diabetes that have expanded the number of people diagnosed with the condition have likely played into the reduced amputation rate as well.

“By and large, we can say a difference has been made and it continues to be made, but much work remains. We’re still seeing more and

these interdisciplinary teams no matter where you are. It takes energy on the part of the clinicians, and it also takes buy-in from hospital or health system leadership,” he said. “But if you can take some time and step out of the day-to-day and just walk over to your buddy who is the vascular surgeon or the interventional cardiologist or the radiologist or the plastic surgeon or the infectious disease doctor and make common cause with them, just form alliances, that energy that you put into the system comes back. It comes back with dividends.”

In its current iteration at USC, SALSA has branched out from its toe-and-flow core (Dr. Armstrong and co-director Vincent L. Rowe, MD, professor of clinical surgery) to bring in other healthcare professionals with relevant expertise, including physical therapists, nurses, plastic surgeons, and prosthetists. In addition to a motivated interdisciplinary team, Dr. Armstrong said four components are essential for successful toe-and-flow amputation prevention initiatives:

- 1) A “hot foot line” to summon immediate toe-and-flow help in emergency departments and in-patient wards: Similar to a stroke line or calling a code for a heart attack, a hot foot line allows in-patient providers to quickly access the limb salvage team to assess the patient and determine whether the issue is primarily a toe problem (diabetic foot infection), a flow (ischemic) problem, or a combination of both. “The key with the hot foot line,” said Dr. Armstrong, “is speed.”

- 2) An out-patient wound clinic

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ately and dispassionately watch and follow its progress,” Dr. Armstrong said. “I grew up with a lot of podiatry’s greats, men and women who really gave so much of themselves when no one knew what the heck this little dinky specialty was. I feel with all I have been given, having wanted for nothing, I have had no excuse but to pay it forward.”

When he compares those days with now—when the United States is a world leader in podiatric medicine that other countries seek to em-

more people developing diabetic foot wounds now than ever before,” he said. “It’s a huge burden on our healthcare system, but it’s a huge opportunity for podiatric surgeons in the United States who really are trying to be the go-to specialty for this.”

## Teaming Up Against Wounds

When it comes to preventing amputations in patients with diabetes, the lack of structural teamwork in the U.S. healthcare environment poses a substantial hurdle. An ar-



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to address tissue loss, close wounds, and move patients into remission: At Keck Hospital, the combined clinic

patients,” said Dr. Lepow. “I came from a private practice setting where everything was kind of fractionated in terms of care. This is a one-stop shop environment that allows us to provide

Armstrong after another facility recommended amputation.

“She had a very bad infection and very poor blood flow. Under the same anesthesia, we had her in the operating room for a debridement and an angioplasty,” said Dr. Armstrong. “Over the span of the next 90 days, we worked really hard and we were ultimately able to heal her” using multiple skin grafts, reconstructive surgery, and a transmetatarsal amputation. With just one prosthesis instead of two, the woman was able to dance at the party. Mission complete.

That was about seven or eight years ago, and Dr. Armstrong still receives annual Christmas cards from the grateful patient. “There are so many patients like that—that we all have in this field,” he mused. “I feel like this is one of the most challenging, frustrating, but ultimately life-affirming jobs on the planet.”

But for now, Dr. Armstrong has another patient to focus on. The woman downstairs—and the physicians from Finland—are ready for the surgery. After he welcomes the physicians, he will continue on to the OR where he hopes his work will make a

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takes place in a “toe hallway,” a “flow hallway,” and a plastic surgery hallway filled with experts in wound healing, Dr. Armstrong explained. “It’s a real interdisciplinary smorgasbord,” he said. “We’re grabbing and pulling each other into rooms across the hallways. It’s a big mess, but it’s fun.”

3) A remission clinic to maximize patients’ hospital-free, ulcer-free, and activity-rich days: For patients whose wounds have healed (SALSA has helped popularize the term “the diabetic foot in remission”), education about self-care and home-based monitoring can yield significant results. “We might spend more time just doing good quality diabetic foot care, trimming calluses, making sure patients are in the right shoes and insoles, and scheduling them for reconstructive surgery as needed,” said Dr. Armstrong. “It’s more ‘toe’ than ‘flow’ and physical therapy is involved as well, but it’s really robust.”

4) Screening clinics where patients with diabetes receive an annual comprehensive foot exam: Risk factors for complications can be addressed in the clinics, and patients can be referred to the remission clinic, the wound clinic, or even the hot foot line as needed.

### Transformative Care

At Baylor College of Medicine, Brian D. Lepow, DPM, sees about 100 patients a week in its toe-and-flow STEP program, which was developed by Drs. Mills and Armstrong’s SALSA. “It has been highly successful in terms of better coordination of care with

a higher quality of care. It’s just a better model for patients.”

Often, patients who end up at STEP are seeking their second or third opinion after being told, sometimes retold, they will have to lose a leg—or both. Dr. Lepow recalled a 54-year-old baker who had been advised she’d need a bilateral lower extremity amputation. It had started with a small diabetic ulcer on her foot, but amid discordant wound and vascular care, her tissue loss had pro-

gressed and her condition deteriorated. Then she heard about STEP.

“Because of the vascular efforts and the efforts of myself, we were able to get her healed. She’s back in shoes and living her life,” said Dr. Lepow. “It was about a year-long process, but it was very rewarding to see her walking after she had been told she’d have to lose both her legs.”

Dr. Armstrong had about 105 days: then, the patient explained, her granddaughter’s quinceañera would be held, and the woman wanted desperately to dance at the birthday celebration. The patient had end-stage renal disease, a right foot amputation, and about 1,500 square centimeters of tissue loss on her left foot. She had driven herself to see Dr.

profound difference in the life of the patient before him, and eventually in the lives of patients who will one day receive treatment from his physician guests.

Without teamwork and alliances, none of it would be possible. “When you and the team give of yourselves like that,” he said, “it’s collectively transformative.” **PM**

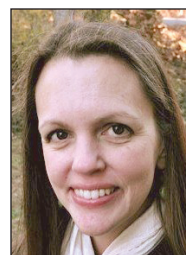
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