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Stanford-India team licenses design to make $5 leg splint for trauma victims

BY KRIS NEWBY

India has the highest number of traffic accidents in the world, many of which result in serious injuries due to the legions of pedestrians, cyclists and motorcyclists sharing the roads with cars.

Courtesy of Stanford-India Biodesign

A disposable, $5 leg splint, designed by Stanford-India Biodesign fellows, helps stabilize injured limbs of trauma victims in India, the world leader in traffic accidents.

Recently, two Stanford University biodesign fellows — Darshan Nayak, a physician, and Pulin Raje, a product designer — licensed a low-cost, disposable leg splint that promises to reduce the harm caused by these collisions by immobilizing injured legs while patients are transported to trauma centers. The licensee, HLL Lifecare Limited, is a government-owned Indian manufacturing company that distributes medical products such as condoms, sutures and contraceptive pills to India's growing population of 1 billion-plus.

Stanford has waived royalty rights for the leg splint through its Socially Responsible Licensing Program.

Nayak, a physician trained at India's Grant Medical College, and Raje, a mechanical engineer and designer from the Indian Institute of Science, created the splint during their fellowships in the Stanford-India Biodesign program, a partnership between Stanford, the Indian government, the All India Institute of Medical Sciences and the Indian Institute of Technology in Delhi. The program aims to foster a new generation of Indian biomedical technology innovators. Typically, the first part of the fellowship is spent at Stanford training with the U.S.-based biodesign fellows, and the remainder is spent in India, working with an interdisciplinary team to identify clinical needs in that country.

The low-cost leg immobilization splint was developed after Nayak, Raje and two other fellows from India spent six months learning the biodesign innovation process at Stanford, followed by three months working at Indian emergency rooms and clinics to identify urgent medical needs. Last month, *MIT Technology Review India* honored Nayak as a "Top Innovator Under 35 in India" for this invention, which editors said, "has enormous potential in India and other emerging markets."

The splint, called Relligo, is deceptively simple: a

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cardboard plank threaded with five Velcro straps along its length. When its side wings are folded up, it becomes rigid enough to immobilize a damaged leg over what can be a two-hour ambulance ride on bumpy roads. Best of all, the design offers a five-fold cost reduction over the most commonly used leg splints, which sell for around 1,400 rupees (about $25).

"The $5 price-point of the splint eliminates the biggest problem that we observed in the field: To save money, ambulance companies and clinics often remove and reuse their expensive splints as patients are moved from the roadside to a trauma center," Raje said. "By making our splint inexpensive, effective and disposable, we increase the likelihood that the limb remains stable during patient transport, preventing secondary damage."

Another advantage to the new design over older metal splints is that it is radiolucent; it doesn't have to be removed before a patient is examined with imaging equipment. (Metal within cage-like splints can interfere with X-ray imaging and can cause harm to patients within a magnetic resonating imaging device because of its strong magnetic fields.) In addition, the three-sided splint tray leaves most of the limb accessible so that wound dressings can be examined and changed with minimal disruption.

"This is Stanford-India Biodesign's second licensed product, and it represents a wonderful achievement for the fellows," said Rajiv Doshi, MD, the U.S. executive director of the Stanford-India Biodesign program and a consulting assistant professor of medicine at Stanford. "This success also validates the importance of using in-country needs assessment to identify unmet medical needs, resulting in solutions that are appropriate for that environment."

Courtesy of Stanford-India Biodesign

Stanford-India Biodesign licensed its second medical device, a low-cost limb immobilization splint, to an Indian medical products manufacturer. Rajiv Doshi, Darshan Nayak, Pulin Raje and Asokan Thondiyath are shown holding the splint.

Today, the two other fellows who were involved with the splint project, Rahul Ribeiro, PhD, and Ashokan Thondiyath, PhD, are teaching Stanford Biodesign innovation methodologies at leading Indian universities.

Since its inception in 2008, the Stanford-India Biodesign program has produced a number of cost-effective medical devices that benefit underserved patients. This includes a low-cost bone drill that helps provide fluids to patients when a traditional I.V. can't be used; a hearing screening device for children in rural India; and an inexpensive neonatal resuscitation device that is lifesaving for babies having breathing difficulties immediately after birth.

"India has the potential to become a world hub for low-cost medical device design," said Paul Yock, MD, director of Stanford Biodesign and a professor of bioengineering. "With the thoughtful, frugal design approach that our Indian innovators take, we believe that their inventions will not only improve health in the developing world, but also collectively help us

understand how to develop more cost-effective technologies for the United States."

Hillary Clinton, former Secretary of State, echoed that sentiment after reviewing Stanford-India Biodesign's neonatal resuscitation device, among devices from other inventors, during an innovation summit in New Delhi last May.

"These cutting-age innovations cost a fraction of other medical devices that address these same problems, make lifesaving health care available to people who may not otherwise be able to afford treatment," she said.

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