

Startup product could detect concussions, win contest

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Jessie Garcia's fortitude is a subject of occasional, exasperated observation by her Grandma Hortensia.

"Tu eres muy tozuda!" the elder Garcia tells her granddaughter in Spanish. "You are very hardheaded."

So far, that condition has served Jessie Garcia well, if not wisely in some cases.

As a student at Lehigh University in 2009, Garcia continued playing in a rugby game after she was knocked to the ground with a concussion that left her with blurry vision, nausea, and sensitivity to light and noise for months.

Years later, however, that same stubbornness gave her the fortitude not only to endure, but also to recover from another blow, discovering that someone had already come up with her idea for a startup: mouth guards designed to electronically detect a concussion-caliber impact.

For three years after that letdown, the 28-year-old Bensalem, Pa., resident worked on lower-cost mechanical alternatives. That time involved more setbacks, six different redesigns, a personal investment of \$80,000, and a fair amount of frustration. The work has finally culminated in a product that Garcia's company, Tozuda LLC (a nod to her grandmother), brought to market May 29 through a Kickstarter campaign aiming to raise at least \$30,000 for new tooling and packaging

and a production run.

"I don't have savings anymore," Garcia said. "We have to get to market quickly. That's what this year is about."

Tozuda's story of grit and improvisation is among many in the region, the birthplace of Yankee entrepreneurship, with Benjamin Franklin among the headliners. For the third straight year, the Inquirer is hosting Stellar StartUps, a contest sponsored by MassMutual Greater Philadelphia to spotlight that still-thriving startup ambition that is the backbone of an important sector of the region's economy.

Nominations are being accepted through June 22 at www.philly.com/stellarstartups. To be eligible, companies must be in business no less than one year and no more than five, and specialize in one of the following nine categories: food/restaurants, health care, products/services, minority/women entrepreneurs, second-act startups (reinvention after retirement), students (high school/college level), technology, just plain cool ideas, and 2017 Stellar StartUps finalists.

Tozuda was a Stellar StartUps finalist last year, which led to connecting with an engineering firm in construction that is using its impact sensors—which attach with an adhesive strip and are intended for any protective headgear—and sparking interest from Ben Franklin Technology Partners of Southeastern Pennsylvania, which provided \$10,000 in matching funds for prototyping and design work, Garcia said.

The company of six employees includes her fiance, Christopher Basilico, a research engineer with a day job at PDC Machines Inc. in Warminster, Pa., who is Tozuda's chief technology officer.

Sales so far have reached about \$25,000 from person-to-person transactions, mostly to coaches, Garcia said.

"We need to sell at least 1,000 sensors on Kickstarter to be successful there and at least 4,000 units for break-even," Garcia said.

With Kickstarter proceeds expected to enable full-scale production, "we'll break \$100,000 easily this fall," Garcia said, knocking for luck on the wooden desk in her office at NextFab in South Philadelphia, a co-working makers' space. She expects to begin shipping by the end of July in time for the start of football season, with sensors individually retailing for \$29.99; \$749.81 for a pack of 25; \$1,399.65 for a 50-pack.

"For what you could spend on one helmet, you could outfit your whole football team," Garcia said, emphasizing that Tozuda sensors do not diagnose concussions; they indicate only when someone should be tested for them. By some estimates, there are 3.8 million sports concussions a year in the U.S., with about half going undetected.

Tozuda set out to produce a low-tech device in part because coaches told her they didn't want to have to consult apps to determine whether someone should be checked out for a serious head injury, she said. Competitors, including Riddell InSite, Prevent Biometrics, and Athlete Intelligence, are electronic-based sensors ranging from \$25 to \$300 per unit.

"We had to think innovatively, but in a simpler way," said Garcia, who has a master's degree in engineering in technical entrepreneurship. "Our advantage is the simplicity of not having to worry about battery life and Wi-Fi, the visibility of any player being able to see the change in color, and our price point."

Many coaches have tight budgets and "just want to know when to take (players) off the field," Garcia said. "And parents want to feel confident the coach is monitoring their children properly."

The simplicity in Tozuda sensors is emphasized in the company tagline: If it's red, check your head.

The sensors are 1.4-inch plastic capsules containing a spring, two tiny steel balls, a clear liquid blend and a red powder dye. The liquid will turn red when a potentially concussive hit is detected—from any direction and within milliseconds of impact. That will happen when linear or rotational accelerations exceed a gravitational force of 85, a trigger point Tozuda says on its website was determined using data from a study by the Department of Orthopedics at Brown University. Researchers found, through more than 161,000 tested collisions on adults, that impacts of 75 g had a 50 percent chance of causing a concussion. Brains of young adults, teens, and children are thought to be more sensitive and susceptible to injury.

Garcia explained that 85 g as "a 10-pound hammer falling from about eight feet above your head."

At Children's Hospital of Philadelphia, head-impact sensors "have become an important tool for researchers ... who are working to calculate the forces experienced by players in contact sports that lead to concussion," said Kristy Arbogast, a research professor and co-scientific director at the Center for Injury Research and Prevention and the Center for Child Injury Prevention Studies.

In an email, she said Tozuda "has tapped into a real need in youth and elite sports." Yet, substantial work remains to be done in concussion research and development, Arbogast said, for Tozuda's technology "to be a valid reliable tool to identify players who might have a concussion." She noted, for instance, that due to age, gender, previous concussion history, and maybe even genetics, an acceleration rate much less than 85 g might lead to injury for some people. (Tozuda's sensor set points are adjusted based on age and level of play; this is not a one-size-fits all

product, Garcia said.)

"Currently, there are no sensors that can be used in actual play to accurately identify players who have suffered a [concussion](#)," Arbogast said. "Rather, it is still the human eye—clinicians and athletic trainers—that are best equipped to diagnose."

Garcia believes that her products can aid in this effort.

"While professional teams and some well-financed sports organizations have the benefit of having trainers or clinicians on staff to monitor from the sideline, the teams that we service unfortunately don't have that luxury," Garcia said. "They have moms and dads who are volunteer coaches."

Nobody said the startup world is an easy one. It's not scaring off Garcia aka the Hardhead.

"I've embraced it—that I'm hardheaded enough to see this through," said the native of Bloomfield, N.J., who began this journey after grad school living with her parents, themselves entrepreneurs as owners of Hispanic Advertising Promotions in Rutherford. She moved to Bucks County—and her company into NextFab—in 2016 to access equipment to make better-quality prototypes. An accelerator in Pittsburgh tried to lure her with money, but she didn't want to be that far from her parents.

Whether Tozuda's progress since last year gets her a Stellar StartUps award this year will be up to an independent panel of judges that will analyze applications based on a number of criteria, including the problem they are trying to solve, the challenges they are facing and their plan for overcoming them, strategies for scaling up, and their uniqueness in terms of product, approach, marketing, social responsibility, and community involvement.

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