I moved to a fishing and farming village in rural Cambodia in the summer of 2008. I was supposed to stay for three months; I ended up staying for six and a half years.

After finishing up my undergrad training I received a government grant to support a research project of my choosing somewhere in the developing world. My funding allowed me to partner with a local non-governmental organization that was already established in the region. Although the majority of their work focused on water and sanitation, the links to anemia and poor nutrition (intestinal parasites picked up as a result of open defecation in fields can lead iron deficiency) were evident to all. And so, I was brought on board to investigate just how problematic anemia truly was in these communities.

The problem of anemia in Cambodia was far dire than I’d ever imagined. Everywhere I went, I saw men, women and children seeking shelter from the blazing sun under the floors of their stilted houses. One of the most common symptoms of the condition is lack of energy, and while we all like to complain that we are tired, most of us really have no idea what it’s like to be truly devoid of energy. Men and women had no energy to work and generate income to support their families, and children had no energy to attend school or even play with their friends. And the worst part was, people didn’t even know they felt so badly because they couldn’t remember ever feeling any different. If you grow up anemic and spend your whole life with poor iron reserves you have no clue just how unhealthy you are.

We often associate anemia with fatigue, possibly shortness of breath or dizziness, but outside of the confines of our Western hospitals, anemia has very real impacts on maternal and child health. Thousands of women die every year as a result of hemorrhage during childbirth caused by anemia, children grow up with cognitive delays and deficits, infections run rampant as a result of weakened immune systems, and billions of dollars are lost each year as a result of decreased worker productivity.

Anemia presents a viscous cycle a disease: women who are born anemic are almost always anemic in their adult lives, and as a result will almost certainly give birth to anemic children. The iron levels in a new mother’s breast milk are so low, and supplementary foods of such poor nutritional value, that those children who are born anemic will almost certainly remain anemic. The cycle is incredibly difficult to break and so anemia runs rampant across the region.

As my three-month stint in Cambodia wound down and I had collected hundreds of blood samples showing just how common the problem was, I was faced with a predicament: Either I return to Canada and begin graduate training in neuroscience (my plan at the time), or I stay in Cambodia and try to unearth a solution to this incredible problem. About a week before I was supposed to leave, I called my supervisor back home in Canada and I went out on a limb. I said that I wasn’t quite done with the work that I had started and that I wanted to stay. I couldn’t just uncover the enormity of the problem, write a report and move on as many before me had done. It was a bold move, but one that paid off. Rather than being berated, I was encouraged to turn the project into my thesis, ditch the rat experiments, and find a solution.

Over the past 30 years there have been a small number of studies that have looked at the use of iron cooking pots as a way to supplement an otherwise deficient diet. The concept is simple: prepare your food in a cast iron pot and some of the iron will leach from the pot and fortify each and every meal. The idea seemed promising, but for one small problem: people don’t like to use iron pots. Iron is expensive,
heavy and rusts very easily, changing the taste and colour of food that is left in them. In low-income countries, where people don't have overflowing drawers or tupperware, food is stored in the pot it is cooked in until it's all eaten, and is therefore very easily spoiled if a cast iron pot is used.

So in concept, the idea of cooking with iron was supported with human and lab trials. But in practice it just didn't work out. I knew that there must be a way to add iron during the cooking process that could later be removed. The iron could be added to any cooking pot, whether it be aluminum – like the ones they use in Cambodia – steel or even clay. It would need to be light to make it easy to use, cheap so that even the most poverty-stricken family could afford to use it, and environmentally sustainable – re-usable over and over again providing the badly needed iron, but not creating unnecessary waste.

In the early months of the project a lot of time was spent on the design of the iron supplement. After developing several unsuccessful prototypes, I landed on the idea of making an iron ingot that was shaped like a small fish. Cambodia is a country that relies entirely on fish. The mighty Mekong River that provides a source of income for millions dominates the country. Fish are seen as a livelihood, a staple food, and interestingly are associated with luck.

Ultimately I decided to model the iron ingot after a species of fish called Try kantrop. The design appealed to the culture's sense of luck – not pandering, but embracing an untapped dimension. Understanding the human link to the project was key here. Scientists often work in silos and it is easy to forget what we are doing, why we are doing it, and how it will impact someone's life. The key to success with this project was not just acknowledging, but embracing the complexity of the problem – medicine, nutritional science, public health and anthropology – a detailed understanding of each in Cambodian context was essential.

From day one, the fish were made in local metal factories. There, scrap iron was melted down and forged into the shape of the Lucky Iron Fish. By using scrap iron, costs can be minimized and the project can contribute to a healthy, sustainable environment. By keeping production local, rather than farming it out to a more experienced company elsewhere in Asia, we are able to contribute to the fledgling economic development of the country. By producing a single fish, we are able to both recycle waste metals and support local livelihoods.

To make sure they actually worked, the iron fish were tested in several ways. First, they were subjected to a battery of tests to make sure that they didn't contain any heavy metal contaminants that could harm rather than help. Next, they were transported to my research lab in Canada where they were used to prepare several different types of soup and drinking water. The results were astounding – the iron fish could provide 75% of person's daily iron requirements by consuming just one litre of fortified soup or water each day.

Once I knew they were safe and at least theoretically effective, I needed to see if people would actually use them. Discoveries promising to save the developing world are made every day, but few actually succeed. Usually they are too expensive, often too complex technically, or sometimes they just aren't adopted at the community-level. The best public health intervention in the world is useless if people don't accept it.

Hundreds of women in several rural villages were recruited into a series of randomized controlled trials. Blood samples were taken over a year to see if the body was actually absorbing the iron that was being leached into the food. The hard work paid off and again the results were impressive: use of the fish led to a two-fold reduction in the prevalence of anemia, and over 90% of families who were given a fish used it every day.

The anecdotal evidence was perhaps even more inspiring. Over the months of working in the villages I constantly had women come up to me and tell how much better they felt after using the iron fish. Their headaches were gone, they didn't get dizzy, they had more energy, and they were sleeping better. It was as if I was reading a (now very familiar) medical text with a list of symptoms of anemia and ticking off each and every one. The fish were truly a success.

Today, the iron fish are being produced at a mass scale. The Lucky Iron Fish Project is now a social venture that employs a team of Cambodian representatives that travel village-by-village spreading the word. With production costs less than US$1, the fish can be produced, packaged and sold for a nominal cost to the hundreds of thousands of families across Cambodia that suffer from iron deficiency anemia.

The main lesson that I took away from my years spent trying to improve nutrition in Cambodia is that you can have the best public health solution in the world, but if people don't buy into it, don't use it, don't remember it, you have nothing. Simple innovations save lives, and the Lucky Iron Fish provides a very simple solution to a complex public health problem.