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**HEADLINE:** Got Toxic Milk?

**BYLINE:** By Lawrence M. Wein.

Lawrence M. Wein is a professor of management science at Stanford Business School.

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**BODY:**

WHILE the anthrax scare at Washington post offices this year proved to be a false alarm, it was a reminder of how vulnerable Americans are to biological terrorism. In general, two threats are viewed as the most dangerous: anthrax, which is as durable as it is deadly, and smallpox, which is transmitted very easily and kills 30 percent of its victims.

But there is a third possibility that, while it seems far more mundane, could be just as deadly: terrorists spreading a toxin that causes botulism throughout the nation's milk supply.

Why milk? In addition to its symbolic value as a target -- a glass of milk is an icon of purity and healthfulness -- Americans drink more than 6 billion gallons of it a year. And because it is stored in large quantities at centralized processing plants and then shipped across country for rapid consumption, it is a uniquely valuable medium for a bioterrorist.

For the last year, a graduate student, Yifan Liu, and I have been studying how such an attack might play out, and here is the situation we consider most likely: a terrorist, using a 28-page manual called "Preparation of Botulism Toxin" that has been published on several jihadist Web sites and buying toxin from an overseas black-market laboratory, fills a one-gallon jug with a sludgy substance containing a few grams of botulin. He then sneaks onto a dairy farm and pours its contents into an unlocked milk tank, or he dumps it into the tank on a milk truck while the driver is eating breakfast at a truck stop.

This tainted milk is eventually piped into a raw-milk silo at a dairy-processing factory, where it is thoroughly mixed with other milk. Because milk continually flows in and out of silos, approximately 100,000 gallons of contaminated milk go through the silo before it is emptied and cleaned (the factories are required to do this only every 72 hours). While the majority of the toxin is rendered harmless by heat pasteurization, some will survive. These 100,000 gallons of milk are put in cartons and trucked to

distributors and retailers, and they eventually wind up in refrigerators across the country, where they are consumed by hundreds of thousands of unsuspecting people.

It might seem hard to believe that just a few grams of toxin, much of it inactivated by pasteurization, could harm so many people. But that, in the eye of the terrorists, is the beauty of botulism: just one one-millionth of a gram may be enough to poison and eventually kill an adult. It is likely that more than half the people who drink the contaminated milk would succumb.

The other worrisome factor is that it takes a while for botulism to take effect: usually there are no symptoms for 48 hours. So, based on studies of consumption, even if such an attack were promptly detected and the government warned us to stop drinking milk within 24 hours of the first reports of poisonings, it is likely that a third of the tainted milk would have been consumed. Worse, children would be hit hardest: they drink significantly more milk on average than adults, less of the toxin would be needed to poison them and they drink milk sooner after its release from dairy processors because it is shipped directly to schools.

And what will happen to the victims? First they will experience gastrointestinal pain, which is followed by neurological symptoms. They will have difficulty seeing, speaking and walking as paralysis sets in. Most of those who reach a hospital and get antitoxins and ventilators to aid breathing would recover, albeit after months of intensive and expensive treatment. But our hospitals simply don't have enough antitoxins and ventilators to deal with such a widespread attack, and it seems likely that up to half of those poisoned would die.

As scary as this possibility is, we have actually been conservative in some of our assumptions. The concentration of toxin in the terrorists' initial gallon is based on 1980's technology and it's possible they could mix up a more potent brew; there are silos up to four times as large as the one we based our model on, and some feed into several different processing lines that would contaminate more milk; and the assumption that the nationwide alarm could go out within 24 hours of the first reported symptoms is very optimistic (two major salmonella outbreaks in the dairy industry, in 1985 and 1994, went undetected for weeks and sickened 200,000 people).

What can we do to avoid such a horror? First, we must invest in prevention. The Food and Drug Administration has some guidelines -- tanks and trucks holding milk are supposed to have locks, two people are supposed to be present when milk is transferred -- but they are voluntary. Let's face it: in the hands of a terrorist, a dairy is just as dangerous as a chemical factory or nuclear plant, and voluntary guidelines are not commensurate with the severity of the threat. We need strict laws -- or at least more stringent rules similar to those set by the International Organization for Standardization in Geneva and used in many countries -- to ensure that our milk supply is vigilantly guarded, from cow to consumer.

Second, the dairy industry should improve pasteurization so that it is far more potent at eliminating toxins. Finally, and most important, tanks should be tested for toxins as milk trucks line up to unload into the silo. The trucks have to stop to be tested for antibiotic residue at this point anyway, and there is a test that can detect all four types of toxin associated with human botulism that takes less than 15 minutes. Yes, to perform the test four times, once for each toxin, on each truck would cost several cents per gallon. But in the end it comes down to a simple question: isn't the elimination of this terrifying threat worth a 1 percent increase in the cost of a carton of milk?

One other concern: although milk may be the obvious target, it is by no means the only food product capable of generating tens of thousands of deaths. The government needs to persuade other food-processing industries -- soft drinks, fruit juices, vegetable juices, processed-tomato products -- to study the potential impact of a deliberate botulin release in their supply chains and take steps to prevent and mitigate such an event.

Americans are blessed with perhaps the most efficient food distribution network in history, but we must ensure that the system that makes it so easy to cook a good dinner doesn't also make it easy for terrorists to kill us in our homes.

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