Vermont Veterinary Medical Association

Report to the Legislature Regarding Unpasteurized Dairy Products: S70

April 10, 2014

My name is Eileen Wolfe and I am a dairy veterinarian from the Brownington, VT. I have been in practice as a federally accredited veterinarian for 33 years and have been in the Northeast Kingdom for 29 of those years. As a practicing veterinarian, I have taken an oath not only to "use my scientific knowledge and skills for the benefit of society through the protection of animal health and welfare [and] the prevention and relief of animal suffering" but also for "the promotion of public health, and the advancement of medical knowledge." The issue of unpasteurized (raw) milk is an issue that we veterinarians have intimate knowledge about through our daily lives as animal health specialists and production medicine consultants on farms. It is also a public health issue about which we have a responsibility to inform all potential consumers so that they may make choices regarding raw milk that are appropriate for them and all members of their families.

In 1938, before the implementation of the Pasteurized Milk Ordinance, milk and dairy products accounted for 25% of all food or waterborne disease outbreaks. As of 2011, that number had dropped to <1% of reported outbreaks *(1)*. The landscape regarding dairy consumption is changing, however. The Pasteurized Milk Ordinance regulates only milk which moves interstate, as federal regulations prohibit the transportation of raw milk and raw milk products across state lines. Raw milk can, nevertheless, be legally sold within a state if that state chooses to allow such sales. As of late 2013, 17 states ban the sale of raw milk. Eleven states allow retail sales of raw milk, 18 allow on-farm sales, and eight permit sales through "cow shares *(2)*."

With this increase in availability of raw milk to consumers could potentially come an increased risk. While milk is an amazing nutrient containing complete protein, fats, carbohydrates, vitamins, and substantial levels of calcium and phosphorus, it is produced from living creatures under real-life conditions. That same nutrient-dense composition provides an excellent growth medium for bacteria. Milk produced by healthy mammary glands of any species will be bacteria-free, but that milk can readily become contaminated in the environment, potentially as immediately as by bacteria on the teat end of the cow. Milking equipment, milk storage vessels, water, air, feed, bedding, soil, and manure are all potential sources of contamination for milk. If milk is not immediately cooled to the proper temperature or not stored at the appropriate temperature, bacterial growth can soar. The bacteria

most likely to contaminate raw milk include several that can have very serious health consequences for people, especially children, pregnant women, the elderly, and anyone with a compromised immune system. These bacteria include E. coli O157: H7, Campylobacter, and Salmonella among others, all of which can have health effects ranging well beyond simple stomach upsets. I refer you to the attached story of a recent outbreak of E. coli in Oregon which had serious consequences for two families with young children and devastating consequences for one toddler *(3)*.

It's important to note that animals can carry and shed these bacteria while remaining healthy and appearing perfectly normal. Thus, meeting your producer, seeing the animals, and touring the farm is no guarantee that the raw milk produced there will be free of pathogens. There is, in fact, a very good chance that raw milk can contain pathogenic disease-causing bacteria. In 2013, a dairy in PA that was licensed to sell raw milk and which not only complied with state requirements for somatic cell and bacterial coliform testing (both indicators of on-farm milk quality) but performed those tests even more often than required was confirmed to be the source of a Campylobacter outbreak. This was the not the first time this dairy had been the source of Campylobacter. In 2012, it was identified as the source of a multistate outbreak sickening 148 people.

A study released last year by the Centers for Disease Control (CDC) found that, in 121 dairy product-associated disease outbreaks between 1993 and 2006 (and this is actually as recent as it gets in terms of large-scale reviews) "non-pasteurized products caused a disproportionate number of outbreaks and outbreak-associated illness and also disproportionately affected persons <20 years of age." I'd like to talk about the numbers in this paper by using an example that I hope will let us all make more sense of what is important. This example is on-farm injuries caused by cattle.

If we were to take a person who was utterly unfamiliar with cattle, for example a fortunate extraterrestrial who suddenly appeared on earth, and presented to them some information about cattle injuries on farms, they might draw some interesting conclusions. A study that looked at injuries occurring in four Midwestern states between 2003 and 2008 found that 21 fatalities were caused by cattle *(4)*. Ten were caused by bulls, while six were caused by cows, and five were caused by groups of animals, likely majority cows. Thus, close to equal numbers of fatalities were caused by bulls and cows in this study, which might lead our extraterrestrial to conclude that bulls and cows are equally dangerous.

If we then told him about a New York study *(5)* that looked at injuries that occurred on farms between 1991 and 1996 and found that 25% of those injuries were caused by bulls and 75% were caused by cows, he might conclude that, in New York, cows are three times more dangerous than bulls (Figure 1).

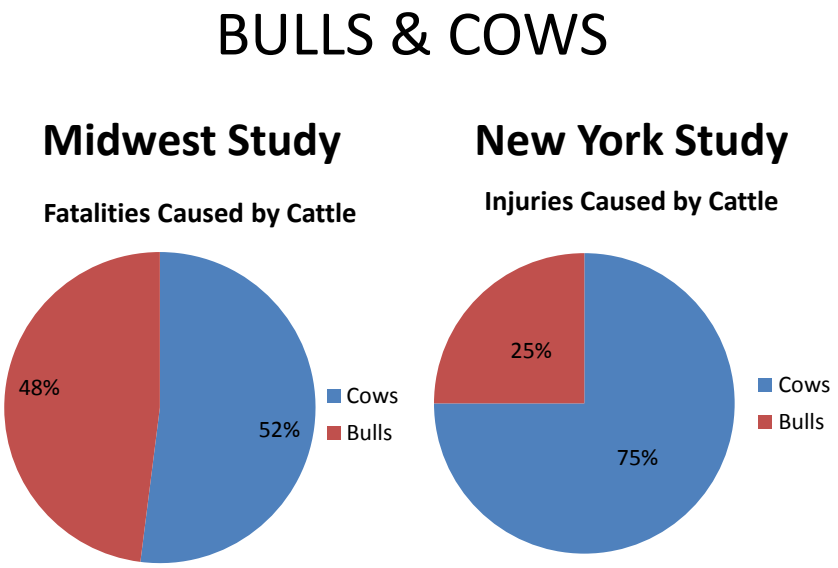

Figure 1

But our extraterrestrial friend is lacking an important piece of knowledge that most us probably know: there are many, many more cows on farms than there are bulls. Temple Grandin *(6)*, a very well-known livestock expert, states that cows comprise 98% of the cattle population in the US while bulls comprise 2%.

With that piece of information, we can show our extraterrestrial friend that the 25% rate of injury seen in NY was caused by only 2% of the animal population (Figure 2), and the 50% fatality rate seen in the Midwest was, even more frighteningly, caused by only 2% of the animal population (Figure 3).

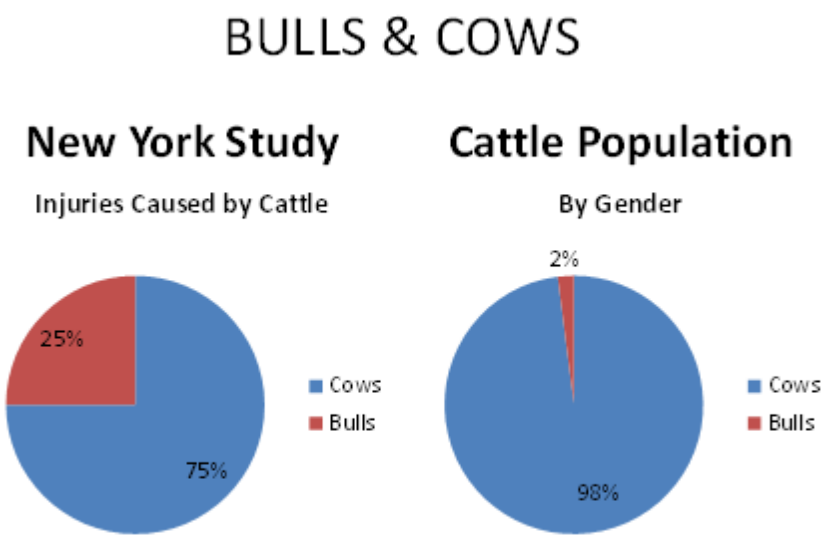

Figure 2

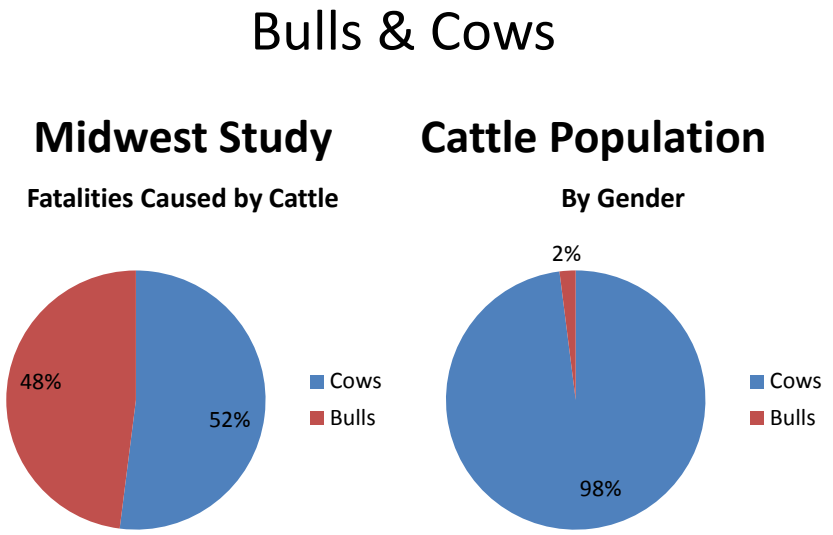

Figure 3

A 2009 study looked at cattle injuries even more closely by taking into account not only the number of bulls vs. cows on a farm, but also the numbers of working hours a farmer was exposed to each. This study reviewed 12000 injury reports in the US and abroad between 1987 and 2008 concluded that "the risk of injury associated with hours of exposure to bulls is higher than that of working around cows *(6)*." The important fact of knowing how few bulls are on farms compared to cows and how much less time

farmers spend working with them makes all the difference in understanding the injury and fatality numbers.

Now, let me return to the CDC paper on nonpasteurized disease outbreaks *(7)*. This study looked at 121 disease outbreaks following consumption of dairy products, with 48 outbreaks involving pasteurized dairy products and 73 involving nonpasteurized dairy products. A number plucked out by many raw milk advocates is the number of individual illnesses: 2890 people sickened from pasteurized milk and 1571 sickened by raw milk. Proponents of raw milk make much of the fact that nearly twice as many people became sick from pasteurized milk, which the numbers clearly show. But let's think back to those bulls and what part they represented in the entire population. Then let's look at this situation in the same light. There are about 314 million people in the United States, and let's assume that they all drink milk and consume dairy products (because we can all agree that they should). Large scale surveys have consistently showed that the percentage of Americans who consume unpasteurized dairy products hovers around 1-1.5%, in some instances under 1%, in some instances up to 3 %*(8, 9, 10, 11)*. For the sake of argument, we'll say that 2% of consumers in the US are consuming unpasteurized dairy products. 2% of 314 million is 6 million, leaving the other 98%, or 308 million, consuming pasteurized dairy products. Again rounding numbers for ease, we can see that we have 50 times as many people consuming pasteurized dairy products as raw products (Figure 4).

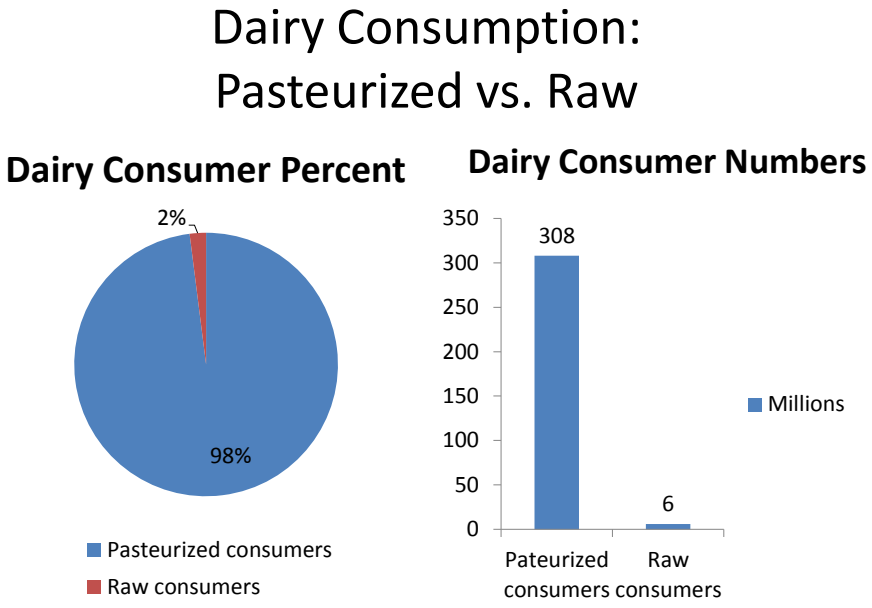

Figure 4

If these products have equal potential to cause disease, we should have 50 times as many people becoming sick from pasteurized products. Instead, we have not quite twice as many, as seen in the chart on the left, "Number of Illnesses," in Figure 5. The chart on the right, "Pasteurized: Raw Ratios," displays the disparity, with the bar on the left showing the rate at which consumers of pasteurized dairy products outnumber consumers of raw dairy products: 50 times as many. The bar on the right shows the rate at which, in this CDC study, consumers of pasteurized dairy products were made ill compared to consumers of raw products: not quite twice as many.

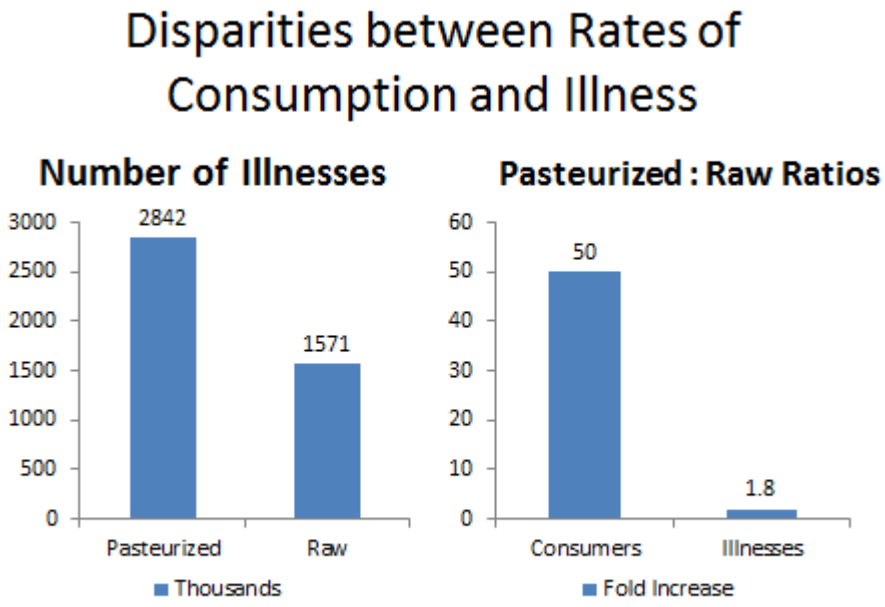

Figure 5

If we turn the equation on its head and look from the opposite perspective, we could say that if about 1500 people become ill after consuming nonpasteurized products, and there were 50 times as many people consuming pasteurized products, it would follow that if pasteurized products are equally disease-inducing, then 50x1500 illnesses, or 78,550 illnesses, would result from pasteurized products. In fact, less than 3000 illnesses did occur. Both of these scenarios might indicate that, in fact, raw dairy products are 25 times as likely to sicken the consumer as are pasteurized products. The truth is even worse, as we will see.

In addition to looking at individual illnesses, this study looked at several other measures of disease. Number of outbreaks was higher for nonpasteurized products (73 outbreaks or 60%) than for pasteurized products (48 outbreaks or 40%). In light of the number of consumers for each type of product, these numbers take on additional significance (Figure 6).

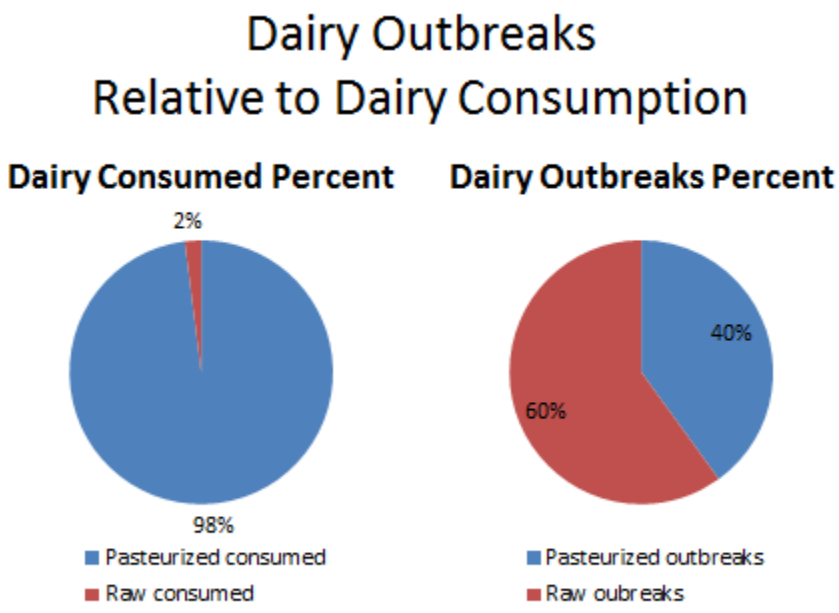

Figure 6

The CDC also considered the actual pounds of dairy products consumed in the US during the relevant time period and then calculated the number of pounds consumed raw (1% of total) and number of pounds consumed pasteurized (99% of total). Looked at in these realistic terms, unpasteurized dairy products were seen to be 150 times more likely to cause disease than pasteurized products. This is significantly more troublesome than the 25 fold risk discussed previously that is seen when looking simply at number of consumers exposed to products (Figure 7).

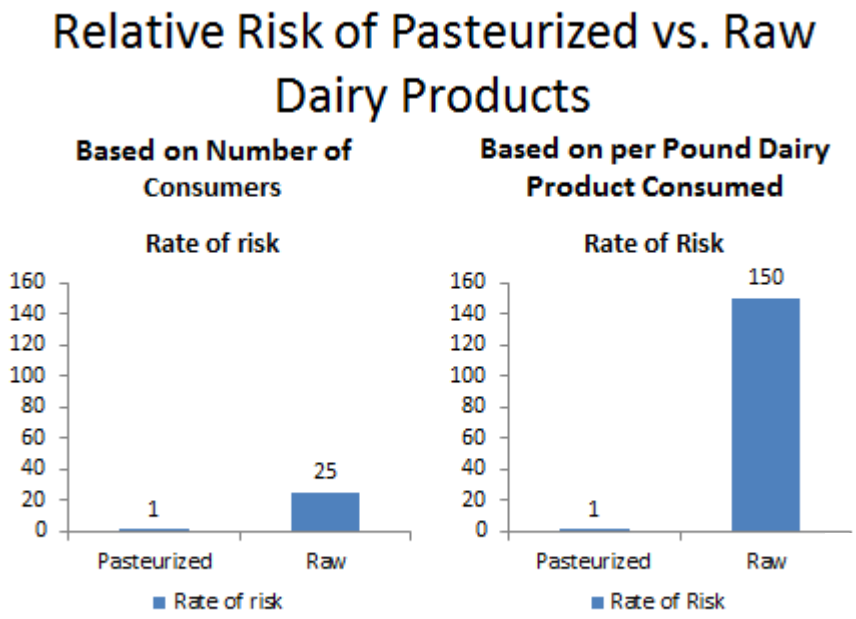

Figure 7

Moreover, looking simply at the numbers of people sickened in this study, the rate of serious illness (measured by rate of hospitalization) was 13% for nonpasteurized products, with 202 of the 1571 people hospitalized versus 37 of the 2890 or 1% for pasteurized products. Thus there was a 13 fold higher rate of serious illness seen in consumers of raw dairy products). Again, considering that 50 times as many people consume pasteurized dairy products as raw products, this is a striking difference in rate of serious illness (Figure 8).

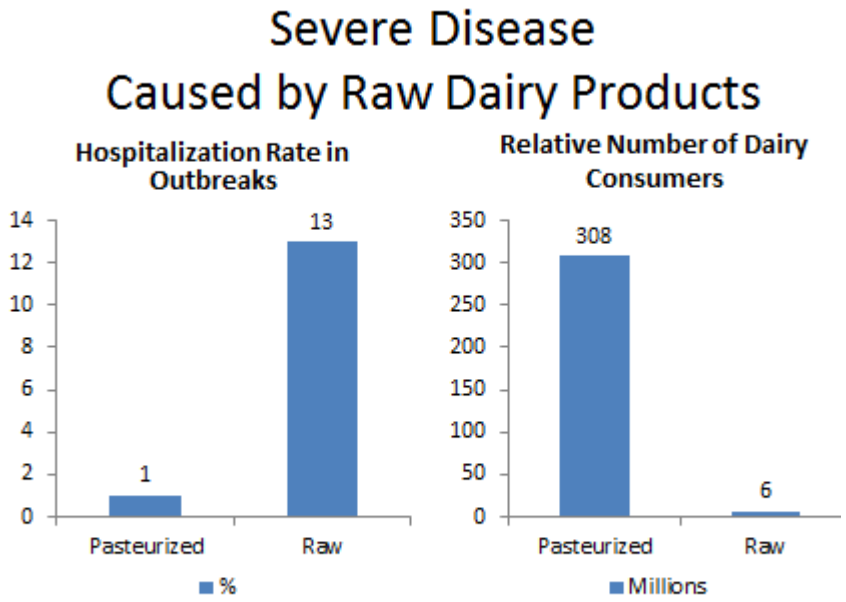

Figure 8

The difference in degree of illness is most likely due to the fact that the outbreaks caused by pasteurized milk were mainly caused by viruses that originate from people, such as the infamous norovirus, cause of cruise ship sickness. Many of these outbreaks could be traced to contaminated food handlers. Conversely, outbreaks from raw dairy products tended to be caused by bacteria with known animal reservoirs, including E. coli O157:H7. This bacterium can cause kidney failure (hemolytic uremic syndrome) and even death, especially in children. It and other bacteria originating from cows (sheep and goats) can be eliminated by pasteurization.

Additionally, the people sickened by the raw dairy products were disproportionately young people under 20 years of age, a very vulnerable group. 60% of cases in the raw milk group were young people, while only 23% of cases in the pasteurized milk group fell in this age range. Protection of the health of the young, who may not be able to give informed consent to the consumption of potentially quite dangerous raw dairy products, is a very important issue.

The CDC points out in conclusion that states that allow the sale of raw milk have twice the rate of disease outbreaks due to raw milk and six times the rate of disease outbreaks due to raw cheese (Figure 9).

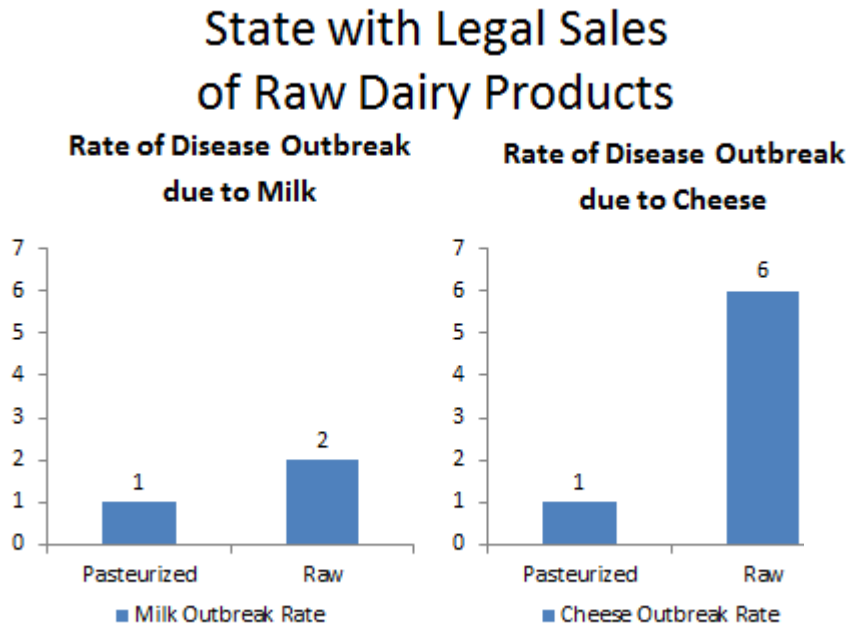

Figure 9

As alarming as this information is, it does not even tell the entire story. Many foodborne illnesses occur as isolated instances rather than as part of outbreaks. Minnesota recently concluded a study *(12)* that looked at diarrheal diseases reported to the state Department of Health between 2001 and 2010 and found that there were 25 times as many sporadic cases of illness (530) related to raw milk consumption as there were illnesses suffered as part of outbreaks (21). In this study as well, children were disproportionately affected. It is notable in particular that the severe cases of E. coli were overrepresented in young children five years and younger with half of the E. coli illnesses occurring in this group. 21% of the children developed hemolytic uremic syndrome, a potentially fatal acute kidney failure. One 11 month old toddler died. Study authors estimated that, due to underreporting of illness, it is likely that up to 17% of raw milk consumers in Minnesota may have become ill with diarrheal disease due to the same raw milk-associated pathogens during the study period.

All these facts and figures are very relevant for Vermont as legislation is considered to widen sales venues for raw milk. Offering milk at farmers' markets and/or allowing for home delivery have intrinsic dangers relative to storage and transportation because of several factors. First, essentially all milk is contaminated, to greater or lesser degrees, on the farm level. This is why creameries regularly run two separate quality tests on bulk tank samples from farms: the Standard Plate Count (SPC) and the Preliminary Incubation Count (PIC) both serve as indicators of sanitary conditions on the farm. Even on the most pristine dairies, these counts are never zero.

Second, between the producer's drive to the delivery point, any stand time, and the consumers' drive home, there is the potential for bacterial growth. Unless all transports, including the consumers' drive home, are made under refrigeration, temperature can quickly become a problem. Data from the National Highway Traffic Safety Administration (NHTSA) indicate that the temperature in a closed car can well exceed that of the outside. When the outside temperature is 83^{o}, the temperature of a car with the windows rolled down 2 inches can climb to 109^{o} in only 15 minutes. Even cool days can be hazardous, as the NHTSA states "Even outside temperatures in the 60s can cause a car temperature to rise well above 110^{o}F. *(13)*"

Third, scientists have long known that the generation time, or the time it takes for a bacterial population to double in any growth medium, is heavily influenced by temperature. As early as 1956, published results showed that bacterial population doubling could occur as quickly as 16 minutes for E. coli at optimal temperatures and, while taking longer for Salmonella, could still occur in 50 minutes. For both these and many other food-borne pathogenic bacteria, the optimal temperatures occurred between 41 and 113^{o}F.

Putting all these facts together gives us a nutrient-dense product that is extremely likely to be contaminated with bacteria. These bacteria have the potential to be serious disease-causing pathogens. This product is a perfect growth medium for these bacteria. We now offer the perfect growth conditions: some warmth. Under proper conditions, which are not very hard to achieve with raw milk, one E. coli bacterium can become 1 billion E. coli bacteria after 12 hours. This is a more than sufficient dose to cause disease. The entire scenario holds true for other milkborne pathogens. A study in Italy which looked specifically at the relationship between consumption of raw milk and infection with Camplyobacter or E. coli concluded that "The raw milk food chain should enforce transport and storage at temperatures of 0 to 4^{o}C [32 to 39^{o}F] to prevent microbial growth and reduce the pathogen levels. As clearly shown by our results, failure to maintain the cold chain carries significant implications for the risk of E. coli O157:H7 infection and HUS [hemolytic uremic syndrome]. When farmers did not maintain correct temperatures throughout the supply chain and when thermal abuse during home transportation and storage were reported, the annual expected cases of infection were higher *(14)*."

What about Vermont? The following information has been tracked by the VT Department of Health *(15)*. In the last 10 years there have been several outbreaks of illnesses associated with the consumption of raw milk. In the vast majority of cases, the causative organism has been the bacteria Campylobacter. These outbreaks include 3 which occurred during 2010 and which involved at least 21 people, over half of which were children. One child experienced fever-induced seizures due to the bacteria and had to be taken to the Emergency Room. Prior outbreaks included an E. coli outbreak in 2008 as well as 8 additional outbreaks of Campylobacter that occurred between 1982 and 2007. Again, these are bacteria with animal reservoirs: contamination very likely occurs in the dairy environment and will be eliminated in milk that has been properly pasteurized. With increased consumption of raw dairy products comes increased risk. I'd like to quote Senator David Zuckerman, Vice Chair of the Vermont Senate Agriculture Committee. Speaking recently on Vermont Public Radio's Vermont Edition on a show about Genetically Modified Organisms, Senator Zuckerman said, "There are scientific studies - there's no broad consensus at this point, clearly, but there are studies showing human health and potential environmental risks from this product and people ought to have the right to make this choice if they want to be that guinea pig or not." *(16)* His comment is quite applicable to the issue of raw milk except that here, there is a very clear and broad consensus that the risks of unpasteurized dairy products are real and significant: at least 18 health and safety bodies have issued policy statements urging the consumption of only pasteurized dairy products, particularly for young children, for whom informed choice is essentially impossible *(17)*.

Another health issue potentially related to raw milk that should be considered in Vermont is rabies. While transmission of rabies in milk has never been proven, such a scenario is impossible to disprove. Rabies is on the rise in Vermont and is likely to remain so as the virulent raccoon strain of the virus is now becoming established in our region. Because the clinical signs of rabies in cows are nonspecific and are very similar to the signs of other neurological diseases, the diagnosis of rabies in a cow can be challenging, and shedding of the virus into milk could occur. There have been instances, including in Vermont, where significant numbers of people have been advised to undergo post-exposure treatment for rabies after potential exposure through raw milk *(18)*. Considering the 100% case fatality rate of rabies, this is mental anguish clearly best avoided – something that pasteurization of milk will achieve.

What about benefits of raw milk? The majority of reports regarding these benefits are anecdotal and involve people who have made a number of lifestyle changes, often including more than one dietary change, and who believe they have seen health benefits. Whether such benefits can actually be ascribed to raw milk is not crystal clear. There have been claims made that raw milk is beneficial in eliminating milk allergy. Milk allergies, when present, are allergies to milk proteins. Milk processing (whether pasteurization or homogenization) has the potential to either increase or decrease allergic response depending on the milk protein involved, the protein's response to the process, and the individual patient*(19)*. Lactose intolerance, which is much more common (and totally different from milk allergy), is another issue that has been discussed with regard to raw milk. Lactose is a sugar contained in milk, and it is digested in the consumer's gut by an enzyme called lactase. Those who lack that enzyme (either due to genetics or due to an age-related decline) are lactose intolerant, and they suffer stomach and gut discomfort after consuming many dairy products. However, the pasteurization of milk does not affect the lactose content of milk, and neither raw nor pasteurized milk contains the enzyme lactase *(19)*. Milk does normally contain lactic acid bacteria, which can generate lactase, and these lactic acid bacteria are killed by pasteurization; however, lactic acid bacteria are unable to grow or make lactase at refrigeration temperatures. If milk is left unrefrigerated, the growth of these bacteria causes rapid spoilage of milk, so there is no way to benefit from the lactase without losing the milk itself *(19)*. With regard to nutrients in milk, certain vitamins (especially Vitamin B1 – thiamin, and Vitamin C) are heat sensitive and are negatively impacted by pasteurization: however, the level of these vitamins in raw milk is so low that one would need to drink over 5 gallons/day to get one's recommended daily allowance. By contrast, the vitamins and minerals that milk provides at high percentages of recommended intakes (e.g. vitamin B12, calcium and phosphorus) are essentially unaffected by pasteurization, as are the major nutrients of milk, its protein and fat content *(19)*.

While nutritional benefits of raw milk are modest or equivocal, the evidence of the potential health risk from raw milk is much more apparent. While raw milk has been consumed without ill effect on many occasions by many people, what is worth thoughtful consideration is that the potential for serious illness exists with the consumption of raw milk and associated products. Moreover, this probability exists at a considerably greater degree than for pasteurized dairy products, and when such sickness strikes, it disproportionately affects young people who may be most susceptible. Young children under five are particularly vulnerable, and these are consumers who really aren't able to make an informed choice. All these factors incline the vast majority of health officials to agree with the Vermont Veterinary Medical Association's policy statement: "Only pasteurized milk and pasteurized fresh milk products should be sold for human consumption. Putative benefits of raw milk consumption on human health are either unsupported by scientific evidence, or cannot be separated from the potential hazards associated with raw milk consumption. Therefore, consumption of raw milk cannot be recommended as a preventive or protective human health measure."

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