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# ASYMMETRY IN RAW MILK SAFETY PERCEPTIONS AND INFORMATION: IMPLICATIONS FOR RISK IN FRESH PRODUCE MARKETING AND POLICY

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## **Asymmetry in Raw Milk Safety Perceptions and Information: Implications for Risk in Fresh Produce Marketing and Policy**

Ronald D. Knutson, Russell W. Currier, Luis Ribera, and Paul Goeringer

**Abstract:** Scientific evidence clearly indicates that consumption of raw milk carries substantial disease-inducing health risks. While federal U.S. policy mandates that milk moving in interstate commerce be pasteurized; within 41 of 50 states, raw milk can be obtained for consumption. Warning labels notwithstanding, a segment of U.S. consumers pays higher prices for higher-risk raw milk than for either organic or conventional milk. The behavioral factors leading to raw milk consumption are explored. The paternalistic regulatory options for reducing the risk associated with drinking raw milk are identified. Implications for fresh produce sold directly from farms to consumers or through farmers markets are drawn.

**Keywords:** raw milk, pasteurization, health risks, behavioral economics, bounded rationality, paternalistic regulations, public health, HACCP, GLOBALG.A.P.

**JEL codes:** A12, A13, A14, D11, D18, D46, D71, D78, D82, I18, K23, K32, Q11, Q18.

### **Introduction and Background**

One of the most controversial issues involving foodborne illness involves the risks associated with consumption of raw milk. Related issues of importance include fresh produce and meat as sources of disease exposure and foodborne illness. While publically reported production and consumption data are not available; the prevalence in terms of the number of producers, consumers, and the percent of products marketed appear to be small. The most recent CDC FoodNet population survey of consumption patterns in nine states indicates that in 2002-03, an average of 3.5 percent of the respondents consumed raw milk in the past seven days. The range was from 2.8 percent in California to 3.9 percent in Georgia. Interestingly, while raw milk sales at retail are legal in California, they are illegal in Georgia. One explanation for the difference could be higher consumption by farm families, particularly by low income farm families. In Washington State, where retail raw milk sales are legal and were found by the authors to be readily available for purchase from consumer cooperatives, farmer markets, and drop-off points, indications are that raw milk sales are less than 1 percent of total milk sales to consumers

(Survey, 2010).<sup>1</sup> While raw milk sales are small, their impact on incidence of food poisoning and the related consequences is substantial as will be discussed subsequently in greater detail (LeJeune and Rajala-Schultz, 2009).

Sales of raw milk have been promoted as “real milk” by the Weston A. Price Foundation (2010), hereinafter referred to as the Price Foundation. A centerpiece for this promotional activity is the internet site titled, “Where I Can Find Real Milk.” In addition to providing comprehensive state-by-state sources of raw milk, this site explains the alleged health-promoting and disease-preventing virtues of raw milk consumption as advocated by this organization. These raw milk proponents also emphasize dairy breeds, such as Jersey, Guernsey, and Brown Swiss, that typically produces less milk per cow but have higher content of solids and butterfat. Their emphasis in terms of animal husbandry is on pasture-fed forages and organic production. However, the promotional emphasis is on the health-promoting benefits of consuming raw, unpasteurized milk coupled with its superior flavor over processed milk products.

While the U.S. Department of Agriculture (USDA) maintains standards for labeling agricultural products as being “organic,” most milk labeled as organic is not sold as raw milk. It is unclear as to how much of the milk sold as raw milk is certified as meeting USDA’s organic standards. Therefore, the emphasis is on production (often pasture grazing) with no further processing, thus implying these dairy products are of superior quality.

Neoclassical economic theory holds that consumption decisions are founded on three assumptions, which are the basis for rational choices theory (Weintraub): 1. Consumers have rational preferences to which they can assign value/utility. 2. Consumers maximize utility/satisfaction. 3. Consumers act independently on the basis of full and relevant information. Are the consumers of raw milk irrational, or are they rational in terms of the information they have available to them? What are the behavior factors that lead consumers to drink raw milk? What paternalistic policy options can be pursued that will reduce the potential for harm given the fact that in today’s society, raw milk consumption is likely to continue and perhaps expand with

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<sup>1</sup> As stated in interview with Claudia G. Coles, Food Safety Program Manager, Washington State Department of Agriculture, April 22, 2010.

disease consequences that may actually be more adverse than in the past? Do the higher costs and ever-increasing consumer expenditures on direct farmer marketed food products present an implication of superior products, prompting motivations to purchase these products despite the higher risks compared to supermarket purchases that must comply with higher private sector standards such as GLOBALG.A.P.? These are the questions addressed in this paper.

In our initial effort to define the scope of raw milk sales and the related policies, we compiled and analyzed the results of two surveys. The first is a survey of the laws/regulations in the 50 United States. Second, the government officials responsible for raw milk regulation in the four U.S. western states of California, Oregon, Utah, and Washington State were interviewed. The officials were from each state's Department of Public Health (SDPH) and from each state's Department of Agriculture (SDA).<sup>2</sup> The SDPH officials interviewed had investigatory responsibilities for any reported foodborne or milk-borne illness incidents including raw milk episodes. The SDA official interviewed had primary regulatory responsibilities, including the promulgation of regulations consistent with the state's statutory standards. These regulations included the licensing of dairies selling raw milk and establishing standards of operation.

These surveys were designed to provide insight into: (1) the conditions that lead to the enactment of laws/regulations that appear to be asymmetrically inconsistent with general standards for food safety; (2) the price premiums that consumers of raw milk are willing to pay for these higher risk products; and (3) the implications for other fresh agricultural product situations that may involve similarly high levels of consumer risks.

### **Science of Raw Milk Safety**

LeJeune and Rajala-Schultz (2009, 95-6) note that while the demand for raw milk has increased markedly in recent years, the potentially adverse consequences of raw milk consumption are indisputable. They note that, while some of the increase in outbreaks, may be the result of improved detection and reporting, "...disease associated with the consumption of raw milk is still an important public health concern in the United States." They found that, while

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<sup>2</sup> The decision to strive to separate the interviews was based on the premise that the responses to questions regarding raw milk risks could be biased by the presence of a government official having joint albeit differing regulatory responsibilities. In Oregon, the goal on separate interviews was not achieved.

very young, aged, sick, or immunocompromized consumers are most adversely affected, healthy young adults can also be affected.

According to LeJeune and Rajala-Schultz, the origins of potentially harmful microorganisms in raw milk lie in both the milk as it is excreted and in subsequent contamination during the time of collection, processing, distribution, and storage. While good animal health and hygienic conditions on the farm are essential for reducing microbiological hazards, complete control of these hazards may be impossible to achieve. In drawing this conclusion, they point out that the transmission pathways for microbiological hazards are incompletely known, that complete control is cost inefficient, and that sufficiently sensitive diagnostic tests are not available. Therefore, "...pasteurization has become the cornerstone for milk safety." (p. 95)

Oliver et al. (2009) reviewed nearly 100 studies of the prevalence of foodborne pathogens in raw milk. He found *Campylobacter jejuni*, Shiga toxin-producing *Escherichia coli* (STEC), *Listeria monocytogenes*, *Salmonella*, and *Yersinia enterocolitica* were the primary public health and food safety issues associated with consumption of raw milk. His comprehensive literature review indicated that seven studies found *Campylobacter jejuni* in the range of 0.4 to 12.3 percent; three studies found Shiga toxin-producing *Escherichia Coli* (STEC) in the range of 0.9 to 3.8 percent; 13 studies found *Listeria monocytogenes* in the range of 1.3 to 12.6 percent, and eight studies found *Salmonella* in the range of 0.2 to 8.9 percent. For example, Rohrbach et al. (1992) reported that of 292 bulk tank samples in Tennessee and Virginia, 12.3 percent contained *C. jejuni*, 8.9 percent *Salmonella*, 4.1 percent *L. monocytogenes*, and 15.1 percent *Yersinia enterocolitica*. One or more foodborne pathogens were found in 32.5 percent of the Rohrbach samples. Headrick et al. (2000) report on morbidity studies that complement and corroborate Oliver's work by documenting raw milk associated foodborne disease outbreaks reported in the United States during the period, 1973-1992.

Leedom (2006) provides an applied and thoughtful physician's statement on infectious diseases having their origin in raw milk. He served as the physician representative on the board of directors at California's Alta Dena Dairy's certified raw milk operation. Subsequent to his serving on Alta Dena's board of directors, this dairy discontinued raw milk production and distribution in 1999. Based on this experience and that of a noted physician he concludes, "Raw milk and raw milk products should be avoided, unless the consumer believes that the improved

taste of the product warrants the risk. Warning labels should appear on all raw milk and raw milk products that clearly spell out the possible dangers, so the consumer can make an informed choice: *caveat emptor*.”

With clear scientific evidence that consumption of raw milk, as well as other unpasteurized dairy products, carries substantial disease-inducing health risks, three questions become the focal point of this analysis:

- 1) Why is there a segment of the population that consumes raw milk, and what are its motivations?
- 2) Why is this population segment willing to pay a higher price for raw milk than for safer, pasteurized and homogenized organic milk<sup>3</sup> and conventionally produced, pasteurized, and homogenized milk<sup>4</sup>?
- 3) What public policy actions are available to reduce the risk associated with drinking raw milk?

### **Nature of the Asymmetries in Raw Milk**

#### **Asymmetry in Perceptions, Information, and Behavior**

Leedom, the physician representative of the one-time retailer of raw milk, was well aware of the high health risk associated with raw milk. Yet, he rightly perceived that a certain segment of the population would take that risk on the belief that it had a better taste. To the Raw-Milk-Facts (2010) proponents, it is more than better taste. They encourage the belief that raw milk not only is better for you but is also a cure or preventative for several otherwise troublesome, even deadly diseases.

Raw milk presented in this way becomes a consumer behavior issue that involves more than economics (Simon et al. 1992; Camerer, et al. 2002; Cramerer, Loewenstein, and Rabin 2004; Just et al. 2007; Just and Peterson 2010). Behavioral economics has expanded the standard economic approach of full rationality where people maximize well-defined goals and preferences

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<sup>3</sup> Hereinafter, pasteurized and homogenized organic milk is referred to as organic milk.

<sup>4</sup> Hereinafter, conventionally produced, pasteurized, and homogenized milk is referred to as conventional milk.

from perfect information that accurately reflect the costs and benefits of decisions. In reality, people make choices with limited information, are not fully aware of hazards, and are influenced by the behavior of others. By challenging these assumptions of full rationality and adopting the concepts of bounded rationality, economists are able to utilize these insights in better understanding contemporary consumer behavior utilizing the disciplines of psychology, social psychology, and sociology (Simon et al. 1992). This expanded problem-solving ability increased the potential for economists to contribute to policy development by involving additional disciplines such as law, medical sciences, and public health (Cramerer, 2002; Morgan et al. 2002, Oliver 2009).

Within the general sphere of behavioral economic thought and bounded rationality, potential raw milk consumers are immersed in misinformation, having the effect of compromising their skills of judgment to accurately weigh the costs and benefits of consuming raw milk. While our review of the literature is undoubtedly incomplete at this stage of our research, there has been substantial research that bears on the application of bounded rationality theory to risk as it relates to issues such as voluntary consumer behavior in alcohol abuse, sexual transmission of HIV, and in the consumption of drugs (Ariely 2009; Loewenstein 2004; Morgan et al. 2002. Morgan et al. (2002) attempted to capture the knowledge of medical and behavioral experts to develop complex systematic mental models to understand risk behavior as a means of improving the ability to communicate risk and to optimize evaluation of risks and ensure sound food and policy choices.

Just, Mancino, and Wansink (2007) identified psychological biases as traits that need to be considered in understanding consumer behavioral factors influencing consumption decisions. The following characteristics and psychological biases might be suggested as factors considered in influencing the behavior of the raw milk consumer subculture:

- 1) Notions of acceptance may have been determined early in life by persons who grew up on a farm or by their peer/reference group and family. Studies by Rohrbach et al. (1992) and by LeJeune and Rajala-Schultz (2009) indicate that 35-60 percent of the dairy farm families consume raw milk. It seems reasonable to anticipate that the practice and preference for consuming raw milk might be expected to carry over to individuals who relocate from dairy farming to cities and may even carry over to succeeding generations.



- 2) The size of the raw milk consuming subsector may be expanded by reference group influence. Bearden and Etzel (p. 184) define a reference group as a person or group of people who significantly influence an individual's behavior and offer that reference groups are important components of marketing strategies to influence product purchase decisions. Behavioral economists, Frank and Hutchens (1993), have found that while coworker interactions are important in influencing consumption versus saving decisions, friends, families, and neighbors are more influential reference groups. Without referring specifically to reference groups, Just et al. (2008) find that social situations, such as eating in groups, may influence food consumption decisions. Aside from family, friends, and neighbors, important reference groups influencing raw milk purchase decisions may include those who shop at grocery cooperatives, farmer markets, and promote and sustain raw milk buying clubs (drop-off points).
- 3) General mistrust of processed foods contributes to consumers' desire for more natural products, more fresh products, more flavor, and the expansion of direct farmer marketings. Concerns about processed food are reflected in surveys indicating that local foods are safer and provide certain health benefits compared with supermarket sources (Onozaka, Nurse, and Thilmany McFadden 2010). This mistrust extends to an erosion of trust in modern marketing systems in general (Ariely 2009) and extends to government as well and has reached an eight year low of 26 percent (Jones 2010). This lack of trust affects peoples' confidence in the of government's ability to regulate and solve problems. In the specific case of raw milk, the information-misinformation battle is being fought on the internet between two opposing forces.

The main raw milk advocates include the closely linked Weston A. Price Foundation as reflected in its "Real Milk Articles" (2010) and Jonsson's "Raw Milk Facts," both of which provide scientific studies and other proof with the concluding allegation that raw milk is as safe as pasteurized milk, is more nutritious, and has disease prevention and curative qualities.<sup>5</sup> Jay-Russell, a University of California-Davis food safety

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<sup>5</sup> One of the more interesting allegations of the raw milk advocates is that homogenization is a causal factor in heart disease (Enig 2003). As a result, both pasteurization and homogenization are considered to be issues of concern from the perspective of those advocating the consumption of raw milk.

veterinarian, presents the opposing view with the establishment of “a clearinghouse for evidence-based studies, presentations, commentaries, regulations, and position statements on raw milk. The content for this site was developed and reviewed by scientists and health educators in universities, government, industry, and professional organizations.”

States that allow the sale of raw milk have attempted to deal with the misinformation issue by requiring that warning labels be placed on containers of retail raw milk. While such labels differ in detail from state to state, the following California Code of Regulations required raw milk label is illustrative:

“WARNING

Raw (unpasteurized) milk and raw milk dairy products may contain disease-causing micro-organisms. Persons at risk of disease from these organisms include newborns and infants; the elderly; pregnant women; and those taking corticosteroids, antibiotics or antacids; and those having chronic illness or other conditions that weaken their immunity.”

Such warning labels on products that have been found to be inherently dangerous are probably useful and an essential from a public information perspective, but are they effective in influencing consumer behavior? Engs reviewed several studies of the effectiveness of warning labels and concluded that they found conflicting results and marginal effectiveness. Argo and Main (2004) analyzed the results of several studies of warning label effectiveness using a meta-analysis approach. They found that warning labels were not effective in influencing consumers’ perceptions of hazards and risks and that this lack of effectiveness was most likely in products purchased frequently, such as cigarettes. Raw milk would appear to fall into the same category. Argo and Main (2004) concluded that the critical issue in evaluating a warning label is that consumers understand the risks and that once risks are understood, the choice of behavior is ultimately up to them. They indicated that consumers’ judgment appeared to be the most difficult for warning labels to influence. Chang and Just (2007) concluded that while health information significantly influenced egg consumption, consumers unwittingly dismissed labeled messages in a few weeks, thus requiring a consistent stream of new or rephrased messages.

## **Asymmetry in Prices**

Not only is a subculture segment of the population willing to take the risk of consuming raw milk, but it is willing to pay a higher price to have access to raw milk. However, if well informed and based on health considerations alone, raw milk consumption appears to be irrational in the sense that a substantially higher price is being paid for a product associated with greater potential for disease transmission. Although not risky like raw milk, the same might be said for organic milk. Despite claims to the contrary (Gold 2010) and while there may be certain environmental benefits from organic production (Green et al. 2009); from the perspective of science, conventional milk is equally as safe and nutritious as pasteurized organic milk (Vicini et al. 2008; Cody and Earl 2009; McCullum-Gomez and Scott 2009). Yet organic milk carries a price premium that averages 78 percent in the major cities of three states surveyed (California, Utah, and Washington) and 103 percent in a larger sample of U.S. markets (Seattle, Portland, Kansas City, Denver, Dallas, and Boston). Raw milk sold at retail in the three survey states was selling at an average premium of 180 percent relative to conventional milk and 57 percent relative to organic milk.

Summary statistics on monthly organic and conventional milk prices for six major cities are shown in Table 1. Results indicate that organic and conventional milk prices were significantly different statistically at the 99 percent level. Price variability was higher on organic milk in four of the six markets as shown by the coefficient of variation, and both milk types had a strong positive correlation suggesting that they moved together in the same direction. Moreover, average price difference, i.e. organic minus conventional milk prices, ranged from \$1.81 in Boston to \$4.33 in Seattle. Boston also has the highest variance among all markets with a coefficient of variation of 33.7 and the minimum and maximum difference values ranging from \$0.83 to \$3.19, respectively. On the other hand, Portland has the lowest variability in milk price differences, CV of 6.96, with minimum and maximum values ranging from \$2.93 to \$4.06, respectively.

**Table 1. Summary statistics for monthly average organic and conventional retail milk prices and price difference by market, April 2008 to June 2010.**

	Seattle		Portland		Kansas City		Denver		Dallas		Boston	
	Organic (gallon)	Conventional (gallon)	Organic (gallon)	Conventional (gallon)	Organic (gallon)	Conventional (gallon)	Organic (gallon)	Conventional (gallon)	Organic (gallon)	Conventional (gallon)	Organic (gallon)	Conventional (gallon)
<b>Mean</b>	\$7.62 (a)	\$3.28 (b)	\$6.57 (a)	\$3.10 (b)	\$6.19 (a)	\$3.69 (b)	\$7.38 (a)	\$2.89 (b)	\$5.78 (a)	\$2.69 (b)	\$5.37 (a)	\$3.56 (b)
<b>StDev</b>	0.53	0.15	0.30	0.32	0.65	0.32	0.64	0.57	1.13	0.37	0.75	0.25
<b>CV</b>	7.01	4.52	4.52	10.46	10.46	8.68	8.68	19.59	19.59	13.84	14.06	7.02
<b>Corr</b>		0.36		0.70		0.80		0.67		0.89		0.69
<b>Difference (Organic - Conventional)</b>												
<b>Mean</b>		\$4.33		\$3.47		\$2.50		\$4.49		\$3.09		\$1.81
<b>StDev</b>		0.50		0.24		0.44		0.50		0.82		0.61
<b>CV</b>		11.53		6.96		17.46		11.06		26.55		33.71
<b>Min</b>		\$3.39		\$2.93		\$1.64		\$3.47		\$2.01		\$0.83
<b>Median</b>		\$4.52		\$3.47		\$2.41		\$4.50		\$3.15		\$1.55
<b>Max</b>		\$4.99		\$4.06		\$3.52		\$5.22		\$4.49		\$3.19

Source: Market survey.

Unfortunately, no comparable raw milk time series data have been collected. For three of the four markets studied, a one-time observation in April 2010 indicated that consumers paid a 57 percent price premium for raw milk over organic milk with a range from 27 percent in Utah to 75 percent in Seattle (Table 2).<sup>6</sup> Relative to conventional milk, comparable average price premiums were 180 percent for raw milk and 78 percent for organic milk.

One explanation for the willingness of consumers to pay higher prices for raw milk lies in Ariely's (2009, 26-53) anchor pricing theory. The anchor price is a reference price or reference transaction price that influences what people might be willing to pay for a product in the same general category. Kahneman et al. (2004) utilize this concept as a precedent for evaluating the fairness of prices in future transactions. For the majority of milk consumers, the anchor or reference transaction price would likely be the price of conventional milk. The conventional milk price then could be used to evaluate or judge the fairness of the higher price of milk paid for organic milk in terms of the extra utility or satisfaction they receive from organic milk purchased at the supermarket.

Using the reference pricing theory of Ariely and Kahneman et al. and our survey of three markets, consumers preferring the organic product were willing to pay 78 percent prices based on their beliefs that it was a better product, for whatever reason and despite the findings of science. For the raw milk consumer, the reference price may reasonably be expected to be organic milk. Therefore, raw milk consumers might reasonably be expected evaluate the price of

<sup>6</sup> While the Oregon market was studied, there was no comparable data from Washington, California and Utah because milk was only available for purchase from farms with a severely limited number of cows.

raw milk relative to the price of organic milk, on the assumption that the only difference is that raw milk is essentially organic milk that is not pasteurized and homogenized. Looked at in this context, raw milk consumers considered the 57 percent higher price for raw milk to be fair—a price they were willing to pay for what they considered to be a superior product, despite the findings of science. In consumer cooperatives, the only other milk available generally was organic milk.

There are also supply-side explanations for the higher price of organic milk. As a general rule, the unit cost of organic production is substantially higher than that of commercially produced products. These higher costs result from restrictions imposed on the use of technological advances and on the combinations of inputs that can be used in production (Knutson et al. 1990; Knutson, Richardson, and Phillips, 1987; Paggi, 2008; Palma et al. 2010; Ribera, 2010). Green et al. determined that the cost of producing organic milk in the United States averaged \$6.38 per 100 pounds (about 35 percent more for organic products than for conventional production). The same restrictions that apply to organic milk also would be expected to apply to raw milk. In addition, the size of a typical raw milk dairy would be much smaller than that of organic milk producers. However, the additional unit costs of producing raw milk do not appear to have been quantified.

**Table 2. Average retail milk prices and price premiums by products and market, April 2010.**

Market	Conventional gallon	Organic		Raw		Raw Goat quart	Percent price premium		
		gallon	half gallon	gallon	half gallon		Relative to conventional		Relative to organic
							Organic	Raw	
California	3.27	5.99	3.67	10.50	8.50		1.83	3.21	1.75
Utah	3.50	5.99	3.37	7.59			1.71	2.17	1.27
Washington	3.19	5.74	3.34	9.80	7.39	9.00	1.80	3.07	1.71
<b>Average</b>	3.32	5.91	3.46	9.30	7.95	9.00	1.78	2.80	1.57

Source: Market survey.

### State Raw Milk Policy Options

According to the FDA (2010), raw milk was recognized as a source of foodborne illness and disease late in the 19<sup>th</sup> century, predating the birth of the agency. The Grade A Pasteurized Milk

Ordinance (PMO) requiring pasteurization was adopted as a model law for use by states and municipalities in 1924 and was adopted by FDA as a rule 1927. Historically, PMO has operated as a cooperative federal-state program, with the National Conference of Interstate Milk Shipments (NCIMS) being the focal point for state representation in the development of pasteurization policy.

Since 1974, the PMO has required that all milk shipped in interstate commerce be pasteurized (Adams et al. 2008). In 1987, after years of legal battles with public interest groups, the Food and Drug Administration (FDA) banned interstate sales and shipments of raw milk intended for human consumption as raw milk but has elected not to regulate sales of raw milk produced and sold within a state (Adams et al., 2008). This federal ban stops all shipments of raw milk from dairies in one state to consumers in another state. PMO regulations are currently being recommended by NCIMS to the FDA as a requirement for milk products imported into the United States.

FDA's ban on interstate shipment and sales of raw milk is valid under the Commerce Clause of the U.S. Constitution. The Commerce Clause limits federal authority to only those items moved in interstate commerce. Since the 1930s, this limit on federal authority has been interpreted by the U.S. Supreme Court to allow for federal regulation of channels of interstate commerce, instrumentalities of interstate commerce and people or objects in interstate commerce, and activities that substantially impact interstate commerce (*Gonzales v. Raich*, 2005). Interstate shipments and sales of raw milk would fall under the instrumentalities of interstate commerce and people or objects in interstate commerce, and the federal government as such would be free to regulate them.

Intrastate production and sale of raw milk has been clearly exempted from the federal ban on raw milk sales. The FDA, in publishing the final rule on raw milk (Federal Register,1987), clearly exempted intrastate production and sales. Because the final rule exempted intrastate raw milk sales, there would also be no issue of federal supremacy and preemption of state laws allowing the sale of raw milk (Adams et al., 2008). With no federal supremacy clause issue, preemption issue, or other interstate commerce issues, states can freely decide whether to allow raw milk sales, the extent to which the sales will be allowed, or whether to ban them altogether.

State prohibitions of raw milk sales could be accomplished explicitly by adopting, by reference, the PMO model to milk sales within a state. However, some state legislatures have chosen to enact a state law that explicitly indicates how raw milk sales are to be regulated. Several states have authorized sales of raw milk that does not move in interstate commerce.

Table 3 is a of summary these state laws and related regulations regarding the commerce in raw milk intended for human consumption. This compilation indicates that all states have policies regarding commerce in raw milk intended for human consumption. However, the nature and degree of regulation covers a wide range.

Typically, regulatory jurisdiction is divided between the state public health agency and the state department of agriculture. Among the responsibilities of the state departments of public health (DPH) is the protection of public health and safety. In carrying out this responsibility, epidemiological investigations of foodborne illnesses and their sources are conducted. The results of such investigations would typically be reported to the state department of agriculture and to local public health agencies having responsibility for licensing dairy farms and food handling establishments. The state DPH will also report its findings to the Center for Disease Control and Prevention (CDC), which, as an agency of the U.S. Department of Public Health Service (USPHS), compiles morbidity and mortality information and recommends control and prevention measures needed to protect public health and safety of the broader U.S. population.

### **States Permitting Retail Raw Milk Sales**

Fourteen states allow only sales from farms permitted to sell raw cow's milk through licensed off-farm retail stores owned by the permitted farm. Goat milk is allowed to be sold in 13 of these states. These outlets are typically required to be licensed by local public health authorities and must meet state standards for food handling and sanitation. While licensing is required, enforcement may be quite variable due to budget and qualified professional worker constraints.

These states typically enforce microbial standards for raw milk sales. These standards are substantially lower than that required for bulk milk sold for processing. California and Nevada have the Standard Plate Count (SPC) standards (15,000/ml or less total bacteria) and Coliform

Count (10/ml or less fecal bacteria) that are less than or equal to that required for pasteurized milk. The other states, including Washington, typically have SPC standards of 20,000/ml and Coliform standards of 10/ml. In a few states, such as Oregon, higher bacteria counts are allowed for goat milk than for cow milk.<sup>7</sup> Utah allows retail sales but requires that the off-farm retail store be owned by the farmer or that the farmer has major ownership interest. The Utah stores were found to be modern facilities with a wide range of specialty health food, organic, and natural products. As might be expected, these stores allocated more than the usual amount of shelf space to raw milk. The Utah law is also interesting because it requires that each batch of milk delivered to the retail stores be tested for pathogens.<sup>8</sup> The Utah State Code also requires that licensed producer/retailers employ Hazard Analysis Critical Control Point (HACCP) procedures in their operations, a requirement that has not yet been implemented. Some states, such as Washington, permit raw milk sales at farmers markets.

### **States Permitting Raw Milk Sales Only From Farms**

Thirteen states allow raw milk sales only from farms that are licensed and approved. These sales of fluid raw milk must only be direct to the consumer/purchaser from such on-farm premises. Eleven of these states allow either cow or goat raw milk to be sold from the farm. In Illinois and Minnesota, the consumers must bring their own container. In South Dakota, a farmer may deliver raw milk to a consumer/purchaser. In Oregon, cow's milk may only be sold from the farm, but the size of farm from which a sale can be made is limited to three cows, two of which can be milking.<sup>9</sup> In Wisconsin, a state that heretofore allowed "incidental" farm sales not in the regular course of business, the Governor in 2010 vetoed a general assembly bill that would have allowed unlimited retail sales. Frequently there are no specific microbiological standards for milk sold from the farm; or, in states such as Kansas, the specific standards are lower (SPC 100,000/ml) than for states that allow sales at retail.

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<sup>7</sup> Oregon only allows the sale of goat milk at retail through stores.

<sup>8</sup> Federal law prohibits the sale of any food containing pathogens. However, as noted by LeJeune and in interviews with state public health officials, specific identification of pathogens is not always easy, particularly considering the short shelf-life of milk. The time involved in specific identification of pathogens also presents a problem tracing the origins of disease outbreaks associated with raw milk consumption.

<sup>9</sup> Oregon appears to be the only state that limits the size of farm. However, the growth of large scale farms certified by USDA as being organic has become an issue that is being debated.



## **States Permitting Cow/Farm Share Raw Milk Programs**

Cow share agreements may be the largest single source of raw milk.<sup>10</sup> Under these share arrangements, consumers typically buy a share in a cow, a herd, or a dairy farm at a fixed price per share (Real Milk, Hedgebrook Farm). A share typically entitles a shareholder/consumer to one gallon of raw milk per week so some consumers may buy more than a single share. The share is a fixed cost to the consumer, although in some cases, shares may be sold back to the farmer if purchases are discontinued. In addition, there may be a smaller fixed cost associated with the procurement of milk bottles. As a variable cost, the consumer pays a boarding fee that covers feed, labor, and other expenses attributed to caring for, milking, refrigerating, and bottling product. Herd share and farm share arrangements are generally higher cost and may vary with the right to purchase additional products, which may be organic. There are no state microbiological standards for milk covered by these share program arrangements; although some suggest that they meet state Grade A standards for dairy farms and for milk sold for processing.

While shareholders are expected to pick up the milk from the farm, delivery services are sometimes offered at extra cost (Hedgebrook Farm 2010). As an alternative, the cow share farmer may offer pick-up groups in communities where there are a number of shareholders, sometimes with “free” drop-off services. This is similar to the drop-off points for retail sales of milk in states such as Washington. Only nine states explicitly prohibit cow/herd/farm share programs, although the policy regarding these arrangements is under review in four states where cow shares are permitted. This means that in 12 of the 21 states that prohibit the sale of raw milk, it is possible for consumers to obtain the product by participating in a cow/herd/farm share.

In states where the sale of raw milk has been banned, cow share agreements present the interesting circumstance that agreements circumvent the law and permit sub rosa sales of raw milk. This paradox issue can be solved in one of three different ways. First, a few states, such as Colorado, have settled this issue by clearly defining these cow share agreements as not to be “sales of raw milk” when certain statutory conditions are met (COLO. REV. STAT. 2010). These conditions include: the farm has to be registered with the state; the milk has to come from the

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<sup>10</sup> This may be the case because on initiating a web-based query the result yielded 3.4 million sites, the majority of which appeared to be offering some type of raw milk share sourcing arrangement.

cow the shareholder owns a share in; the agreement must be in writing and must include a bill of sale for the interest and a boarding contract; the warning label must be affixed to the milk container; and the shareholder must receive information on the herd health, including an explanation of the results of all tests performed on the herd and the milk. If these conditions are met, a consumer would be confident that his/her cow share agreement does not violate any laws prohibiting the sale of raw milk in Colorado.

The second situation is where the state does not have its raw milk statutes and regulations clearly defined so that neither the public nor a court can decide if a cow share agreement would constitute a “sale”. A district court, in Ohio, was unable to determine if cow share agreements constitute a “sale of raw milk.” The court’s decision was based on the fact that the state Department of Agriculture (DOA) had failed to properly define the terms “sale” or “sold” in any of its regulations relating to raw milk and had provided an undefined exemption for an unspecified group to consume raw milk. DOA argued that the exemption was limited to only those living on the dairy farm, but the court found this to be subjective without DOA properly setting forth the exemption and to whom the exemption was applicable in the regulations. The court also would not adopt a definition for the word “sale” and held that this was best left to the DOA to weigh the various competing public interests. For these reasons, the Ohio court was unable to determine if the cow share agreement constituted the “sale of raw milk” (*Schmitmeyer* 2006).

Third, the state could clearly define in its raw milk statute and regulations that a cow share agreement is a “sale”. A Maryland appellate court has found these agreements to constitute “sales of raw milk”. The case arose when a dairy farmer wished to start selling fractional interests in his herd and supplying the fractional owners with their share of the raw milk. In looking at the characteristics of the agreement, the court found that the consumers continued to pay fees to the dairy farmer for the life of the contract with the only benefit received by the consumers being the right to receive raw milk. The court found this scheme to be sufficiently like a sale that it was within the Department of Health’s authority to regulate and prohibit (*Oyarzo* 2009).

Interestingly, the Maryland court, in *Oyarzo*, described situations where a cattle share agreement would not constitute the “sale of raw” milk. Traditionally, cattle owners have entered into agreements with third parties to feed their cattle, more commonly known as agistment agreements. In such an agreement, the third party is a bailee for the actual owner of the cattle, and not also an owner of the cattle. Any milk produced would be incidental to the rights that come with owning the cattle. Under such an agreement, any milk delivered by the third party would not be a sale because the owner already owns the raw milk (*Oyarzo*). Such traditional agreements would fall outside of prohibitions on sales of raw milk found in many states.

Virginia has also found such agreements to be “sales of raw milk”. In Virginia, the herd owner sold 48 percent of the goat and retained 52 percent of the goat. The herd owner attempted to argue that Virginia defined a “sale” as when title passed from seller to buyer, and here the only sale was when the shareowner got a 24 percent interest in the goat. The Virginia Supreme Court disagreed and found that title to the goats did not matter. The issue was title to the raw milk, and it passed when the herd owner delivered the milk to the shareowner. The court found that part of the rental fee paid could be shown to be the value of the raw milk received and was nothing more than a sham. The court finally found that the shareowner did not receive just milk from his/her goat, but all the milk was put in a common container, and the share owners collected from that. For these reasons, the court had no problem finding this agreement to be a sale of raw milk (*Kenley 1989*).<sup>11</sup> Despite these Virginia court cases, the prevalence of cow/herd share arrangements in Virginia indicates that producers have found ways to structure their operations in a manner that has not been challenged, as illustrated by Hedgebrook Farm.

Based on the above decisions, it seems reasonable to conclude that litigation, regarding whether various cow/herd share arrangement is likely to continue until state legislatures clarify the language and intent regarding milk procured by consumers under cow/herd share agreements. Departments of Agriculture or other responsible agencies must then follow through with consistent and appropriately clear regulations. While resolution of this issue is particularly

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<sup>11</sup> It should be noted that this goat owner had previously tried to lease out her goats by the day. Under this arrangement, a person would pay her a fee to lease 24 percent of a goat and pay a daily maintenance fee. The lease entitled the lessee to all the by-products of the goat, including its milk. The Virginia Supreme Court also found this to be a sale of raw milk and in violation of state law. The court’s reasoning was that the rental fee could be shown to be the price of the raw milk and just a way to avoid the ban on raw milk sales (*Carbaugh 1983*).

important for states that otherwise prohibit the sale of raw milk, all states legislatures and regulatory agencies should study and monitor cow/herd share arrangements.

### **States Prohibiting Raw Milk Sales**

Twenty-one of the 50 U.S. states prohibit retail raw milk sales through either retail stores, farmers markets, or directly from farms. However, consumers in nine of these states may obtain milk legally under a cow/herd/farm share arrangement. This means that there are only 12 states where consumers do not have legal access to raw milk.

**Table 3. U.S. inventory of regulatory policy regarding the sale of raw milk**

<b><u>Regulatory policy</u></b>	<b><u>Frequency</u></b>
Prohibit sale	21
Prohibit leasing	9
Allow on farm sale	
Cow or goat	11
Goat only	2
Permit sale at retail stores	
At any licensed store	12
Only farmer-owned store	2

Source: Author survey

## **Conclusions and Implications**

### **Experience with Raw Milk Programs**

For consumers who are willing to pay the price, raw milk may be available in as many as 41 of the 50 U.S. states. None of the policy options have effectively eliminated disease incidents believed to be attributable to raw milk. However, regulators in the four states surveyed believe that they have fewer incidents due to their regulatory action. But these are states with generally

lower microbiological standards such as SCC, meaning that the milk is of higher quality, although not necessarily safe.

### **Potential Raw Milk Policy/Regulatory Improvements**

State public health officials observe that if federal requirements for pasteurization were adopted by reference for in-state dairies, it would be the safest option. However, regulatory authorities in the four western states surveyed acknowledge that, while this option will reduce raw milk consumption, it will also incentivize producers and consumers into black-market arrangements. Analogies can be made to drugs, prostitution, and to raw milk products that cross the border from Mexico. In a black market there will be less control over quality, sanitation, and related production, bottling, and handling practices and, therefore, more disease exposure risks are likely.

Oliver (2006, p. 204) reasons that "...policy makers are subject to bounded rationality in thinking about problems and solutions as an alternative to system-wide reform." As a result, they seek modest adjustments to policy rather than larger-scale policy innovation. However, he also cites John Stuart Mill's conclusion that the only purpose for which government power can rightfully be exercised over any member of society is to prevent harm to others (p. 196). Applied to raw milk policy, if the only person harmed is the person who knowingly drinks this potentially dangerous product, there is no justification for policy action.

The reasoning of Mills does not appear to apply to the case of raw milk because: (1) The consuming public is not consistently well informed and (2) the raw milk consuming public frequently provide this potentially dangerous product to at least other members of their family if not to events such as pot luck dinner gatherings. Leichter (2003, p. 611) makes the point that: "The choices of even affluent and well educated people are only as good as the information on which they base their lifestyle decisions." He then indicates that Americans are losing confidence in both science and medicine due to their perceptions of conflicting views over both the nature and causes of health problems.

Camerer et al. suggest an asymmetrically paternalistic, regulatory approach that creates large benefits for those who are inclined to make errors in judgment, while imposing little or no harm or costs on those who are fully rational. “Such regulations are relatively harmless to those who reliably make decisions in their best interest, while at the same time advantageous to those making suboptimal choices.” (Camerer et al. 2002-03, 1212). This conclusion is consistent with the findings of Argo and Main (2004) that consumers’ judgment is the most difficult to influence through warning labels, Chang and Just’s finding that the impact of consumer information dissipates in a short time, and LeJeune and Rajala-Schultz’s apprehension regarding the ability of improved information to persuade the consuming public of raw milk risks. With these observations in mind, the following state options are offered for consideration. While each option takes a somewhat different approach, the commonality of the options is that *each requires the same specified approach across all states.*

- 1) More stringent and uniform standards could be applied across the policy/regulatory options. Much can be learned from the experiences of states such as California, Utah, and Washington, all of which have extensive legislative, regulatory, and enforcement experience. This option does not require that all states make retail sales of raw milk legal. However, it should recognize the reality that in 41 of 50 states, raw milk having widely different quality standards is available to consumers. A starting point for accomplishing regulatory uniformity is adoption of standard producer licensing and testing procedures across all states where raw milk is sold or where cow/farm share arrangements exist. A more comprehensive study than this survey paper cited here would be required to determine the specifics of this option.
- 2) A science-based set of Good Agricultural Practices (GAP) could be specified and applied to all producers in all states that provide consumer access to raw milk. While GAPs are becoming standard operating procedure for fresh produce sales through supermarkets, they do not appear to have been developed or considered for producers who make raw milk available to consumers. The Grade A standards established under PMO/NCIMS are a logical starting point, but they do not go far enough in terms of the practices farmers should adopt to ensure milk safety through optimal animal husbandry, worker health and

hygiene, milking cleanliness, bottling sanitation, etc. RAW USA (2010) provides a list of raw milk production practices for human consumption that are useful but much too general. Wightman's *Raw Milk Production* (2008) is also a useful starting point for abstracting a set of GAP standards for raw milk, but unfortunately it was not written exclusively for producers who provide consumer access to raw milk.

Historically, an industry standard for raw milk dairy operations was developed by the American Association of Medical Milk Commission (AAMMC) standards last subscribed to by a California dairy no longer in production of raw milk for retail sales. The most recent version of a national raw milk standard was formalized and published in 1999 but has neither been updated nor adopted by the current raw milk purveyors (Wightman 2010.) Wightman indicates that preliminary work and study are underway to develop a national standard for raw milk dairy operations comparable to AAMMC standards previously noted. To be effective, these standards would need to be adopted by all states that allow consumer access to raw milk.

- 3) HACCP or HACCP-type regulations could be more fully applied to raw milk policy/regulatory systems. In broad overview, HACCP involves the identification of critical points at which microbiological contamination can occur, regular microbiological testing and record keeping at those points, and taking additional control measures if contamination is detected (FDA 1997). Quality of milk measured by presence of pathogens and by the microbiological standards for milk that is sold, the place of sampling (critical control points), and the frequency of sampling/testing would contribute to risk reduction. The five main testing parameters include somatic cell count (SCC), plate counts, preliminary incubation, coliform counts, and specific pathogen testing. The frequency and types of testing vary by state regulations, and some operators choose to do a split sample and pursue dual testing at another private independent laboratory, reflecting concern for perceived prejudice and bias against raw milk dairies.

Specific pathogen tests are especially important for raw milk dairies. Wightman (2008) recommends monthly testing and if consistently negative, quarterly testing. This may be too infrequent for raw milk intended for human consumption. At the other

extreme, testing every batch, as Utah requires, would offer the most attractive risk reduction but at an extraordinary cost that may preclude any standard of reasonableness. On the other hand, raw milk prices reflect consumers' willingness to pay a substantial premium that is coupled with a highly inelastic demand.

If HACCP-type procedures were to be implemented, each farm would be required to have a HACCP plan and record-keeping system that would be available to state regulators. Clearly a HACCP model could be employed for raw milk dairies, but this concept is little discussed as a dairy industry standard, based on review of literature.<sup>12</sup> One difficulty would be the observation that adherence to all procedures would not assure that the final product is pathogen free as is obvious from experience with microbiological contamination of raw meat.

### **Implications for Marketing and Policy Regarding Fresh Agricultural Products Not Subject to GAP Standards**

Issues and experiences highlighted for raw milk in this paper should not be interpreted in isolation from sales of fresh produce through farmers markets. While there may be a consumer perception that farm sales and farmers market sales are safer than standard commercial venues (Onozaka et al. 2010), this has no basis in science. Private organizations led by GLOBALG.A.P. and their affiliated food retailing members (largely chains of supermarkets and restaurants) are filling in this void by adopting and specifying increasingly detailed and widespread good agricultural practices that are subjected to third-party compliance audits as a raw product purchasing requirement. Despite the existence of U.S. federal standards for organic foods, programs to promote sales of fresh produce through farmers markets, and programs to encourage consumption of fruits and vegetables, these programs have no authority to apply GAP or HACCP type standards to farm or farmers market sales. That is, farm sales and farmer market sales have no GAP standards that are comparable to those of GLOBALG.A.P., i.e. specifically designed to prevent bacterial contamination and related foodborne illnesses.

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<sup>12</sup> This is not an unusual occurrence in the dairy industry or for government regulation of the food industry in general. In 1999, the National Conference on Interstate Milk Shipments (NCIMS) initiated a voluntary dairy HACCP pilot program for dairy plants to test the concept that a HACCP program could function as an equal alternative to the numerical ratings that have been used for years to measure a plant's compliance (FDA 2010). While revised in 2001, this program is still in pilot status and under review by NCIMS.



## Implications for Economic Research

While raw milk may be considered to be a unique case, greater attention needs to be given to situations where consumers are willing to take risk and even pay a higher price than under low risk situations. This is particularly the case where there are broader impacts on society. Research in this arena can best be pursued on an interdisciplinary basis. While economists have done a good job in working with and drawing on the research findings of psychology, it may also be fruitful to pursue working with sociologists because of the group interactions and their effects on economic decisions. Much of the research that behavior economics pursues is focused on experimental methodologies. More research with primary data emphasis from field studies is needed to verify and discover how these principles apply in practice. Policy makers and educators are in great need of expert assistance in making program decisions that have important economic and public health impacts.

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