Cost of *E. coli* O157:H7 illness in Canada

The following information is excerpted from a 2007 study by the George Morris Centre in Guelph, Ontario.

Cost of Illness and Treatment

The framework for the cost calculations are based on Frenzen (2005) and estimates of Canadian costs were imposed. The following are explanations for the costs of various health services in Canada, many of which use data from the Canadian Institute for Health Information (CIHI). Costs of productivity loss and premature death were also established for the Canadian context.

Costing Methods

Visit to a Physician: The cost of a visit to a physician was taken from the National Grouping System Categories Report, Canada, 2003-2004 (CIHI, 2006). This report uses the National Physician Database to report statistics on the utilization, cost and distribution of physicians' services through provincial medical care insurance plans. The report gives a detailed breakdown of cost per service for various types of physicians. For the purposes of this research the reported cost per service of a family medicine physician was used and adjusted to 2006 value using the consumer price index (CPI) for health care. The cost was calculated to be $59.92 per visit.

Visit to the Emergency Department: Reported ambulatory care visits and expenditure by hospitals, in the functional centres of ambulatory care and emergency within the hospital, were used to calculate the average cost of an emergency department visit[1]. The reported data from CIHI was for 2002-2003. Therefore, the calculated cost was converted to 2006 value using the CPI for health care, giving a cost per visit of $112.32.

Hospitalization: The cost of hospitalization was again calculated using CIHI data. To estimate the cost per day, the total number of inpatient days was divided by the total hospital expenses reported in 2002-2003 (CIHI, 2005). This was then adjusted to 2006 value using the CPI for health care, culminating in a cost of $1,171.24. The cost of hospitalization for someone with HUS would be higher largely due to haemodialysis and the intensive care required for a patient with kidney failure. An estimate for this type of treatment in Canada was not found. Therefore, an adjusted estimate was established using the US data (USDA, 2006). The World Health Organization statistics show that in 2005 per capita expenditure on health care in Canada was 52% of the per capita expenditure in the United States (World Health Organization, 2006). Using this ratio a patient admitted to a Canadian hospital with HUS is estimated to cost $17,500.00.

Outpatient Medication: The cost of outpatient medication was difficult to establish in this context, especially to narrow the cost down to those medications used in the treatment of an *E. coli* O157:H7 infection. Research that investigated the difference in drug prices between Canada and the United States reported an average discount in Canada of 24% at the retail level (Graham and Robson, 2000). Therefore, to estimate the cost of both prescription and non-prescription drugs in Canada this report used the costs given by Frenzen et al (2005) adjusting them to a Canadian 2006 dollar value and discounting them by 24%. The cost for the drugs used in the treatment of an *E. coli* O157:H7 infection was calculated to be $53.18 for prescription drugs and $7.76 for non prescription drugs.

[1] Ambulatory care includes "specialized diagnostic, consultative, treatment and teaching services provided primarily for registered clients. These services are generally provided in a hospital setting…" and the emergency unit "provides assessment, diagnostic and treatment services to individuals with conditions requiring immediate attention" (CIHI, 2005).

Haemodialysis: As mentioned above, 10-15% of children will develop HUS after an *E. coli* O157:H7 infection and will likely require haemodialysis. Patients who develop end-stage renal disease (ESRD) will also require ongoing haemodialysis or a kidney transplant. A detailed discussion of various forms of haemodialysis and their costs in Canada was presented by McFarlane (2004), and the costs in this research were reported as 2003 US dollars and per patient per year. McFarlane (2004) reviewed four studies which, in total, gave nine different costs for various forms of haemodialysis. Therefore, to establish a cost for this research an average of these nine costs was calculated, converted to Canadian dollars using the average exchange rate for 2003 (Bank of Canada, 2003) and adjusted to 2006 value using the CPI for health care. The resulting cost per patient per year of haemodialysis was calculated to be $85,137.90. Although Health Canada (2001) estimated the average cost of dialysis to be $50,000, the McFarlane study was used as it was substantiated by a comprehensive analysis.

For the purpose of the cost estimation presented below, chronic medical costs per case for those were estimated to be the average cost of haemodialysis given above ($85,137.90) multiplied by the average life expectancy for an ESRD patient, 5 years (Anonymous, 1999). Despite a kidney transplant being financially cheaper in the long-run and preferential for the patient (if it is not rejected), it is difficult to find appropriate donors and there is a waiting list for transplants so, for the purposes of this calculation, the estimated cost of dialysis was used as the cost of chronic medical care.

Productivity Loss: The calculation of average daily income of an individual was kept relatively simple and was calculated by dividing the total GDP of Canada (annual, income based) by the estimated population of the country (Statistics Canada, 2007). Average yearly income based on this calculation was $44,353.40, or $170.59/day based on a 260 day work year. Most of the severity levels evaluated productivity loss based on the number of days missed from work. However, productivity loss due to ESRD is presented slightly differently in the calculator. No data specific to Canada could be found on the productivity loss from ESRD, thus for the purposes of this calculation the difference between the daily income in the US calculation (USDA, 2006) and that calculated for Canada was imposed on the ESRD lost productivity value presented by USDA (2006). The Canadian value was 87% of the US value. Therefore, lost productivity for a Canadian patient due to ESRD was estimated at $43,000.

Premature Death: The average annual income of $44,353.40 was used to calculate the net present value (NPV) of lost earnings due to premature death. This was calculated for 45 years of employment (ages 20-64, inclusive) and an inflation rate of 2% was also imposed. The NPV of a premature death was calculated to be $833,588.26.

Cost of E. coli O157:H7 Illness in Canada

The costs and case numbers for Canada were input into the Foodborne Illness Cost Calculator (USDA, 2006). It must be noted that age of the patients is not incorporated into this calculation. This will impact the calculation. For example, each premature death is given the full value of $833,588.26. In addition, all cases were included in the loss of productivity calculation. This not only avoids the use of US employment data being imposed, but also accounts for the fact that when a child is ill, it is highly likely that a parent will remain home/ take the child to hospital and, therefore, there is a loss of productivity even though it is not directly a loss from the patient.

Populating the calculator with as much Canadian data as possible resulted in a total cost of illness being approximately $29.6 million. The USDA (2006) estimated the cost of illness for the US at $US431 million (Can $522 million[2]). If the Canadian cost of illness were estimated by taking the per capita difference in health care expenditure (World Health Organization, 2006) and population differential (approximately a 10^{th}) the estimate would be $27.1 million. Therefore, the resulting cost of $29.6 million appears to be a reasonable estimate.

[2] Based on average 2005 exchange rate (Bank of Canada, 2003).

Cost to the Agricultural Industry

Recalls

Placing a dollar estimate on the cost of recalls related to *E. coli* O157:H7 is not possible from a general perspective. Each recall can be quantified on a case-by-case basis, but at the same time, each recall is unique and different. Recalls differ from each other in four key areas:

- Order of magnitude with regard to volume of product involved
- Geographic distribution
- Channel of distribution
- Cost of the product

Other factors include the timing of notification and whether the product was exported or not. All of these variables are crucial to determining the potential cost of the recall and each of them can vary widely from case to case. In addition, as noted above, the specific costs of the recall involve bearing all the costs of picking up recall product from customers or other sources as well as product refunds and paying for a replacement product. This, of course, varies by product and geography. Once packers have the product, they either send it to rendering or sell it to a cooking operation. In either case, reclaiming any value is minimal, say packers.

Discussions with packers regarding this issue revealed a reluctance to generalize about recall costs and magnitudes, given the high variability and differing factors from case to case.

In addition, there is no solid database of actual recalls. While the Canadian Food Inspection Agency (CFIA) tabulates official regulatory-induced recalls, many recalls are done voluntarily by a packer based on test results or other concerns. These would not necessarily be part of official records.

With those variables noted, there is a CFIA data base of recalls and the rationale for those recalls. The following table shows CFIA *E. coli* O157:H7-related recalls in comparison to total recalls by year.

Table 6.1

Year	# of *E. coli* O157:H7 Recalls	Commodity Type	Annual # of Recalls
2000-01	3	3- Meat and Poultry	340
2001-02	5	4 - Meat and Poultry 1 - Processed Fruit and Vegetable	480
2002-03	7	6 - Meat and Poultry 1 - Dairy	378
2003-04	2	2 - Meat and Poultry	343
2004-05	4	4 - Meat and Poultry	276
2005-06	7	7 - Meat and Poultry	259
2006-07	4	3 - Meat and Poultry 1- Fresh Fruit and Vegetable	NA

Over the past six years prior to 2006-07, there was an average of nearly 350 food recalls by the CFIA. Of those recalls, about 5 per year, or less than 1.5% were *E. coli* O157:H7-related. The following graph shows the pattern of the *E. coli* O157:H7 recalls in Canada.

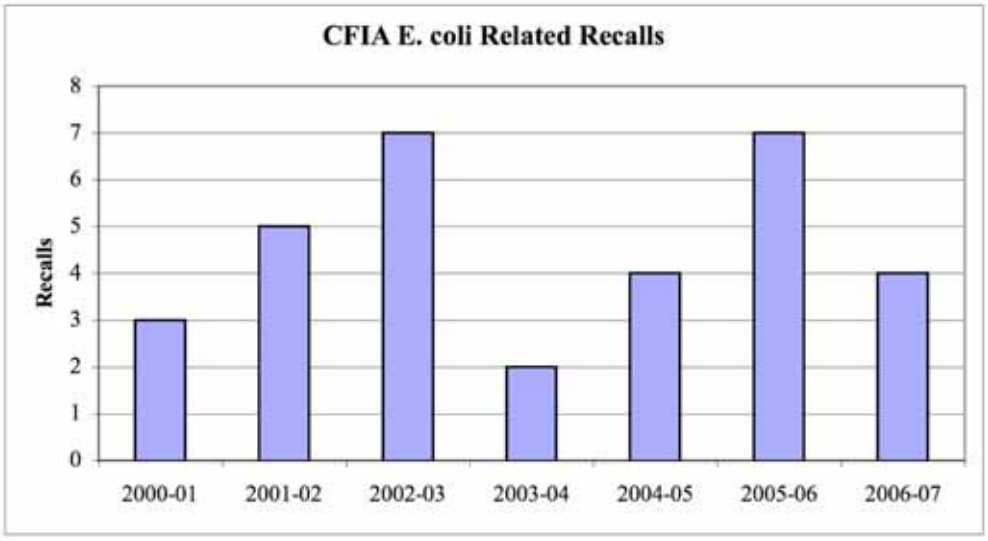

Figure 1 Source: CFIA

There are three key points regarding *E. coli* O157:H7 recalls in Canada as illustrated by the table and graph.

- *E. coli* O157:H7 recalls are a very small share of total CFIA recalls
- Not all recalls are meat and poultry related, as vegetables and dairy products are also affected
- There does not appear to be a pattern of increase or decrease in recalls

Beyond the data noted above, and for the reasons cited prior, there is very little that can be directly concluded or asserted with regard to recall costs. Furthermore, it is not possible to infer or even make a conjecture regarding costs because the CFIA does not officially track the volume or size of the recall. As such, no assumptions can be made regarding the cost of the product being recalled in an "average" recall. No assumptions can be made, therefore, regarding the annual costs of *E. coli* O157:H7-related recalls in Canada.

With that noted, it can be asserted that generally, recalls have not been burdensome for Canadian packers. The main challenge for a beef packer that endures a recall would be plant de-listing by the United States Department of Agriculture (USDA). If that occurs, there would be material pricing loss as the plant would have to move product in the domestic market. If the plant is large, this would have a material impact on revenues. This is a huge risk for packers.

Another factor that is going to result in recalls becoming more of a cost burden is the revised CFIA *E. coli* O157:H7 policy. In addition to ground beef, grinds and trim, the new policy would subject a plant to recall all products produced in the plant from clean-up to clean-up. This would increase costs for obvious volume reasons but also due to the increased values of the primals (the basic meat cuts used for steak and hamburger) that must be recalled. Furthermore, there is a longer shelf life on the product, which would mean a greater volume that would, in fact, have to be absorbed by the plant.

Costs Associated with Litigation

Litigation tends to occur more often in the United States than in Canada; however, class action litigation is a growing phenomenon in Canada, particularly in Quebec, Ontario and British Columbia which all have provincial class action legislation (Schoenfeld, Penny, and Terry, 2001). Litigation relating to *E. coli* O157:H7 contamination over the past 15 years in the United States has amounted to approximately US$300 million (Marler, 2007).

In Canada there have been limited cases. However, one example was a case resolved in January 2001 when the 143 class members received approximately $800,000 from the company that made Fleetwood Sausages (Klein Lyons, 2001). In this particular case class members were classified into three categories; those who were not admitted to hospital, those who were admitted for less than 30 days, and those that have ongoing medical symptoms from the infection or who were admitted to hospital for more than 30 days. Those who were not admitted to hospital received a payment of $4,000. Those who were admitted to hospital for less than 30 days received a lump-sum of $7,500 plus $700 for each day spend in hospital, and were reimbursed reasonable and documented costs incurred by them or family as a result of the infection. Finally, those who could prove continuing symptoms from the infection or who stayed longer than 30 days in hospital were given the ability to further negotiate compensation with the company (Justice Wong, 2001).

Essentially, litigation has not yet surfaced as an identifiable cost associated with *E. coli* O157:H7 in Canada. Litigation related costs can obviously be serious and burdensome for any particular company. Furthermore, it can reasonably be expected that litigation costs could increase in the future. As of now, however, for the industry as a whole, these costs are not material and cannot now be regarded as a significant burden to the industry.

Market Demand Impact

This section of the report attempts to assess the impact of *E. coli* O157:H7 on beef demand. The purpose of the section is to attempt to quantify the financial impact of consumer concerns regarding *E. coli* O157:H7 as it relates to reduced consumption and expenditures. The fundamental premise is to determine how damaging *E. coli* O157:H7 has been to the beef industry in terms of consumer expenditure within the industry. The main source of the information and analysis is previous academic and industry research into factors that drive beef demand.

It also needs to be noted that *E. coli* O157:H7 outbreaks have negatively impacted other food sectors as well. The fresh vegetable sector, spinach in particular, has been severely impacted by a 2006 *E. coli* O157:H7 outbreak. In addition as noted above, in Canada, the dairy sector as well as the fruit and vegetable industries have also been impacted by *E. coli* O157:H7 recalls.

As such, while the focus of this report is the beef sector, this section will apply the findings from the beef industry to other relevant sectors as well.

Defining Demand

Demand, also referred to as a demand curve, is a schedule of beef quantities consumers will purchase over a range of beef prices. A shift in beef demand occurs when the entire beef demand curve shifts up (demand increase) or down (demand decrease). Changes in beef price or the quantity of beef consumed do not cause the beef demand curve to shift. Rather, changes in other factors, such as prices of competing meats (e.g., pork or poultry), demographics (e.g., income, age distribution, etc.), or health or food safety concerns cause the beef demand curve to shift. When beef demand increases (i.e., shifts up), say as a result of an increase in the price of poultry that causes consumers to substitute beef for poultry, the result is higher beef prices at any level of beef consumption than prior to the demand shift. Conversely, when beef demand decreases (i.e., shifts down) beef prices are lower at any beef consumption level than prior to the demand shift.

Kansas State University (KSU) researchers conducted one benchmark study that assessed individual factors that influence beef demand in 2000 (Schroeder, Marsh, and Mintert, 2000). The system included factors accounting for prices of competing meats and total consumer expenditures, changing consumer demographics, food safety problems, health information, and seasonality. The impacts of individual demand determinants on beef demand were calculated each year from 1992 through 1998.

With regard to food safety, which of course is the focus of this project's *E. coli* O157:H7 research, the Kansas study utilized beef recalls as a measurable variable. Kansas Beef Demand Model Results indicate beef demand declines when beef food safety recalls occur. The demand model results indicate a large increase in beef recalls leads to a significant downward beef demand shift. The KSU research asserted that "The beef industry cannot afford to be passive and simply react to food safety problems after they occur. Rather, the industry needs a proactive food safety program to minimize the negative impact on beef demand associated with FSIS recalls."

Food Recalls, Health and Safety Impacts on Demand

According to a Harris Poll of 2,563 adults surveyed online between April 10 and 16, 2007 by Harris Interactive(R), consumers are concerned about the incidence of recalls among manufacturers and suppliers of food and pet food products. More than four in five (86%) mentioned at least some concern, with three in ten (29%) indicating that these recalls are a serious concern for them. Essentially, the consumers surveyed indicated that they would at least temporarily stop purchases of the brand involved or the product involved in the recall (Harris Interactive Inc, 2007).

In addition, foodborne illness outbreaks are significantly changing consumer shopping behaviour and attitudes, according to the Food Marketing Institute (FMI) U.S. Grocery Shopper Trends, 2007. The number of consumers "completely confident" or "somewhat confident" in the safety of supermarket food declined from 82 percent in 2006 to 66 percent—the lowest point since 1989 when the issues of pesticides in apples and contaminated grapes were widely reported. Consumer confidence in restaurant food is even lower at 43 percent. The Trends survey found that safety concerns prompted 38 percent of consumers to stop purchasing certain foods in the past 12 months—up from 9 percent in 2006. Among those who stopped buying products, the items most often mentioned were spinach (71 percent), lettuce (16 percent), bagged salad (9 percent) and beef (8 percent). The survey was conducted in January 2007, when the outbreak linked to spinach was still in the news and illnesses associated with other foods were starting to make headlines (Food Marketing Institute, 2007).

In addition, the USDA's Economic Research Service has asserted that "highly publicized international food safety incidents may lead to lasting changes in consumer perceptions about food safety and their food purchasing patterns. Here, the hypothesis is that, following the resolution of the problem that caused a major international food safety incident, consumer perceptions about the implicated food product and about the exporting country's ability to produce safe food may be slow to change, and these perceptions have a lasting influence on food demand and global trade (USDA, 2001).

The message of this section, therefore, is clearly that food safety issues associated with *E. coli* O157:H7 have serious negative ramifications for consumer demand for the affected products. These food safety issues could also translate into negative implications for Canada's ability to export beef and other products around the world.

There is no question that consumer concerns regarding *E. coli* O157:H7 have a negative impact on beef demand. A negative impact on demand translates into lost purchases and lost revenues for the beef industry. Based on the Kansas State research, the National Cattlemen's Beef Association has calculated that from 1991 through 1999, beef recalls due to safety concerns cost the industry as much as $1.4 billion in lost demand at retail in the United States. The $1.4 billion in lost demand at retail amounts to approximately US$180 million per year during the 1990s. It needs to be noted, however, that the U.S. data was retail only. Beef tends to be sold about 50% retail and 50% foodservice. As such, the total demand loss in the U.S. could be closer to 2.8 billion over the 1991-1999 period, or about $300 million per year.

Canadian beef demand patterns and developments are almost exactly the same as U.S. demand developments. The only difference is that the U.S. tends to have a higher per capita consumption of beef. The point, however, is that the U.S. data can be imposed on Canada with reasonable certainty of it being equally applicable. Therefore, that U.S.$2.8 billion demand loss estimate can be adjusted to a Canadian demand loss.

Thus, based on the U.S. experience, it can be estimated that in Canada, using current exchange rates, annual demand loss due to concerns regarding *E. coli* O157:H7 likely amount to about $30 million per year. That is, the industry loses about $30 million per year in Canada due to consumer concerns about *E. coli* O157:H7.

About the George Morris Centre

Founded in 1990, the George Morris Centre is a Canada-wide, not-for-profit charitable organization based in Guelph, Ontario. As an independent think-tank, the Centre provides industry decision makers with critical information and analysis on issues affecting the Canadian agri-food sector. The Centre's products and services assist public and private sector clients who are adjusting to change, and those leading the change.

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