

Figure 7.15. DISCRETE PROBABILITIES: Public Perceptions of Risk

This Figure 7.15 contains four newspaper articles which appeared over about a two-week period in April, 1995, in *The Globe and Mail*; they illustrate the use of so-called subjective (or personal) probabilities in the context of how people, both lay and expert, perceive the risks associated with a number of familiar activities. The first article EM9513 is a more general editorial on the topic, and it refers to three other articles; these follow in this Figure 7.15 in the order they are referred to in the editorial.

EM9513: *The Globe and Mail* Editorial, April 17, 1995, page A10

A heady analysis of everyday risks

TODAY we would like to give you a sense of the inner workings of the collective mind of *The Globe and Mail* editorial board. Now, before any jokesters start cracking wise about how nature abhors a vacuum, let us say that the issue we have been wrestling with is risk analysis.

How, we wondered, do humans mentally process risk when it comes packaged in terms of there being a one-in- X chance of something dreadful happening? Our musings about cognition arose from a wonderfully instructive letter appearing in the paper last week by Jane Fulton, a professor of health policy and ethics at the University of Ottawa.

She pointed out that the hue-and-cry over the reduction of firemen at Canadian airports was statistically dumb. Planes rarely crash and even when they do, the inconsiderate machines generally can't be relied on to smash themselves up on airport runways. So why not put our tax money into something that is more cost-effective at saving lives, she wondered.

Why not be, you know, rational, as opposed to: Oh-my-god-did-you-see-those-gory-bloody-pictures-of-50-plane-passengers-burned-to-cinder-and-ash-in-Pakistan; FOR GOD'S SAKES, CANADA MUST HIRE MORE FIREMEN.

There was amongst our collective mind a general sense that the airport firemen were almost entirely symbolic. God may or may not be dead, but humans' fates are in the 20th century continually cast in terms of chance and risk. Hardly a day goes without a news story throwing up statistics such as a one-in-seven chance of death being connected with cigarette smoking, one-in-100 from motor vehicle accidents, one-in-20,000 from an airplane crash, one-in-100,000 from a poisonous bite or sting, a one-in-3-million chance of dying from food poisoning.

Nonetheless, it was not clear to us how individual tragedy was translated into personal decision by the wet and soft computer we call the brain. Some of us – well, Andrew Coyne – maintained that we can decide these things rationally. In the same way that we budget our finances, so we can and do arrive at some kind of rough measures of risk. Moreover, if there are differences amongst individuals about the weight of a given risk, collectively a kind of consensus is arrived at by the whole. As a society we put a price on danger.

Others – well, Marcus Gee – related the real-world difficulties of arriving at a risk common market. He described a situation he was intimately familiar with wherein a mother was demonized by the thought of her child being electrocuted and a father tried to argue that inconvenience of putting safety plugs probably out-weighed the risk. Consensus had not yet been arrived at.

AND finally, still another anonymous board member – well, Stephen Strauss – argued that when he thought about dangers there was never any mathematics involved. One-in-four, one-in-100, one-in-1,000 were for all intents and purposes the same. One-in-a-million was not an emotionally effective way of saying: Don't worry. The language of risk was located deep in the stomach. If things felt

scary we believed they were dangerous because numbers don't speak the visceral language of fear.

Given that the collective editorial mind had conflicted and opposing notions of reality – again, we warn you, we will not listen to your snide asides about how typical the day must have been – we decided to see what is known about communicating risks to people. Part of the result of that inquiry was the news story that appeared in the paper on Thursday wherein Health Canada polls of risk analysis by Canadians were reported.

(Again, to the wisenheimers, yes, *Globe* editorial writers actually do research what they opine about and in so doing sometimes do unearth the unknown).

There were several striking things about the surveys. It is comforting that after millions of news stories, and thousands of studies and dozens of advertising campaigns, that the public at large understands how dangerous cigarette smoking is to their health. It was ranked as the No.1 risk. But that was almost the sole constant. Men/women, young/old, Quebecers/the rest of Canada, the general public and experts all exhibited strikingly differing judgments when it came to determining just how risky something was.

SYSTEMATIC disagreement was not an aberration of the Canadian survey. Numerous studies in the arcane academic sub-discipline known as "risk communication" reveal that – wonder of wonders – the disputations of the *Globe* editorial board in fact do indeed mirror the world. That is to say people everywhere take risk numbers and frame them in boxes formed by their life world views.

If you are an optimist, you play down the scary things in life. If you are an economic rationalist, you play up rational risk assessment. If you feel oppressed and powerless, all the world's a very scary place. What you do, as well as who you are, affects your world view. In the Health Canada study, toxicologists who worked for industry were much more skeptical of animal studies showing chemicals were dangerous than were scientists who worked in government or academe.

And people who work in dangerous occupations persuade themselves that it is the other fellow who is at risk.

If the collective mind of *The Globe and Mail* had trouble arriving at a common agreement about how it understood risks, it is because there is no common understanding. The experts say the one-in- X numbers are an objective face plastered over what is intrinsically a subjective and political area of human endeavor. The anonymous author of this editorial – okay, the aforementioned Stephen Strauss – wanted to use this contradiction as a platform to pronounce on the impossibility of rationality in public and private life.

The reasonable thing is to rank risks and to act accordingly. Big, preventable dangers should receive the most public money and attention. They should also be the ones that individuals did their utmost to avoid. However, people apparently don't think about risks rationally, and in a democracy, freedom often translates into a mutual respect for the irrationality of others. Another editorial board mem-

ber – see the name by the words "Editor-in-chief" – said that this sounded to him like the newspaper was not describing unreason, but embracing it. Was there not a middle

path?

Therefore, the muddled mind of *The Globe and Mail* has adopted a paradox as its editorial stance. We firmly believe every Canadi-

an should be more sensible when it comes to measuring the likelihood of dangers in his or her life, but we just as firmly believe they won't be.

EM9511: *The Globe and April 8, 1995, page D7*

Perils of peanut butter and other risks

Re Firemen Removed From 15 Airports (April 5):

It is certainly time that Canada took a serious look at how we manage risk. In 1995, few, if any, of us will burn to death on a Canadian airport runway, while more than 250 of us will die in a crash involving a tractor-trailer. Four children died in Ontario last year because they were run over by a farm tractor or a wagon being driven by their parents. Forty thousand of us will die this year from the long-term effects of tobacco smoke.

A recent study done jointly by researchers at Harvard and Stanford Universities determined that we have a one-in-a-million chance of death from many activities, including eating 40 tablespoons of peanut butter or travelling 1,000 kilometres in an airplane. Airplanes and airports are very safe, compared with other activities we take for granted – like driving on the 401 in Toronto.

It is time to take millions of dollars of fire-

fighting equipment out of Canadian airports where the risk of dying from fire is almost zero – so that we can either invest that money where we will save lives or stop borrowing that money on the world bond market. Dollars spent in air-sea rescue save hundreds of lives while the same dollars spent at airports save none.

We need to stop spending money where it does not make a difference to saving or protecting lives and spend it where we get a bang for the buck. This risk-management approach is needed in many areas of public spending – for example, to shift spending toward preventing cancer and away from treatments that do not change the probability of death. Cancer mortality is the same now as it was in the 1950s, and we are spending billions of dollars to stave off death rather than to support health.

As for the anxiety expressed by pilots and flight attendants, may I remind them that they are safer in an airplane than in a car. And

so are their passengers. Planes crash and burn rarely, and crashes almost never occur on the runway.

Crashes are newsworthy because people die in groups and not as individuals like they do in cars, in industrial accidents, or from smoking.

We cannot buy all things with our limited public funds. In past years regulators have established fat budgets and spent money without assessing the long-term impact – now the nation is at risk. My hope would be that every federal and provincial government would take heed of the Transport decision to spend smarter and spend less. Airports are just the beginning. Every Canadian life should be equally guarded against risk: on a farm, in a school, on a highway, in a logging camp, or for a cop on the beat.

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EM9508: *The Globe and April 5, 1995, pages A1, A5*

Firemen removed from 15 airports

Safety reduced, unions warn

**BY HUGH WINSOR
Parliamentary Bureau**

OTTAWA – The Department of Transport removed firefighters from 15 smaller airports and trimmed funding for emergency response services at 10 others last Saturday, a budget-related cutback that has led to accusations of reduced safety for travellers and flight crews.

Canadian pilots joined displaced firefighters yesterday to protest against what they call a compromising of standards to comply with the government's fiscal agenda. That accusation was quickly rejected by Transport Minister Douglas Young.

"Emergency response services at the affected airports will now fall below the International Civil Aviation Organization and other commonly accepted standards," said Captain Brian Boucher, the Canadian Air Line Pilots Association's expert on ground services and firefighting.

Canada's major international airports, the

only ones strictly subject to the ICAO standards, are not affected by the cutbacks and would be forced by international pressure to maintain those standards in any case, Capt. Boucher said.

While other Canadian airports are required only to meet standards set by Transport Canada, the ICAO rules have been a reference point.

The ICAO standard advises that emergency response vehicles should be able to reach the end of the farthest runway in not more than three minutes, but ideally in two minutes in normal conditions. Transport Canada has adjusted its own requirement to apply only to the midpoint of the farthest runway, usually a shorter distance from the firehall.

The Union of Canadian Transport Employees, which represents 500 airport firefighters, is arguing safety in a bid to reverse the cuts, and has formed a coalition of unions representing most workers in the aviation industry.

The cuts amount to "playing Russian roulette" with the lives of air travellers and workers, the coalition said yesterday.

Emergency response services at the 15 airports where firefighters have been eliminated will now be provided by municipal fire departments, which do not have firefighters trained in the specialized techniques for dealing with airplane fires.

Some of the municipal services are as much as 30 minutes away from the airports.

Transport Canada has reacted strongly to try to thwart the union's public-awareness campaign, warning that any department employee caught distributing publicity material will face disciplinary action.

Employees are prohibited by Transport Canada policy from publicly criticizing government policy, Victor Barbeau, the assistant deputy minister responsible for airports, said in an interview yesterday.

"That rule applies to the whole civil service," he added, arguing that only elected

Figure 7.15. DISCRETE PROBABILITIES: Public Perceptions of Risk (continued 1)

officers of public service unions have the right to comment on government policy.

The pilots and the other union groups are stressing the importance of having firefighters at the airports because response time in the case of aircraft fires is crucial. They also say 75 per cent of all air disasters occur on the runway within 500 feet of the centre line and within 3,000 feet of the takeoff or landing point.

"As an airline captain, I want to know that properly trained firefighters can be there within two minutes, or it's all over," Capt. Boucher said.

The pilots' representative was supported by Denise Hill, president of the airline division of the Canadian Union of Public Employees, which represents 7,500 flight attendants.

"The public perception of air travel in Canada is that it is safe and in the event of an emergency, flight attendants and trained airport firefighters in sufficient numbers will assist passengers to evacuate the aircraft and rescue survivors from a crash. The reality is quite different," she told the news conference.

Mr. Young discounted the safety allegations in a prepared statement. "There is no question that Transport Canada will continue to

maintain the high level of aviation and airport safety Canadians have come to expect. Canada's air transportation system is safe."

He also said his department's proposed regulations on emergency-response services will be supplemented by new aviation rules to enhance safety and security.

Mr. Barbeau said on-site firefighting is only one small part of the overall system of air safety.

Each of these airports will have an emergency response plan, which includes providing early warning to local fire departments if a plane is experiencing difficulties.

The department has been planning the cutbacks for a year and has been consulting all sectors of the industry, Mr. Barbeau said. "We want the right number of people with the right equipment in the right location depending on the degree of risk. We are trying to assure the very best degree of safety while putting in motion a level of service which makes some sense."

Even with the cutbacks, 94 per cent of air travellers will pass through airports with on-site emergency services. But in 21 regional airports, including places such as Victoria and London, Ont., that service will be pro-

vided by a single firefighter with a single foam-spraying truck.

Mr. Barbeau also disputes the union contentions that reducing the size of crews reduces safety. The principal obligation of the firefighters is to provide a fire-free path for passengers and crew leaving the plane and the department will be purchasing new trucks with increased foam capacities in single-vehicle stations.

Where firefighters were eliminated

Here are the 15 airports that lost their firefighters on Saturday, a coalition of unions says:

Newfoundland: Wabush.

Nova Scotia: Yarmouth.

Quebec: Mont-Joli, Sept-Iles, Val D'Or and Baie-Comeau.

Manitoba: Churchill and The Pas

Alberta: Fort McMurray and Lethbridge.

British Columbia: Fort Nelson, Quesnel, Sandspit, Smithers and Williams Lake.

EM9512: The Globe and April 13, 1995, pages A1, A14

Risk-free world within reach, Canadians say

Experts at pains to explain optimism found by survey, which also shows what things people see as scary

BY STEPHEN STRAUSS
Science Reporter

More than 60 per cent of Canadians polled in a Health Canada survey believe that "a risk-free environment is an attainable goal in Canada."

However, in a complementary survey of 150 Canadian toxicologists, only 19 per cent of these poison experts shared their fellow citizens' optimism about a risk-free future world.

Results and comparisons of the two surveys will be published in three scientific papers to appear this year in the *Journal of Risk Analysis and Uncertainty* and in the journal *Risk Analysis*.

In addition to their optimism about humans' ability to cast health risks out of their lives, the 1992 survey of 1,506 Canadians produced a plethora of other data about how we feel about scary things.

For example, with the exception of heart pacemakers, women ranked every one of 38 potential areas of danger as riskier than men. In many areas the differences were

dramatic. Women surpassed men by 23 percentage points (64 to 41 per cent) in thinking sunbathing is highly risky.

There was a difference of more than 15 percentage points between men and women in their perception of high risk in areas as diverse as crime and violence, AIDS, motor-vehicle accidents, stress, ozone depletion, malnutrition, nuclear power plants, drinking alcohol, chemical pollution and waste incinerators.

The survey, which is statistically significant, shows in a less surprising vein that the older Canadians get – 55 and up – the more dangerous to their health they perceive the world to be. In particular they think street drugs, crime and violence, breast implants, alcohol and pregnancy, sun tanning, asbestos, video display terminals, drinking alcohol and cigarette smoking are much riskier than do people under 30.

Young people out-fear their elders only when it comes to heart pacemakers, pesticides and various forms of chemical pollution.

People also exhibited marked differences in evaluating threats to them and their fami-

lies, compared with threats to the Canadian public as a whole. Nuclear power and nuclear waste rank at the top of perceived personal health risks even when respondents live in British Columbia or the Prairies where nearly a nuclear generator exists.

There was also one regional difference. Quebec inhabitants find the world significantly riskier in many categories, including street drugs, AIDS and nuclear wastes, than do people in the rest of Canada.

The survey also shows how little Canadians are willing to increase their health risks in order to improve the economy. About 70 per cent of those surveyed disagreed strongly or somewhat with any suggestion that they should accept some risks to health to strengthen the economy.

One of the most striking aspects of the studies was the difference between the risk experts and the lay public. While the toxicologists' study was not as statistically robust as the general survey, attitude differences leaped out.

Nearly 90 per cent of the scientists believe

that natural chemicals could be just as harmful as manufactured ones. Almost two-thirds of the men and women on the street believe the opposite.

More than 70 per cent of the toxicologists believe that fruits and vegetables contain natural, cancer-causing substances. Almost an exact number of Canadians at large disbelieve it.

The ranking of dangers also varies significantly. Cigarette smoking is at the top of both lists and recognized as a high danger by close to 60 per cent of both groups. However, the public at large believes ozone depletion is the next biggest risk to them, ranking nearly as high as smoking. But among the experts, diminished ozone is only the 10th most risky thing, and only about 20 per cent think it is highly dangerous.

With the exception of cigarettes and motor-vehicle accidents, Canadians at large find the world a riskier place than do the experts. In addition to ozone, differences of more than 25 per cent show up in risk evaluations of chemical pollution, street drugs, nuclear wastes, food additives, pesticides in food, breast implants, AIDS, stress, PCBs and dioxin.

In an area of significant agreement, more than 60 per cent of the experts, like about 70 per cent of the public, refuse to accept health risks to strengthen the environment.

There are a number of explanations for the wide differences between men and women and between risk experts and amateurs, said Paul Slovic, a psychology professor at the University of Oregon who co-wrote the papers. He believes that the Canadian public's faith in a risk-free future reflects their naiveté.

"My hunch is that they haven't thought out what it would take to achieve zero risk," he said. It is also possible that people skipped right over the word "attainable" when thinking about a goal.

Prof. Slovic said he is not sure what accounts for the difference between men and

women in Canada.

However, he pointed to sex and ethnicity data from a similar survey in the United States showing that black women and black men exhibit very little difference in their weightings of risk. And when the white population was looked at more closely, it turned out that a relatively small number of white males – about 30 per cent – have very different attitudes from the rest of the population. It is their enthusiasms that skew the sex difference.

This group trusts science and industry, thinks experts should make decisions, and doesn't think that the country is better off when people are treated more equally. "I call it the Newt Gingrich syndrome," Prof. Slovic said.

In a contrary vein, other U.S. data show that there are significant risk-assessment differences between men and women scientists, with women finding the world a riskier place. This has led to suggestions either that women are more likely to be taught that the world is a dangerous place, or that as nurturers and protectors of children women have become biologically more fearful than men.

The differences between experts and the public reflect differences in both experiences and in training. The public reacts to the drama of news reports and natural disasters, while the scientists look at the numbers, Prof. Slovic said.

"What this shows in part is that the public point of view won't be changed simply by throwing more numbers at them."

How we view risk

Percentage of Canadians in a 1992 survey who said they considered these a high risk to the public:

	Men	Women
Cigarette smoking	56	65
Street drugs	51	62
Breast implants	51	66
Ozone layer depletion	50	68
Chemical pollution	45	61
Stress	45	63
Crime and violence	43	64
Nuclear waste	42	54
Suntanning	41	64
AIDS	39	58
Motor vehicle accidents	39	57
Food additives	31	42
Pesticides in food	30	44
Drinking alcohol	26	42
Asbestos	25	26
Nuclear power plants	22	39
Food irradiation	17	26
High voltage power lines	16	27
Mercury in dental fillings	11	14
Medical X-rays	10	14
Tap water	9	15
Video display terminals	8	12
Heart pacemakers	7	6
Contraceptives	6	12
Contact lenses	2	5

- ① Comment critically on the use of the word 'statistically' in the first sentence of the third paragraph of the editorial EM9513 reprinted on the first side (page 7.49) of this Figure 7.15: *She pointed out that the hue-and-cry over the reduction of firemen at Canadian airports was statistically dumb.*
- ② On the third side (page 7.51) of this Figure 7.15 in the second paragraph of the left-hand column of the article EM9508 *Firemen removed from 15 airports*, it is stated that: *..... the ... groups are stressing the importance of having firefighters at the airports because response time in the case of aircraft fires is crucial;* comment critically on this statement in light of the following sentence in the same paragraph: *They also say 75 per cent or landing point.*
 - Which sentence in Professor Fulton's letter best addresses this matter? Explain briefly.
- ③ Comment critically, from a statistical perspective, on the phrase: *The survey, which is statistically significant, ...* in the first sentence of the third paragraph of the middle column on page 7.51 of the article EM9512 reprinted overleaf and above.
 - Suggest an improved wording for this sentence.