Figure 2.2d. SURVEY SAMPLING: Introductory Illustrations 2

For the three investigations in the four newspaper articles EM9519, EM9501, EM9524 and EM9528 reprinted in this Figure 2.2d, the Plan involves a *census* (*i.e.*, a complete count) – all deaths in Canada in the first article, all traffic fatalities in Canada in the second article, and all traffic fatalities in Ontario in the last two articles. These Plans are to be *contrasted* with those of the investigations in the preceding four shorter and six longer articles (in Figures 2.2a, 2.2b and 2.2c), which involve *samples.* Of interest in the present context is the statistical issues which are *different* in these two Plan types (sampling and taking a census).

EM9519: The Globe and Mail, June 2, 1995, page A4

Rising deaths among infants stun scientists

Unexpectedly high mortality rate may be signal, demographers warn

BY ALANNA MITCHELL
The Globe and Mail

For the first time, Statistics Canada has recorded a far higher number of deaths among Canadians than it expected, including the first rise in 31 years in the infant mortality rate.

The figures, published yesterday, left those who follow population trends flabbergasted, so contrary are they to what had been predicted.

"One wonders whether this is kind of like the canary they used to let loose in the mine", said Bob Glossop, co-ordinator of programs and research at the Vanier Institute of the Family in Ottawa. "Could this be the first indication that the environment is becoming increasingly toxic?"

The jump in deaths between 1992 and 1993 has pushed the percentage increase to the highest level on record. In fact, it is the greatest increase, comparing one year to the next, since the devastation of the Second World War.

According to Statscan's predictions, based on the age and sex structure of the population, the number of deaths ought to have risen 3 per cent between 1992 and 1993. Instead, it rose 4.3 per cent. To people who follow population trends, this is an enormous difference.

In all, about 600 more men and 1,900 more women died in 1993 than expected, said Statscan, for a total number of 204,912 deaths. In 1992, the number was 196,535.

Statscan analyst Kathryn Wilkins said that some of the unexpected deaths among women were the result of smoking-related diseases. Among men, some stemmed from HIV-AIDS, diabetes, lung disease and stroke. The year 1993 was also a bad year for influenza in March and April, which may also have caused the jump in deaths.

The infant mortality rate rose to 6.3 deaths for every 1,000 live births in 1993 from 6.1 deaths in 1992. The rate, considered the quintessential indicator of a nation's social health, last rose in 1962, Ms. Wilkins said. She said the rise was largely due to deaths of babies in the first week of life.

Partly as a result of this rise, the life expectancy of someone born in 1993 was actually lower than that of someone born the year before. For males, the figure stood at 74.8 years, 0.03 of a year less than in 1992. For females, it was 81.0 years, a loss of 0.18.

"It caught our attention", Ms. Wilkins said of the infant mortality rate. She added that Statscan will not know whether this is a blip or the beginning of a new trend until data for the next few years are in.

Reversals in such long-standing trends are rare in population studies. Even rarer is when they are also unexpected, as this one was. Although demographers said they cannot predict trends, and these figures might be an anomaly, the fact that such crude indicators as rate of infant mortality and numbers of deaths were being affected was cause for alarm.

"The overall fact of the increase is an indication that the delivery of health and social programs is really in trouble", said Ellen Gee, chairwoman of the sociology and anthropology department at Simon Fraser University in Burnaby, B.C.

Roderic Beaujot, a sociologist at the University of Western Ontario in London, said it is very unusual in First World counties to see an increase in the infant mortality rate and a decline in life expectancy. He noted that when this happened in the former Soviet Union – although to a much more pronounced degree – it was thought to be a sign of the social disarray there.

'One wonders whether this is kind of like the canary they used to let loose in the mine. Could this be the first indication that the environment is becoming increasingly toxic?'

Dr. Gee noted that infant mortality is tied to two main factors: access to health care and nutrition in the pregnant woman. Since access to health care is good for most non-aboriginal women, the answer to the rise may lie in poor nutrition for would-be mothers.

Lawrence Nestman, director of the School of Health Services Administration at Dalhousie University in Halifax and the author of a book on the delivery of health care in Canada, said he doubts the rise in deaths is the result of health care, which is still what he called a "Cadillac" service.

Rather, he said, it may be the fallout from several years of economic unceraintly. The link between unwanted unemployment and poor health has long been established, he said.

"I think the chickens are coming home to roost", he said.

The articles EM9501 and EM9524 on pages 2.24 and 2.25 are also used in Figure 11.1 of the STAT 231 Course Materials.

1 In the fifth paragraph of the article EM9519 reprinted above, it is stated that Statscan predicted a rise in the total number of deaths in Canada of 3 per cent between 1992 and 1993 but that the *actual* rise was 4.3 per cent. In light of this (and other) information in the article, discuss critically, from a *statistical* perspective, the statement: *The difference between the predicted and actual number of deaths in Canada in 1993 is so small proportionately (1.3 percent) that it is not statistically significant and is most likely due to chance.*

(*continued overleaf*)

2 In the sixth paragraph of the article EM9519 reprinted overleaf on page 2.23, the total numbers of deaths in Canada in 1992 and 1993 are given. Outline, in point form, the *measuring* issues that are raised by these two numbers.

3 List the explanations that are given in the article EM9519 reprinted overleaf on page 2.23 for the unexpected rise in the total number of deaths in Canada in 1993; include with each explanation the name and affiliation of the person who suggested it.

- On the basis of the information given in the article, rank the three explanations in order of plausibility; justify your ranking briefly.

EM9501: The Globe and Mail, March 28, 1995, page B23

Belts get credit for drop in deaths

Dramatic improvement in the fatality rate came when Canadians began to buckle up

BY PATRICK SULLIVAN
Special to The Globe and Mail

Most auto makers enjoyed robust profits in 1994, and by year's end the Canadians who drive their products were enjoying a dividend of their own – the country's lowest traffic-fatality figures in 39 years.

Transport Canada estimates that 3,021 motor vehicle drivers, passengers, motor cyclists and pedestrians were killed on Canada's roads in 1994, a 16.1-per-cent decrease from the 3,601 deaths recorded in 1993. It is the country's lowest total since 1955.

The department's data indicate that the 1994 decline is part of a general trend that began after 1973, when the record of 6,706 road deaths was set. By 1980, the annual total had dropped to 5,461 deaths, and by 1990 it fell to 3,966.

Chris Wilson, director-general of road safety and motor vehicle regulation at Transport Canada, says there are several reasons for the decrease but most of the credit has to go to increased seat-belt use.

He said surveys show that more than 90 per cent of drivers and passengers routinely buckle up today, and when seat-belt usage gets that high even most high-risk drivers, such as young men, are wearing belts.

"That is when you begin to see dramatic improvements," he said. As recently as 1986, surveys showed that only 63 per cent of Canadians were wearing seat belts.

The decline in traffic fatalities is most visible in hospital emergency rooms. "I personally have noticed it, and I think most emergency physicians would tell you the same thing," said Dr. Alan Drummond of Perth, Ont., a past president of the Canadian Association of Emergency Physicians.

Jan Ahuja, chief of emergency medicine at Ottawa's Civic Hospital, said seat belts are one of emergency doctors' best friends. In 1974, the year he graduated from medical school, their use was not mandatory and 6,290 people died in collisions. He attributes most of the 52-per-cent drop since then to the belts.

"The most severe injuries we see involve people who get in trouble by hitting a windshield or steering wheel, or being ejected following a collision – the very things a seat belt prevents," he said.

Safety experts esimate the belts have prevented 16,000 deaths and 300,000 injuries in Canada since 1980. Transport Canada says usage is now high in all provinces. In a 1994 survey, Newfoundland led with 95.7 per cent usage, and Manitoba came last at 86.1 per cent. The national average was 90.1 per cent.

Mr. Wilson said air bags have had an impact on traffic safety, but it is still relatively small because fewer than one in five cars on the road in 1994 were equipped with them.

"Where we do expect them to make a difference is in terms of major injuries that cause long-term problems, such as lost jobs, lifestyle changes and marriage breakdowns. Those numbers haven't been declining very quickly – there were 27,000 major injuries in 1985 and 25,000 in 1992. The decline is encouraging, but it's still small. I think air bags may have an impact by turning major injuries into minor ones."

Douglas Beirness, director of information for the Ottawa-based Traffic Injury Research Foundation, thinks traffic fatalities may now be approaching their lower limit.

He said the auto industry recognized that customers are interested in safety features and moved to provide them, but whether drivers use them properly is another question. Anti-lock brakes, which are now standard on many cars, were expected to reduce the number of accidents because they allow drivers to maintain steering control when brakes are applied, he said, "but this hasn't happened because people don't know how to use them properly."

And regardless of safety improvements, Dr. Ahuja said, a huge problem remains. "The majority of accidents we see are still related to alcohol use, and if I could make one recommendation for change it would be in this area."

A recent study, co-written by Dr. Beirness, supports that view. It found that almost half of all drivers killed on Canadian roads in 1991 had been drinking, and 62 per cent of them had a blood-alcohol level of at least 150 milligrams a decilitre; the legal limit is 80 mg/dl. The proportion of heavily impaired drivers has actually increased since the 1970s, the study indicated.

Until this drunk-driving problem is solved, many physicians say, it won't matter how safe auto makers make their cars.

4 Describe concisely the *Question* that underlies the article EM9501 reprinted above.

- Identify the *response* variates mentioned in the article and the *focal* (explanatory) variate.

5 Explain briefly whether the data on annual traffic fatalities in Canada come from investigations with *experimental* or *observational* Plans, and indicate what *statistical* issue is raised by this matter in the context of the article.

6 In our use of the FDEAC cycle, we distinguish (up to) six categories of error – study, non-response, sample, measurement, model and comparison. Outline, in the order you consider to be of *de*creasing importance, the six categories of error in the figure of 3,021 traffic fatalities in Canada in 1994, given early in the second paragraph of the article EM9501 reprinted above.

Figure 2.2d. SURVEY SAMPLING: Introductory Illustrations 2 (continued)

EM9524: The Globe and Mail, June 22, 1995, page A10

ANALYSIS / *Mike Harris hates it and promises to kill it, but accident statistics and public opinion may be vindicating the NDP's notorious pet project*

Taking more than a passing glance at photo radar

"Following a thorough review of safety statistics, both here in Ontario and elsewhere, we have concluded that photo radar is simply the government cash grab we had always expected."

– Mike Harris

BY MARTIN MITTELSTAEDT
Queen's Park Bureau

Among the NDP policies that irk in-coming Ontario premier Mike Harris the most is photo radar.

The Progressive Conservative Leader has denounced the device as a government revenue grab disguised as a highway safety measure. He has suggested that photo radar is another step along the road to a society run by an all-intrusive state where law enforcement officials keep tabs on people's every move.

But Mr. Harris may have the wrong story on photo radar.

The new devices haven't turned out to be a big revenue source for the government. And although many factors affect highway safety, the introduction of photo radar has coincided with the first steep drop in the number of fatalities on Ontario roads in four years.

And perhaps even more surprising than the reduced death toll is the rising public acceptance of photo radar. A recent poll by the Environics Research Group found that most Ontario residents approve of the devices being used to fine speeders.

Ontario Provincial Police began using photo radar last Aug. 15, part of a pilot project running to the end of this month. To date, police have issued 240,000 tickets for fines totalling $16-million. The NDP said photo radar would raise as much as $200-million annually.

The safety argument will be answered later this year, when the Ministry of Transport releases a report on the pilot project. A report by the ministry earlier this year indicated that the devices have already had a major impact by causing drivers to slow down.

Mr. Harris made his pledge to drop photo radar in March, basing his opinion on only four months of accident statistics at one OPP detachment and at one OPP district. The figures he cited seemed to show that photo radar had no effect on safety.

But something did occur to make Ontario roads safer last year. According to figures compiled by the OPP, the number of highway deaths they investigated plunged to 634, a drop of 118 (16 per cent). It was the first major decline in the fatality toll in four years.

The number of deaths had remained stable in the first four years of the decade, averaging 750 annually.

The reason for the sharp drop in the death toll is open to interpretation. Highway carnage has been in a long-term decline. Experts have attributed past drops in death rates to seat-belt use, campaigns against drunk driving and the introduction of safety features such as air bags.

Determining the precise effect of photo radar, given these other factors, is difficult. Last year also marked the start of graduated drivers licences in Ontario, meaning that inexperienced drivers must wait longer to have full use of the roads.

Mr. Harris said he opposed photo radar because alcohol is the key factor in 40 per cent of all driver fatalities. Excessive speed was cited in 18 per cent of fatal collisions.

Mr. Harris's statistics came from the 1992 Ontario Road Safety Annual Report by the Ministry of Transport, which covers all accidents, including those on city streets.

But looking only at highways, which is where photo radar is in use, the picture is completely different.

In fatal accidents investigated by the OPP over the past five years – mainly on highways – speed was the most important contributing factor. It was cited in 51 per cent of deaths in 1989, 44 per cent of deaths in 1990, 56 per cent in 1991, 42 per cent in 1992, 28 per cent in 1993 and 25 per cent in 1994.

It was only last year, for the first time in five years, that alcohol exceeded speeding as a cause of death, being cited as a contributing factor in 28 per cent of fatal accidents.

A politician hunting for easy votes might have found it in offering to cancel photo radar two years ago, when the idea was first advanced by provincial officials and was deeply unpopular.

But an Environics poll conducted in April found that a majority of Ontarians, 55 per cent, approved of used photo radar to fine speeders, while 44 per cent were opposed.

"We've actually seen support climbing at a very slow but steady pace since 1993, when we first started asking the question", said Jane Armstrong, a pollster at Environics.

The current poll results are an almost exact reversal of the figures from 1993.

Part of the reason for the growing support is that the longer photo radar is on provincial highways, the more used to it drivers become. Ms. Armstrong also said many respondents approve of the reduction in highway speeds that have been the major observable effect of the introduction of the technology.

The poll also found major variations in support and opposition to the devices.

Women are more strongly in favour of photo radar than men, while the strongest opposition is among young males aged 18 to 24, the group usually found to be the worst drivers in accident surveys. "You get the image of the young male not being too keen", Ms. Armstrong said.

7 Describe concisely the *Question* that underlies the article EM9524 reprinted above.

- Identify the *response* variates mentioned in the article and the *focal* (explanatory) variate.

Compare and contrast your answer with that to Question 4 on the facing page 2.24.

- Name the four *confounding* variates mentioned near the middle of the article.

8 Using information in the article EM9524 reprinted above, comment on the time period for the latest reduction in the number of fatalities on Ontario roads and the time period when photo radar was in operation.

9 The term *stratifying* in statistics means 'subdividing'. Identify the stratification of the 1994 Ontario traffic fatality data mentioned in the article EM9524 above, and explain briefly the contribution it makes to answering the Question being asked.

(*continued overleaf*)

EM9528: The Globe and Mail, June 29, 1995, page A8

Photo radar gone soon, Harris says

Ontario's new goverment just awaiting measures to improve highway safety

BY JAMES RUSK
Queen's Park Bureau

TORONTO – Photo radar will be dead in Ontario as soon as the new Progressive Conservative government prepares a package of measures to improve highway safety, Premier Mike Harris announced yesterday.

The measures, which will not include photo radar, are being prepared by the Minister of Transportation and the Solicitor-General and will be presented to the cabinet next week.

If they are approved, "it will not take very long" before Ontario's four photo radar vans are pulled off the highway, Mr. Harris said after his government's first cabinet meeting yesterday.

Former premier Bob Rae, whose NDP government started the photo radar trial, questioned the government's decision. "I think it is unwise", Mr. Rae told reporters. "I think it puts human lives at risk, which is not something that a reasonable government would want to do."

Although the radar vans went on the road only last summer and the province's trial of the system was still incomplete, Mr. Harris said the cabinet had decided that the two ministries behind the trial had not been able to prove the case for photo radar.

"What we have is that they [the two ministries] have no evidence to present to us and could not present us with anything that indicated that photo radar was responsible for reducing accidents, or reducing death, or reducing injuries", he said.

Safety officials have said removing the photo radar vans from the road after less than a year would provide less time than needed to evaluate the technology.

Government data show there was a sharp drop in highway deaths last year on roads patrolled by the Ontario Provincial Police, which is the only police force in Ontario to use photo radar, a system of camera-equipped vans that catch speeders by photographing their licence plates. The drop from about 750 deaths a year to 637 last year coincided with the introduction of photo radar, a graduated licencing plan for new drivers and more airbags in new automobiles.

Fatal traffic accidents investigated by OPP

YEAR	ACCIDENTS	DEATHS	INVOLVING SPEEDING	INVOLVING ALCOHOL
1989	729	867	371	188
1990	614	744	270	129
1991	628	741	354	172
1992	645	758	273	171
1993	641	755	180	133
1994	553	637	141	154
1995*	182	205	41	28

*to May 31

Source: OPP Traffic and Marine Branch

Mr. Harris did not give reporters any of the information on which the cabinet reached its conclusion about the efficacy of photo radar. But he said that it, and the information that will be developed as data are compiled from the trial of photo radar, will be made public "in the fullness of time."

"We obviously concluded that the over-riding consideration for photo radar, as opposed to other methods of [speed] control, was cash revenues to the province. We are not interested – in making a decision on safety on the highways – in using cash as the deciding factor."

John Bates, founder of Mothers Against Drunk Driving Canada, said "it's really dumb to cancel this thing."

He said that "the only people who want to cancel photo radar are the people who speed. They are the same people who pass you on the right shoulder."

Mr. Bates noted that the cabinet made its decision on the very day that an authoritative insurance-industry publication in the United States published an article that says photo radar is helping to improve road safety in Ontario.

While in opposition, the Conservatives said that photo radar, rather than being an effective safety measure, was only a revenue grab by a cash-hungry government and promised to abolish it as soon as the party took office.

Mr. Rae said the NDP government made the decision to use photo radar to fight speeding because they had been advised by the police that it was the the most up to date and effective technology available.

The decision to end its use, Mr. Rae said, was "all about the ideology of this government, the ideology that Mr. Harris has."

Referring to a recent public-opinion poll indicating that a majority of Ontarians now support photo radar, Mr. Harris said yesterday he interprets this poll as meaning that most Ontarians want the government to take steps to improve safety on the highways.

10 Compare and contrast the explanations given for the recent reductions in the annual number of traffic fatalities in Canada and in Ontario in the articles EM9501 and EM9524 reprinted on the second and third sides (pages 2.24 and 2.25) of this Figure 2.2d.

- Describe briefly the primary *statistical* issue that is involved in any difference in explanation.

11 Describe briefly what you consider to be the main *difference* in the *statistical* issues that arise in the *sample surveys* described in the preceding four shorter and six longer articles (in Figures 2.2a, 2.2b amd 2.2c), and the three investigations based on taking a *census* in this Figure 2.2d.