

CHAPTER 6. DISCUSSION

This study was prompted by several inter-related concerns expressed by residents in the Cooley peninsula. These include a perceived high incidence of cancer in the area; the perception that cancer incidence is on the increase; and a concern that the BNFL installation at Sellafield may be affecting people's health. This chapter begins by reviewing the extent to which the findings reported here support these concerns. The chapter concludes with a brief discussion of some other factors which may influence cancer rates in Louth. As in the other chapters, a question and answer format is adopted in the interests of clarity.

Does Louth Have A High Incidence Of Cancer?

The crude death rates and crude morbidity rates suggest that the cancer incidence in Louth is not too different from the national average. However, these crude rates are deceptive because they do not take any account of the fact that Louth has a higher percentage of younger people. Age standardised and age specific rates therefore provide a more reliable guide. The age standardised mortality ratios indicate that Louth had about 15 per cent more male deaths and 6 per cent more female deaths than might be expected compared with the national average over the period 1970 to 1999. It was ranked 4th worst for males and 5th for females (Table 2). The age standardised incidence rates based on the National Cancer Registry data for the period 1994 to 1997 likewise indicate Louth has a high incidence. The incidence rate for males was 4 per cent above the national average whilst the female rate was 6 per cent above. Louth was ranked 6th for males and 7th for females (Table 9).

The age specific mortality rates indicate that this excess mortality is not confined to one or two age groups but is found at every age (except 5-14) for males and every age except 35-44 and 65-74 for females (Table 3). The age specific incidence rates depict a similar situation. The male rates were again higher in Louth for most ages, but they are more or less the same as the national rates for the 5-14, 15-24, and 45-54 age groups, whilst they are lower for the 55-64 age group. The female rates were lower in Louth for 5-14, 35-44 and 45-54 age groups but are higher for all other ages (Table 10). Both the mortality and morbidity data suggest a significantly increased risk associated with females aged 25-34. The morbidity data suggest that the 15-24 year olds also have a higher risk.

The mortality also indicate that cancer is more frequently the cause of death in Louth than elsewhere at most ages for both males and females (Table 4). Overall cancer accounted for 22.0 per cent of all male deaths in Louth between 1970 and 1999 (compared with 20.7 per cent nationally) and 21.5 per cent of all female deaths in Louth (compared with 20.4 per cent nationally). These percentage differences may appear small, but they translate into a substantial number of deaths over a 30 year period.

No matter what way one looks at the figures, there can be little doubt that the perception of an above average risk of cancer in Louth is in fact an accurate reflection of the real situation.

Does Cooley Have A High Incidence Of Cancer?

The concerns originally expressed to the author were about cancer in Cooley as opposed to Louth in general. So does the evidence suggest that Cooley has a particular problem?

The mortality data do not allow rates to be compared for small areas. However, information was published in the *Annual Report on Vital Statistics* on deaths in Drogheda M.B. and Dundalk U.D. each year until 1995. This allows standardised mortality rates to be calculated for these two towns and, by a process of elimination, for the rest of the county (including Cooley). These calculations suggest that Drogheda and

Dundalk had a substantial number of excess deaths from cancer in the period 1970 to 1999, but the rate for the rest of the county was more or less the same as the national average (Table 5).

The morbidity data from the National Cancer Registry permit a much more detailed geographical analysis, but the results need to be treated with caution because the data were only available at the time of analysis for a five year period. Nevertheless, these data support the impression that Drogheda has a very high incidence, although the standardised incidence ratios for Dundalk are not much different from the national average (Table 11). The ratios for other parts of Louth varied, but no area exhibited markedly elevated rates for both males and females. The most striking feature, however, is that Cooley had the lowest standardised incidence ratio for males (79.5) and the second lowest for females (92.5). Both ratios are well below the national average.

The main conclusion therefore is that the perception of a high incidence of cancer in Cooley is not supported by available data.

Have Cancer Rates Increased In recent Years?

The time period covered by the morbidity data available from the National Cancer Registry is too short to permit any firm conclusions to be made about trends in morbidity. However, despite significant fluctuations from one year to the next, the mortality data cover a long enough time period to allow some conclusions to be drawn about long-term trends.

The crude death rates exhibit a long-term trend towards an increase, especially for females (Figure 5 and Figure 6). The percentage of all male deaths and the percentage of all female deaths caused by cancer have also increased since the 1970s (Figure 11 and Figure 12). These trends suggest a deteriorating situation. However, the age standardised and age specific rates tell quite a different story.

Male age standardised rates declined both nationally and in Louth, but the rates in Louth fell at a faster rate than the national rate (Figure 9). This has two implications. First, the risk of dying from cancer at a given age has generally declined for males. Second, the number of excess deaths in Louth has declined, bringing Louth more into line with the national average. Females age standardised rates also display a downward trend, both in Louth and nationally (Figure 10). However, the rate of improvement for females in Louth is much less than that for males, and has merely kept pace with the national trend. There is therefore little evidence to suggest a narrowing of the gap between the higher Louth rates and national rates for females. Nevertheless, the overall situation for females in Louth has been one of improvement, albeit at a slower rate than for males.

The age specific death rates provide more detail on these trends. The age specific death rates for males in Louth declined for all ages below 65 (except the 15-24 age group where the numbers are very small) (Table 6). Further, the rate of decline for all ages between 25 and 64 was higher than the national average. However, against this, the age specific death rate for males aged 65-74 and 75 or over increased both in Louth and nationally. The rate of increase was slightly higher in the 65-74 age group in Louth, but much lower than the national increase in 75 or over age group.

The age specific death rates for females in Louth declined for most age groups, but the rates of decline in Louth were not much different to those at national level. Women in the two oldest age groups fared better - the age specific death rate declined for females in Louth in the 65-74 age group, whereas the rates increased at national level, and although they increased in Louth for women aged 75 or over, they did so at a slower rate than nationally. However, the rates for females aged 25-34 and 35-44 increased in Louth, whereas they declined nationally. This, as noted previously, is a disturbing development.

Overall the data do not support the perception of a deteriorating situation. The crude death rates and the

percentages of people dying from cancer have increased, but this is because the population is now on average older than it was in the past. More people now survive to an older age due to a decline in deaths from some of the other major causes of death (especially coronary heart disease), whilst a decline in the birth rate in the early 1980s means there are proportionately fewer people in the younger age groups. Given that the risk of dying from cancer increases with advancing age, a higher percentage of the total population are now at risk of dying from cancer in a given year (causing the crude death rate to rise), whilst the fact that people are now living to an older age increases the likelihood of cancer being the cause of death.

Given that cancer accounts for a growing percentage of all deaths, it is easy to understand how the perception of a deteriorating situation might arise. The age specific rates indicate that there was an increase in the rates for young adult females and for older people of both sexes. The increases in the age specific rates for those aged 75 or over may in part be a function of the trend towards an ageing population, due to the fact that this age group is itself 'ageing' (i.e. it now contains more elderly people than before), resulting in an increased risk of cancer. Nevertheless, the predominant trend for most ages and for both sexes was towards improvement. These improvements were especially marked for males aged 55-64 and females aged 65-74.

Does Sellafield Cause Cancer In Louth?

The available information does not permit a definitive answer to this question. All the evidence, either for or against, is extremely circumstantial.

If nuclear emissions from Sellafield were a cause of cancer on this side of the Irish sea, then one would expect to find higher rates of cancer mortality and morbidity in the areas which might be assumed to be most exposed to these emissions. The fact that the cancer mortality and morbidity rates for Louth are above the national average would therefore be consistent with the 'Sellafield hypothesis'. Likewise, if nuclear emissions from Sellafield were a cause of cancer on this side of the Irish sea, then one would expect cancer rates to decline with any reduction in the emissions from Sellafield. British Nuclear Fuels Limited claims to have considerably reduced the emissions from Sellafield over the past few decades.¹⁹ The decline in cancer mortality in Louth since 1970 would therefore again be consistent with the Sellafield hypothesis.

However, some of the findings reported here also cast doubts upon the Sellafield hypothesis. For example, although the mortality and morbidity rates for Louth are above the national average, they are not uniformly high across the county, nor are they highest in the areas one might expect to have greatest exposure. Most parts of Louth do not in fact have above average rates of mortality or morbidity. The mortality rates were only found to be above the national average in Drogheda and Dundalk, whilst the morbidity rates only appear to be substantially above average for Drogheda. Further, the morbidity rates for Cooley – the area one might expect to be most affected by discharges from Sellafield – were well below the national average. It is possible that the observed differences in mortality and morbidity rates may have been caused by inaccuracies in the data. For example, cancer patients normally resident in Cooley and other rural areas in Louth may have been erroneously allocated to Drogheda and Dundalk, with the result that the rates in the rural areas are understated whilst those in the urban areas are artificially inflated. However, if morbidity and mortality actually is higher in the urban areas, it seems unlikely that the causes are related to discharges from Sellafield.

Also, the general improvement in cancer mortality rates since 1970 is not totally consistent with the Sellafield hypothesis. Although the age specific rates for most ages declined in Louth, consistent with the Sellafield hypothesis, they also declined in the country as a whole, suggesting that factors unrelated to

¹⁹ The Radiological Protection Institute of Ireland reported that the total estimated radiation dose to a heavy consumer of seafood from discharges from Sellafield fell from 70 microsieverts per year in the early 1980s to 2 microsieverts in the mid-1990s (*Irish Times*, November 1, 1996).

Sellafield may have responsible for the improvements. The fact that the rate for males declined at a faster rate within Louth than elsewhere would, it is true, be consistent with the hypothesis that reduced discharges from Sellafield contributed to the decline in the cancer rates in Louth. However, the age specific rates for females in Louth did not also improve at a faster rate than the national rates. To be consistent with the Sellafield hypothesis, one would either have to argue that the discharges from Sellafield affected men much more than women (which would appear unlikely) or else that for women the improvements resulting from the reduced discharges were counterbalanced by a corresponding increase in cancer rates caused by other more local factors.

The analysis of cancer sites in Chapter 5 indicates that in general people in Louth are susceptible to the same types of cancer as elsewhere. However, there are of course some variations. Louth has an excess number of skin cancers, especially non-melanomas (both sexes) but also, in much smaller numbers, melanomas in females. Louth also has an excess number of lung cancers and stomach cancers for both sexes, and in situ tumours of the cervix. There is also a small excess of leukaemia cases for both males and females. On the plus side, Louth has fewer than expected cases of colorectal, prostate and breast cancers. The author readily admits to a lack of expertise in this area, and is therefore open to correction, but (with the possible exception of leukaemia) the types of cancer found in Louth do not suggest a major problem of nuclear contamination.²⁰

As noted above, the evidence either for or against the Sellafield hypothesis is circumstantial. It is important to keep an open mind. However, if forced to draw a conclusion, it is the author's opinion that Sellafield at present is probably not causing problems to the health of people in Cooley or in Louth. Whether it could cause problems in the future, due to an industrial accident or even an act of terrorism, is a separate issue beyond the remit of the present study.

What Other Factors Might Account For The High Cancer Rates In Louth?

Even if one accepts that Sellafield is not a significant cause of cancer in Louth, the fact remains that the mortality and morbidity rates in Louth are above the national average. This raises questions as to why they should be so high. There is a long list of possible factors, but discussion will be confined to three.

Background Radiation

The annual average dose to a person in Ireland from all natural and artificial sources of radioactivity is estimated at 3,000 microsieverts.²¹ This dwarves the amount that has been detected in Ireland from Sellafield and other nuclear installations. Other artificial sources include radiation from medical and dental diagnostic procedures, atmospheric tests of atomic bombs, certain occupational activities, and some consumer products (most notably tobacco). Natural radiation sources includes cosmic radiation (i.e. charged particles from outer space), radioisotopes inside the body (from the food, water, and air consumed), terrestrial radiation and radon gas. Radon gas accounts for about two thirds of all natural radiation.

Terrestrial radiation results from the nuclear disintegration of radioactive elements found in rocks, resulting in the release of alpha particles, beta particles, and gamma rays. Alpha decay results in the ejection from an unstable atomic nucleus of an alpha particle consisting of two protons and two neutrons. The atomic number (i.e. number of protons) of the atom declines by two, changing it into a different element, whilst the

²⁰ Leukaemia, other than the chronic lymphatic type, and breast cancer are the two main types known to increase in proportion to the radiation dose (*Encyclopaedia Britannica*). Breast cancer rates are below average in Louth (although the death rate between 1980 and 2001 was higher).

²¹ *Irish Times*, 1 November, 1996.

atomic weight (combined number of neutrons and protons) declines by four. Negative beta decay involves the ejection from an unstable nucleus of an electron and an antineutrino that are produced by the decay of a neutron into a proton. This raises the atomic number by one (again changing the element into a different element) but leaves the atomic weight unchanged. Since the atomic weight either remains the same or is decreased by four, there are only four possible chains of parent and daughter nuclei, referred to as radioactive series. These are named after the first discovered element. The neptunium series, headed by neptunium-237, can only be produced artificially by nuclear reactions, due to neptunium-237's extremely long half-life of 2,000,000 years, but the other three (the thorium, uranium and actinium series) are found in nature.

The thorium series begins with thorium-232 and ends with radium-228. The actinium series actually begins with uranium-235 and ends with lead-207, passing through actinium 227 (which was discovered first) along the way. However, it is the uranium series, beginning with uranium-238 and ending with lead-206 that is of most interest here as one of the links in the chain is radon-222.

There are 20 known isotopes of radon ranging from radon-204 to radon-224), but the most common is radon-222.²² Radon-222 is formed by the radioactive decay of radium-226. Other isotopes include radon-220 (formerly known as thoron), part of the thorium series, and radon-219 (formerly actinon), part of the actinium series. The term radon generally applies to radon-222.

Radon's parent is radium-226. All the isotopes of radium are radioactive and short-lived on the geological time scale, so radium occurs naturally only as a disintegration product in the three natural radioactive-decay series. Radium-226 in the uranium series is the most stable isotope (1,620-year half-life). Its parent is thorium-230. Radium-226 can be stored in the bone, where it produces abnormal changes in the bone marrow, including anemia and leukemia, cancers of the bone, and paranasal sinuses.

Radon-222 is a colourless, tasteless and odourless gas seven and a half times heavier than air. It is quite rare in nature because it has a short half-life (3.8 days) and its parent, radium-226, is itself quite rare. However, trace quantities of the gas can seep up from soil and rocks containing radium through the foundations, basements, or piping of buildings and can accumulate in the air of houses that are poorly ventilated (possibly because of improved insulation). The gas can then be breathed into the lungs. Radon-222 quickly decays to form a series of daughter nuclides, most of which are alpha-particle-releasing isotopes, such as polonium-210. These daughter nuclides are deposited on the respiratory tract when inhaled, and the respiratory tract is consequently irradiated by the alpha particles producing a risk of lung cancer.

Radon levels can vary considerably from one house to the next, depending upon factors such as ventilation and underground fissures. If allowed to disperse, radon will decompose into lead-210 which is stable. However, the likelihood of radon concentrations building up will reflect the mineral composition of the underlying geology and soils. Rocks containing minerals with higher levels of uranium and radium will produce more radon. Granite, the main rock type in Cooley, is a prime candidate. A survey conducted by the Radiological Protection Institute of Ireland (RPII) reported that Louth had a higher than average percentage of houses with radon levels above the recommended levels.²³ People living in houses with high radon levels run a 1 in 50 lifetime risk of developing lung cancer. Although houses with high radon levels form only a small minority of those tested in Louth (14 per cent), it is possible that radon levels may contribute to the observed excess of lung cancer in Louth (although smoking is a much more likely cause).

²² The isotopes of an element have the same number of protons but a different number of neutrons in their nucleus. All radon isotopes have 86 protons (which is what defines them as radon). Radon-222 has an atomic weight of 222 – this is the combined number of neutrons and protons. Subtraction indicates that it has 136 neutrons.

²³ *Irish Times*, 21 November, 1996.

Concerned householders can get their house tested by the Radiological Protection Institute of Ireland for a modest fee.

Urbanisation

Studies elsewhere often report an association between cancer rates and urbanisation. It was noted above that Drogheda and Dundalk have higher mortality rates than the rest of the county and that Drogheda has a higher morbidity rate. Given that Louth is the most urbanised county in the country (apart from the County Boroughs and Dublin County), it is possible that the above average mortality and morbidity rates may be a function of urbanisation.

To test this hypothesis, the percentage of people living in towns of 5,000 people or more was calculated for each county using the 1996 census data.²⁴ The percentage of people in urban areas was correlated with the standardised mortality rates (1971-1999) and standardised incidence rates (1994-1997) for males and females. (See Appendix A for details of the method of calculation). The correlation coefficients are shown in Table 17.

	Per Cent Urban
Male SMRs 1971-1999	0.846**
Female SMRs 1971-1999	0.664**
Male SIRs 1994-1997	0.521**
Female SIRs 1994-1997	0.457*

Table 17. Correlations Between Urbanisation And Cancer Rates
(Significance level: * = 0.99, ** = 0.95)

There is a substantial difference between the correlations for mortality and those for morbidity. Given that the mortality and morbidity data cover different time periods, it is possible that the correlations between cancer and urbanization may have changed over time. To test this, separate standardised mortality ratios were calculated for the 1970s, 1980s and 1990s and correlated with urbanization. The results are shown in Table 18.

	Per Cent Urban	
	Males	Females
1970s	0.851**	0.624**
1980s	0.780**	0.357*
1990s	0.674**	0.621**

Table 18. Correlations Between Urbanisation And Cancer Mortality In Three Decades
(Significance level: ** = 0.99, * = 0.95)

It will be noted that the correlation between mortality and urbanisation declined for males, although it remained strongly significant in the 1990s. The correlation for females declined rapidly in the 1980s, but it rose again in the 1990s. In all instances the correlations for mortality were much stronger than for morbidity.

Figure 17 shows the plot of the male standardised mortality ratios 1971-1999 against per cent urban. The straight line superimposed upon the plot is a regression line. This indicates the SMR rate one might expect for any given percentage of urban population. It will be noted that the line suggests that Louth might be

²⁴ The 1996 census was selected because it is the one which corresponds to the period covered by the morbidity data. However, repeating the analysis using the 1981 census data was found to make little difference. Also repeating the analysis using towns of 1,500 or more and 10,000 or more made little difference.

expected to have an SMR higher than 100 because of its high percentage of urban population. However, it will also be noted that the point for Louth is well above the line, indicating that Louth has a much higher SMR than expected, even taking account of its urban population.

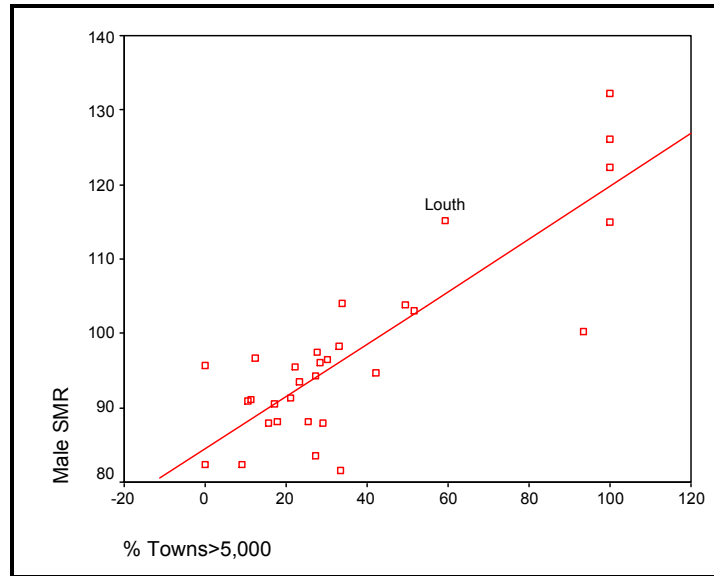


Figure 17. Scattergram Of Male SMRs Against Per Cent Urban

Figure 18 shows a similar plot for females. The line again suggests that Louth might be expected to have an above average SMR because of urbanisation, but the actual SMR is well above the rate that might be expected.

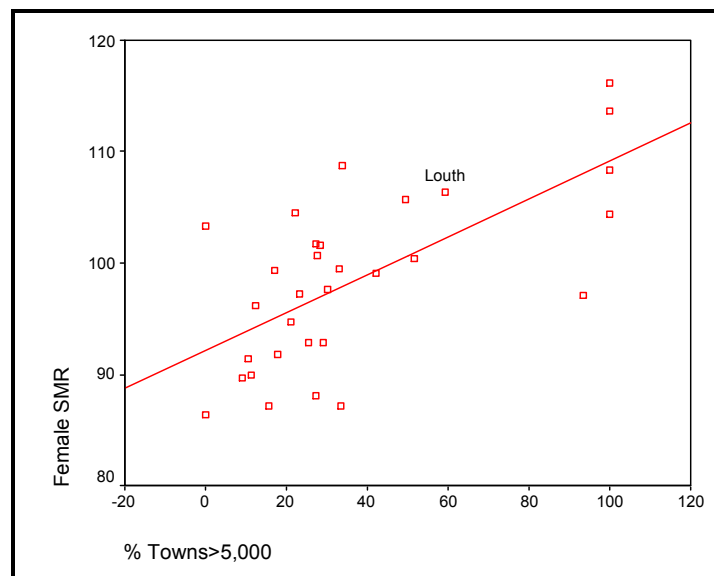


Figure 18. Scattergram Of Female SMRs Against Per Cent Urban

Figure 19 shows the Scattergram for male standardised incidence rates. It will be noted that there is a broader of scatter of points around the line, especially on the right hand side of the diagram, reflecting the

lower degree of correlation. The line would be in a different position and the correlation would be slightly higher if Limerick County Borough did not have such a low SIR. However, Louth would probably still be above the line, indicating that the high incidence of cancer in Louth is not simply a function of its degree of urbanisation.

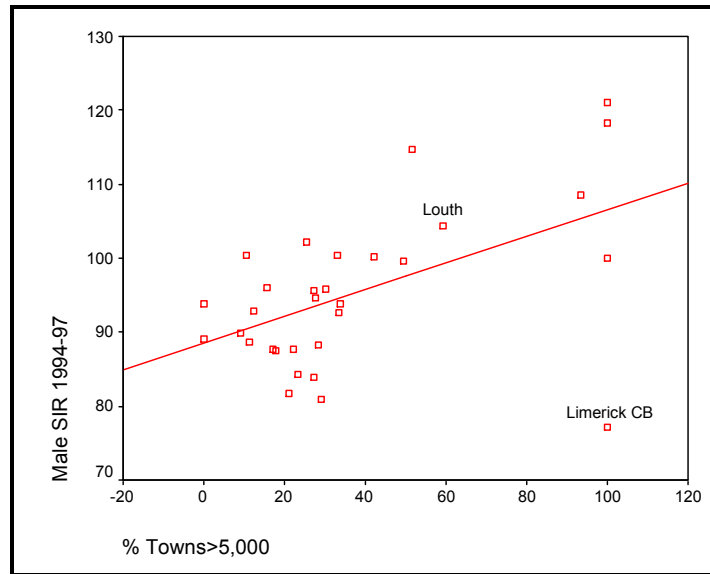


Figure 19. Scattergram Of Male SIRs Against Per Cent Urban

Similar conclusions can be drawn from Figure 20 which shows the Scattergram for the female standardised incidence rates. The scatter of points around the line is even greater than it is for males (reflecting an even lower degree of correlation), but Louth would clearly lie above the line even if the SIR for Limerick was similar to the other cities.

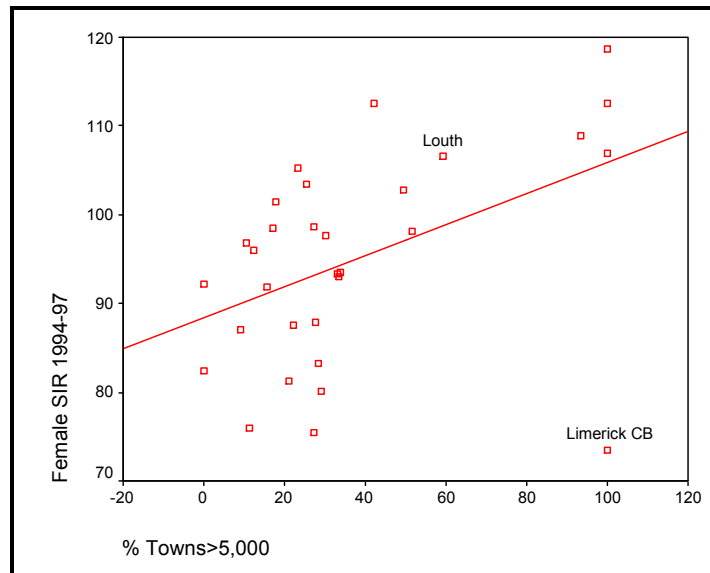


Figure 20. Scattergram Of Female SIRs Against Per Cent Urban

To summarise, the mortality data suggest that part of the excess in mortality in Louth can be attributed to the high percentage of its population living in urban areas, although the conclusions from the morbidity data are much more ambiguous. However, although urbanisation might account for some of the excess cases in Louth, it falls short of explaining all the excess cases, so urbanisation provides only a partial explanation.

Even if it is accepted that there is an association between cancer and urbanisation, the question still remains as to why cancer should be more common in urban areas. Also, why should urbanisation affect men more than women?

Smoking

It would be remiss not to mention smoking as a probable major causal factor. Cigarette smoking is without much doubt the single most important cause of lung cancer which, in turn, accounts for the largest number of cancer deaths amongst men and the second largest number amongst women. Smoking is also believed to contribute to other forms of cancer and is a major risk factor for many other health problems, including coronary heart disease, bronchitis, stillbirths and birth defects.

The author has no information on smoking levels in Louth compared with other areas. However, it may be possible to make some inferences using data on lung cancer mortality from the Public Health Information System over the period 1980-2001. Although the death rate in Louth fluctuated quite considerably from year to year, it was on average higher over the 22 year period in every 5-year age group over the age of 50 for males. No clear pattern emerges for females. The standardised mortality rate for lung cancer, standardising to the European Standard Population, was 36 per cent above the national average for males, but only 2 per cent above the national average for females. The male rate was 2.5 times the female rate nationally, but 3.5 times the female rate in Louth.

If one assumes that the risks of developing lung cancer from radon gas are much the same for males as for females, then the huge disparities in lung cancer mortality are almost certainly due to differences in smoking rates between males and females. The percentage of smokers was traditionally much higher for males than for females. However, smoking levels fell amongst men in the 1970s and 1980s, but have generally increased amongst women from about the 1960s. This probably explains the decline in deaths from lung cancer amongst men from the early to mid-1990s onwards, both nationally and in Louth, whilst the rates for females have been climbing steadily since at least the early 1980s.

More information would be required on smoking levels for both males and females in Louth, and the extent to which they have changed relative to national trends, to establish the extent to which smoking accounts for the patterns and trends in cancer mortality reported in Chapters 2 and 3. However, smoking must be regarded as a prime suspect.

Concluding Comments

The evidence would suggest that the residents of Louth have cause to be concerned about cancer. The mortality and morbidity rates for cancer are higher in Louth than would be expected, even taking into account that Louth is the most urbanised county in Ireland apart from Dublin city and county and the other County Boroughs. However, the age standardised mortality rates are falling for males and females, both in Louth and nationally. The Louth rates are falling faster than the national rates for males, but the female rates in Louth are only keeping pace with the national trend. Nevertheless, these overall improvements disguise a deteriorating situation for certain age groups, most notably the more elderly age groups of both sexes, and the young adult age groups for females. The increased age specific rates for the more elderly age groups may in part be due to a reduction in some of the other major causes of death, but whilst the numbers are fairly small the increase in the age specific rates for women aged 20-34 is a disturbing trend.

The report was unable to draw firm conclusions as to what extent the high rates of cancer in Louth can be attributed to Sellafield. However, it is the author's impression that probably very few cases in Louth are a direct consequence of emissions from Sellafield. On the other hand, there must be something causing the higher rates in Louth. Smoking is undoubtedly the principal cause of many cancers, but whether it is the reason for the higher mortality and morbidity rates in Louth is impossible to say in the absence of data on smoking levels and trends in Louth relative to those nationally.

The low incidence found in Cooley is striking, given that it was the perception of a high incidence amongst the residents of Cooley that prompted this study. One possibility is that Cooley may in fact have had a high incidence in the period immediately before that covered by the National Cancer Registry (i.e. before 1994). This would have initiated the perception of Cooley as an area of high risk, which would then have been reinforced by each subsequent new case (even if the incidence rate was actually lower than elsewhere). Another possibility is that cancer may have previously been fairly uncommon in Cooley compared with other places, but that the number of cases has increased in Cooley as elsewhere, mainly due to a decline in some of the other major causes of death and the fact that people are now living longer. The relatively sudden appearance of a 'new' disease (i.e. cancer) on the scene could create the impression of an 'epidemic'. Whatever the reason for the original concerns, the fact that Cooley is the nearest point in the Republic to Sellafield would have provided an apparent explanation for the epidemic, which would serve to intensify concerns. Each subsequent new case, especially of a younger person, would simply serve to reinforce these concerns.

Cooley is by no means unique. Communities all over the country have become concerned about a perceived risk of cancer, often reinforced by a local suspected cause (e.g. industrial pollutant, landfill site, high tension power lines, radio mast, etc.). The fact that people are concerned, even if their concerns turn out to be completely unfounded, should be regarded as a problem. If there is nothing to worry about, then they need to be reassured. If there is something to worry about, then something should be done to redress the situation. Either way, it is essential to have the information required to make an informed judgement. The National Cancer Registry is an invaluable asset in this regard and one which will become increasingly useful as more data are accumulated. Time will help resolve many of the methodological problems associated with small numbers. However, if the data are to be useful in evaluating the concerns of local communities, it is essential that the data should be accurately geocoded. It is also essential that the records should be complete. There would seem to be a strong case to be made for reporting to be made mandatory.