Environmental epidemiology in Norway
Bert Brunekreef
Institute for Risk Assessment Sciences, Universiteit Utrecht
Institute for Risk Assessment Sciences, Universiteit Utrecht, PO Box 80176, 3508 TD, Utrecht, Netherlands
Telephone 31 30 2535400 direct line 31 30 2539490 Telefax 31 30 2539499 e-mail b.brunekreef@iras.uu.nl

I am from the most densely populated country in Europe (393 inhabitants per square kilometer, not counting ministates such as Vatican city). Norway’s population density is just about the lowest at 14 per square kilometer. As environmental pressures and problems are closely related to population density, one would expect the Netherlands to devote rather more resources to studying environmental health problems than Norway. Yet, judging from research output as evident from MEDLINE, this is not so. The simple (one could argue: simplistic) search string ‘environmental epidemiology Norway’ produces 54 publications per 1 million inhabitants. The score for the Netherlands is just 25.

Now, a perhaps large part of the explanation lies in regional traditions in epidemiology. Scandinavia has long been strong on epidemiologic research, and the three other countries Sweden, Denmark and Finland produced even more papers in this field per million inhabitants (64-85). But another long-term stronghold in epidemiology, the U.K., is about level with the Netherlands at 27 per million, and Switzerland, Germany, Spain, Italy, Belgium and France bottom out at 8-16 per million. Excellent population health registries existing in Scandinavian countries have stimulated epidemiologic research into many issues including environmental health risks exemplified by studies of the effects of Chernobyl-disaster related radioactive fall-out on birth defects in Norway.1-3

Whereas population density drives some environmental exposures (such as those related to traffic, energy production), it is essentially unrelated to others. We all live in homes, and the home indoor environment can be a source of many contaminants from tobacco smoke, cooking, moisture, home decoration etc. Such exposures are of concern everywhere. Norwegian researchers have addressed a variety of indoor pollution issues, including indoor surface materials4-5, indoor exposure to tobacco smoke, nitrogen dioxide, allergens and dampness and mold problems6-10. Water purification is also a process unrelated to population density, and Norwegian epidemiologists have contributed to our understanding of the possible ill effects of chlorination by-products on, e.g., birth defects and foetal growth11-13. The use of child day care facilities has been widespread in Scandinavia for decades, and day care visits have been linked to acute otitis media and respiritory infections in various Norwegian studies14-18.

Yet other exposures may be of specific concern because of geochemistry or local dietary habits. An example of the former category is radon gas that is high in areas of Norway and Sweden because the soil or bedrock on which homes have been build is rich in uranium19-21. An example of the latter is elevated exposure to persistent contaminants accumulated in fish in frequent fish consumers living in coastal areas22. Fish consumption may, on the other hand, be protective against development of allergic and heart disease23. The cold winter climate has stimulated experimental as well as epidemiological research into the effects of cold temperatures on human health24-25.

But even the study of environmental exposures at the low end of the international range of exposure variation can be surprisingly fruitful. Nowadays, there is a lot of debate about whether thresholds exist at the population level for non-cancer effects of air pollution. To study this, one needs low exposure areas, not high exposure areas. Obviously, within the low exposure areas there needs to be sufficient contrast in exposure to allow meaningful studies, but new advanced approaches to assessing exposure to air pollution at the microscale have made such studies possible, for example in Oslo where exposure contrasts are also enhanced because of the topography26-28. Time series studies on day-to-day variations in respiratory hospital admissions in relation to low levels of traffic-related air pollutants have also been conducted, suggesting a specific role of pollutants other than PM1029,30. Another exposure of much current interest, UV radiation possibly increased by a diminishing stratospheric ozone layer, has also been fruitfully investigated in Norway where in view of the high latitude, UV exposure is less than in more southern countries31.

Also, heavy industry and associated pollution just across the Norwegian-Russian border has created rare opportunities to search for clues in the aetiology and exacerbation of allergic disease32,33 as well as cancer and heart disease34, another site polluted by industrial emissions in Norway has also been investigated to elucidate effects or air pollution on bronchial responsiveness in children35; historic nuclear testing across the Russian border has initiated studies into thyroid cancer36.

In conclusion, despite its relatively small population, and its lack of environmental health problems typically associated with high population density, Norwegian researchers have been remarkably productive...
in the field of environmental epidemiology in the past decades. The strong infrastructure in terms of population health registries provides a basis for continued productive research in this area. Inclusion of novel exposure assessment modeling tools within geographic information systems will provide additional opportunities for research by linking geocoded health and exposure data.

REFERENCES