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A PRELIMINARY RADON MAP FOR CANADA ACCORDING TO HEALTH REGION

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The recent publications of the combined analyses of residential radon studies in Europe and North America have shown that there is a significant risk of lung cancer at residential radon levels. In order to assess the population risk due to radon, the knowledge of the spatial distribution of indoor radon levels is essential. Here a preliminary radon map for Canada is presented, based on historical radon measurements collected in 6016 locations across Canada with the health region as the basic geographic units.

INTRODUCTION

Epidemiologic studies of uranium and other underground miners have consistently shown that miners exposed to high levels of radon are at an increased risk of lung cancer[(1)]. More recently, concern has arisen about lung cancer risks among people exposed to lower levels of radon in homes. The recent publication of the combined analyses of residential radon studies in Europe[(2)] and North America[(3)] have shown that there is a significant risk of lung cancer at residential radon levels. In order to identify radon-prone areas, a radon map for Canada is required. Radon risk communication and public concerns are the driving forces of radon risk mapping in addition to the management needs for a regional or national radon program.

Canada is a vast country; however, most of the population lives on a small portion of the land. With 3.3 people per square kilometre, Canada has one of the lowest population densities in the world. To present the national health burden of radon exposure, a radon map weighted by population would be appropriate. However, to identify radon-prone areas, a geographic radon map without population weightings is more suitable. Both indoor radon measurement data and geological data relevant to radon are very limited in Canada. With very limited radon data, the health region is a realistic mapping unit.

Canada is divided into 127 health regions based on the information given by Statistics Canada in 2005[(4–6)]. The geographic size of a health region depends partly on population. There are more health regions in areas of high population density. In the far north where population density is very low, a health region can cover a very large geographic area, as shown in Figure 1.

MATERIALS AND METHODS

Since 2003, indoor radon measurement data have been collected by Health Canada with assistance from other federal departments, provincial governments and radon-testing industries. In addition, an informal radon survey was conducted by Radiation Protection Bureau in the National Capital Region[(7)]. The historical radon measurements data available in various formats have been entered into one database designed at Radiation Protection Bureau. All relevant information about monitoring type and duration were included in the database. There are a total of 6016 address locations and 16745 radon test results in the radon database.

Once the data were geo-coded, it was possible to investigate various aspects of spatial distribution of radon levels. In this paper, characteristics of historical radon levels for 127 health regions of Canada are presented. Each health region was assigned a colour according to the key radon characteristic in the region: the percentage of dwellings having radon concentration above the new Canadian radon guideline[(8)] of 200 Bq m^{-3}.

RESULTS

Results of radon measurements are available for 52 of the 127 health regions. With the available data, a preliminary radon map of the percentile of observations >200 Bq m^{-3} in Canadian health regions is shown in Figure 2. This map suggests that radon levels are the highest in some areas of Central and Atlantic Canada. However, radon data are missing from more than half of the health regions.

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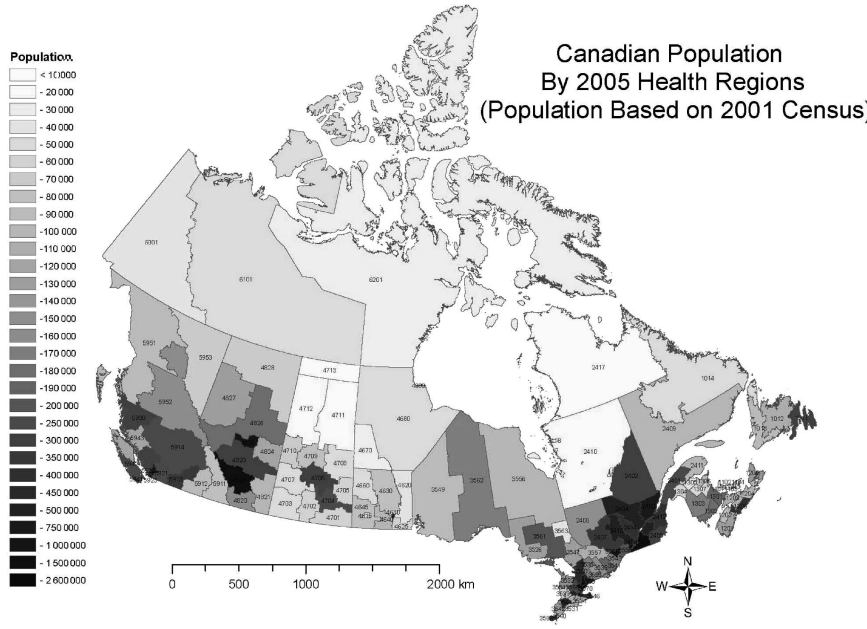

Figure 1. Health regions in Canada.

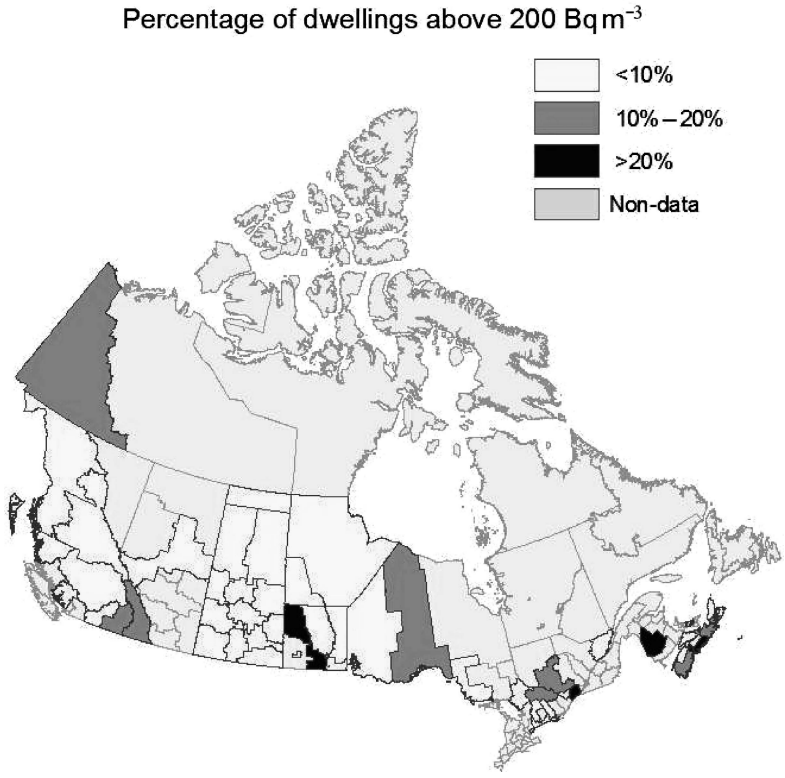

Figure 2. Radon map for Canada: percentage of dwelling above 200 Bq m^{-3}.

This map might be particularly interesting for public communication, demonstrating to the public that radon concentrations can vary widely and how likely a dwelling in a given health region could have a radon concentration higher than the new Canadian action level. Only a few health regions (5 out of 52) have more than 20% dwellings with radon concentrations over the Canadian radon action level of 200 Bq m^{-3}. In 8 out of 52, 10–20% dwellings could require remedial measures. However, most regions (39 out of 52) have <10% dwellings for which an action to reduce radon exposure would be needed. Among the 52 health regions where radon data are available, some health regions have more than 1000 dwellings tested for radon and some health regions have only few measurement results available. For those health regions with <100 houses tested for radon, the uncertainty is large and more measurements are required to establish a representative radon level for that region. It must be emphasised that this map is preliminary.

DISCUSSION

With historical radon survey data and recent mini surveys in the National Capital Region, a preliminary radon map has been developed. The map allows the identification of areas potentially prone to radon. However, because of very limited data, many health regions have yet not received a radon characterisation. More radon surveys will be needed in the near future to fill this big gap.

In this study, we have considered only one example using the health region as the basic geographic unit. There are other ways to present radon risks nationally province-by-province, within a province county-by-county or within in a county community-by-community. The development of radon maps for Canada is a dynamic and ongoing process.

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