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PRELIMINARY STUDIES ABOUT RADON RISK EXPOSURES IN STEI AREA

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Abstract
The radiation dose from inhaled radon and radon decay products represents most of the total dose received by population from natural sources of radiation. Radon is calculated to be the second most important cause of lung cancer after smoking and this may make remedial actions to reduce potential health hazards necessary. But, most studies have demonstrated at increase risk of lung cancer at high concentration for both smokers and nonsmokers. The objectives of our work were to determine the general distributions of radon and its progeny concentrations in dwellings, the magnitude of exposures and to assess the potential lung cancer risk in Ştei area. The estimation of risk is made under the epidemiological approach and use the BEIR VI age-duration risk model (EC Radon Software).
Keywords: radon, lung cancer, risk

1. Introduction

Lung cancer represents the major cause of cancer death worldwide with approximately 1 million deaths each year. Global statistics estimate that 25% of all lung cancer worldwide is not attributable to smoking [6].

2. Method and samples

To quantify individual risks for the persons exposed in these areas we use in the present study the recently (2000 years) developed European Community Radon Software (ECRS). The ECRS is used in order to calculate the lifetime risks for individuals with various attained age and with different radon exposure and smoking status [4].

The correlation between the residential radon concentrations in our data and the risk to develop lung cancer was studied using ECRS linear models for the risk estimates, with stratification for study, age, sex, and detailed smoking history by classifying each person as a smoker, a non-smoker or an ex-smoker.

For each case the risk calculation can be performed by taking the exposure information for an individual or a group living in the same house. We adopted a risk model simplified from the BEIR VI model, with constant excess relative risk per radon exposure for both sexes and across various age groups and exposure periods. The BEIR VI age-duration risk model made use of the most up-to-date data on 11 cohorts of radon-exposed underground miners (National Research Council, 1999) [5]. In applying this model in the software to estimate risks from exposure in homes, it is assumed - as in the BEIR VI report (BEIR, 1999) - that the ERR per unit exposure is the same for both sexes at all ages at exposure, and does not require modification to allow for differences between the mining and domestic environments.

3. Results and discussions

Using ECRS we calculated the lung cancer mortality for individuals with attained ages from 1 to 75 years with 5 years intervals (18 ages), males, 7 radon exposure and 3 smoking categories. We calculated separately for the all categories the risk of lung cancer relative that of to lifelong nonsmokers.

Table 1 shows the risk of lung cancer relative that of to lifelong nonsmokers with no radon exposure by radon concentration for various smoking categories in the 30-year period according to the length of time that the person lived there. The correlation between the risk of developing lung cancer and residential radon was linear in the present study [2]. We applied the assumption used in the European Collaborative Studies: the proportionate increase of risk of 8, 4% per 100 Bq/m^3 of measured radon received during 75 years [2], [3]. Table 2 show the whole life lung (75 years) cancer mortality for lifelong nonsmokers and continuing smokers of 15-24 cigarettes per day at various levels of radon concentration.

When the data from this preliminary study were combined with external data on the absolute risk estimated from European studies, the cumulative risks of death caused by radon by the age of 75 years were estimated to be 0, 42% and 10, 11% for nonsmokers respectively for continuing smokers of 15-24 cigarettes per day. Increasing radon concentration we obtained increased cumulative risks: 0, 47% for nonsmokers and 11, 63% for smokers at 100 Bq/m^3, respectively 0, 67% and 16% for nonsmokers and smokers exposed at 400 Bq/m^3. For ex-smokers, the cumulative risk in the first 10 years after smoking is assumed to be about 80% of those for smokers [2].

Table 1. Risk of lung cancer relative that of to lifelong nonsmokers with no radon exposure by radon concentration for various smoking categories in the 30-year period according to the length of time that the person lived there

Radon concentration (Bq/m^3)	Relative risk of lung cancer		
	Lifelong nonsmokers	Ex-smokers (< 10 years)	Current cigarette smokers (15 – 24 per day)
0	1	19.9	25.1
100	1.08	21.6	27
200	1.2	24	30
400	1.3	26	32.5
800	1.6	32.1	40
1000	1.8	36	45
2000	2.5	49.9	62.5

Table 2. Whole life lung cancer mortality (75 years) for lifelong nonsmokers and continuing smokers of 15-24 cigarettes per day at various levels of radon concentration

Radon concentration (Bq/m^3)	Lung cancer mortality (%)		
	Lifelong nonsmokers	Ex-smokers (< 10 years)	Current cigarette smokers (15 – 24 per day)
0	0.5	0.7	8.7
100	0.8	0.9	10.7
200	1	1.1	12.6
400	1.3	1.5	16.4
800	1.9	2.3	23.3
1000	2.2	4.6	40.3
2000	3.8	5.8	47.6

4. Conclusions

The present study describes a solid base to be able to study and estimate in the future the risks and mortality attributable of radon. In agreement with the results of the European Collaborative Studies [2], these data provide the evidence that residential radon is a cause of

lung cancer in the general population. This preliminary study is crucial to develop a further model in order to obtain more precisely estimates of radon risk exposures

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