A prediction model for assessing residential radon concentration in Switzerland

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Indoor radon is regularly measured in Switzerland. However, a nationwide model to predict residential radon levels has not been developed. The aim of this study was to develop a prediction model to assess indoor radon concentrations in Switzerland. The model was based on 44,631 measurements from the nationwide Swiss radon database collected between 1994 and 2004. Of these, 80% randomly selected measurements were used for model development and the remaining 20% for an independent model validation. A multivariable log-linear regression model was fitted and relevant predictors selected according to evidence from the literature, the adjusted R(2), the Akaike's information criterion (AIC), and the Bayesian information criterion (BIC). The prediction model was evaluated by calculating Spearman rank correlation between measured and predicted values. Additionally, the predicted values were categorised into three categories (50th, 50th-90th and 90th percentile) and compared with measured categories using a weighted Kappa statistic. The most relevant predictors for indoor radon levels were tectonic units and year of construction of the building, followed by soil texture, degree of urbanisation, floor of the building where the measurement was taken and housing type (P-values <0.001 for all). Mean predicted radon values (geometric mean) were 66 Bq/m(3) (interquartile range 40-111 Bq/m(3)) in the lowest exposure category, 126 Bq/m(3) (69-215 Bq/m(3)) in the medium category, and 219 Bq/m(3) (108-427 Bq/m(3)) in the highest category. Spearman correlation between predictions and measurements was 0.45 (95%-CI: 0.44; 0.46) for the development dataset and 0.44 (95%-CI: 0.42; 0.46) for the validation dataset. Kappa coefficients were 0.31 for the development and 0.30 for the validation dataset, respectively. The model explained 20% overall variability (adjusted R(2)). In conclusion, this residential radon prediction model, based on a large number of measurements, was demonstrated to be robust through validation with an independent dataset. The model is appropriate for predicting radon level exposure of the Swiss population in epidemiological research. Nevertheless, some exposure misclassification and regression to the mean is unavoidable and should be taken into account in future applications of the model

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