Correcting for measurement errors when estimating lung cancer risk associated with radon exposure among uranium miners

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Context

In epidemiological studies, Measurement errors (ME) can substantially bias the estimation of the parameters. A broad variety of methods for ME correction has been developed, but they have been rarely applied. The present work 1/ characterizes ME associated with radon exposure ([222]Rn and its decay products) in the French cohort of uranium miners, 2/ evaluates its impact on the estimated excess relative risk of lung cancer death associated with radon exposure and 3/ assesses the behavior of different methods for correcting ME effects.

Materials & methods

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French Cohort of Uranium Miners

- Includes more than 5000 miners chronically exposed to radon with a follow-up duration of 30 years
- ME associated to radon exposure have been characterized for each individual, taking into account the evolution of uranium extraction methods and that of radiological monitoring over time.

Simulation study

- Simulation study (1,000 replications) based upon the baseline data of the French Uranium Miners Cohort Study.

Results

Characteristics of ME associated with radon exposure

Allodji et al., J Radiol Prot 2012

- About 50-60% of the bias was corrected
- SIMEX seems to offer better performance for the correction of ME than the two other methods implemented.

Performance of ME correction methods

Allodji et al., Stat Med accepted

- In case of perfect knowledge of ME characteristics:
  - About 50-60% of the bias was corrected
  - SIMEX seems to offer better performance for the correction of ME than the two other methods implemented.

- In case of imperfect knowledge of ME characteristics:
  - Serious overestimation (overcorrection) with the SIMEX method
  - None of the three error-correction methods was able to provide any meaningful bias correction.

Correction of ME in the French uranium miners cohort

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- Corrected ERR was increased (ranging from 0.909 to 1.700 per 100 WLM).

Discussion & conclusion

This work illustrates the importance of ME correction in order to obtain more reliable ERR estimates of lung cancer risk associated with radon exposure among French uranium miners. Such corrected risk estimates should prove of great interest in support to the determination of protection policies against radon.

References