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Impact of Classical and Berkson Multiplicative errors in Radiation Doses on Dose-Response Analysis

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Widely used nowadays methods of risk estimation presume the presence of fluctuations only along the axis of effects, while as an actual factor (dose) certain its point estimate is used. Meanwhile practically there is no situation where the individual or simulated dose estimate has no statistical distribution. And though in the last decades reiterated attempts were made to develop mathematical tools which take into account two-dimensional distribution of not only the effect but the dose as well, the problem has not been solved yet neither in purely mathematical nor in procedure aspect. One of the main reasons for such situation is the fact that the dose measurements are inevitably accompanied by errors of either classical or Berkson type, or by certain its mixture. In this connection there is no final decision concerning the influence of the classical and Berkson error in the measured dose on the final result of the risk-analysis, which is usually expressed in terms of relative (ERR) or absolute (EAR) risk.

The most striking example of actualization of this problem is the risk-analysis of results based on yearly radio-epidemiological investigations of the cohort of children with thyroid dose as a result of Chernobyl accident. It is important to note that in these studies the absolute and relative frequencies of thyroid cancer cases in this cohort are found with quite high accuracy. Not only point dose estimates but also interval estimates (in statistical sense) are obtained. But interpretation of results of this thyroid radio-epidemiological study was based on risk estimation methods which do not take into account the presence of significant uncertainties in doses. One of the consequences of the assumption about the absence of errors in doses can be that the risk estimates are biased and the curve "dose – effect" is distorted. The aim of present work is

to study the influence of multiplicative classical and Berkson errors in thyroid dose on the estimate of the radiation risk.