# Mechanistic modeling for mammography screening risks

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## Abstract

Western populations show a very high incidence of breast cancer and in many countries mammography screening programs have been set up for the early detection of these cancers. Through these programs large numbers of women (in the Netherlands, 700.000 per year) are exposed to low but not insignificant X-ray doses. ICRP based risk estimates indicate that the number of breast cancer casualties due to mammography screening can be as high as 50 in the Netherlands per year. The number of lives saved is estimated to be much higher, but for an accurate calculation of the benefits of screening a better estimate of these risks is indispensable.

Here it is attempted to better quantify the radiological risks of mammography screening through the application of a biologically based model for breast tumor induction by X-rays. The model is applied to data obtained from the National Institutes of Health in the U.S. These concern epidemiological data of female TB patients who received high X-ray breast doses in the period 1930-1950 through frequent fluoroscopy of their lungs. The mechanistic model that is used to describe the increased breast cancer incidence is based on an earlier study by Moolgavkar et al. (1980), in which the natural background incidence of breast cancer was modeled.

The model allows for a more sophisticated extrapolation of risks to the low dose X-ray exposures that are common in mammography screening and to the higher ages that are usually involved. Furthermore, it allows for risk transfer to other (non-western) populations. The results have implications for decisions on the frequency of screening, the number of mammograms taken at each screening, minimum and maximum ages for screening and the transfer to digital equipment.

***KEYWORDS: mammography screening; breast cancer; mechanistic modeling.***

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