

## Cosmic Rays, CT Scans and Education: Additional Factors that Might Influence Longevity and Mortality in Norway

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### ABSTRACT

It has previously been reported that differences in life expectancy can be linked to income. In Norway, a registry-based study that included all Norwegian residents aged  $\geq 40$  years (2005-2015) was performed. This study showed substantial and increasing gaps in life expectancy by income level during the interval between 2005-2015. Compared to the United States, the largest life expectancy differences were for individuals in the lower to middle part of the income distribution, although differences were observed at all income levels. Despite its undeniable strengths and although this paper can be considered as a significant contribution to this field, it has some shortcomings. The first shortcoming of this study is due to ignoring the effects of population exposures to natural and man-made ionizing and non-ionizing radiation on life expectancy. Another shortcoming arises from ignoring the strong impact of education on lifestyle. In summary, what is observed in this study might be at least to some extent, due to education-related changes in lifestyle and not necessarily income (despite the mutual links between education and income).

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### Keywords

Household Income; Life Expectancy; Mortality; Education; Lifestyle; Radiation

### Introduction

To discern the differences in life expectancy and causes of death in Norway that can be linked to income and to compare those differences with current US estimates, Kinge et al., [1] have previously performed a registry-based study that included all Norwegian residents aged  $\geq 40$  years (2005-2015). The authors observed substantial and increasing gaps in life expectancy by income level during the interval between 2005-2015. Compared to the United States, the largest life expectancy differences were for individuals in the lower to middle part of the income distribution, although differences were observed at all income levels. Despite its undeniable strengths and although this paper can be considered as a significant contribution to this field, it has some shortcomings.

The first shortcoming of this study is due to ignoring the effect of population exposures to natural and man-made ionizing and non-ionizing radiation on life expectancy. Due to the orientation of the Earth's geomagnetic field, primary and secondary cosmic rays (energetic charged particles from galactic and solar sources along with secondary radiation generated from impacts of these particles with our atmosphere) pen-

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erate to much lower altitudes in the polar regions in countries including Norway. The routine observation of the northern lights (aurora borealis) in countries such as Norway and aurora australis or southern lights near the South Pole is explained by this phenomenon. Moreover, it has been reported that Norway is one of the most radon-rich European countries [2]. In addition, according to the Norwegian Radiation Protection Authority (Strålevern Rapport 2015:13) while Norway performs slightly fewer radiological examinations per person than the European average, it is among the European countries performing the most CT examinations. This report also states that due to high numbers of CT scans, Norway is among the European countries with the highest radiation doses from radiological examinations [3]. It is worth noting that some evidence shows that compared to non-irradiated individuals, exposure to low-dose radiation may increase lifespan and reduce cancer mortality [4]. The present study is not inconsistent with this assertion.

Another shortcoming arises from ignoring the strong impact of education on lifestyle [5].

It is well documented that higher levels of education induces individuals to exercise regularly and get regular health checkups [6]. Given this consideration, what is observed in this study might be at least to some extent, due to education-related changes in lifestyle and not necessarily income (despite the mutual links between education and income).

### Authors' Contribution

All authors have made substantial contributions

to conception and design of the study and the review of the original Norway registry-based study. All authors have given final approval of the current version of the paper.

### Conflict of Interest

None

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