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Lifestyle risk factors and future cancer burden – estimating the potential of primary prevention

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Cancer is a major public health challenge contributing considerably to the burden of diseases and deaths in Germany. For the sake of cancer prevention, it is vital both to know the risk factors that contribute most to this cancer burden and to assess the impact of evidence-based public health interventions in terms of their effectiveness in reducing the future cancer incidence. As only few studies have previously investigated the potential impact of cancer control strategies in Germany and a comprehensive assessment has been lacking so far, the main purpose of this dissertation was to assess the potential for cancer prevention in Germany by quantifying the contribution of main modifiable cancer risk and preventive factors to the cancer burden and by investigating the potential impact of evidence-based preventive measures on the future cancer incidence.

To estimate numbers and proportions of cancer cases that can be attributed to various lifestyle-related and environmental risk and preventive factors in Germany in 2018, population-attributable fractions (PAF) were calculated by sex and age group for ages 35 to 84 years based on population projections, national cancer incidence and exposure data, and published relative risks. Assuming independence of risk factors, exposures to different risk factors were combined using the product of risk factor-specific PAFs, in order to obtain the total proportion of cancer cases that could be attributed to all cancer risk factors considered in this work.

It was estimated that of all incident cancer cases to be expected at ages 35 to 84 years in Germany in 2018, 37.4% of incident cancer cases are attributable to the considered modifiable risk factors and thus are potentially avoidable. The lifestyle-related factors, in particular smoking (PAF = 19.3%), but also dietary factors (PAF = 7.8%), excess body weight (PAF = 6.9%), and physical inactivity (PAF = 6.1%) contribute most to this cancer burden. Smaller but still substantial proportions of attributable cancer cases were estimated for infections (PAF = 4.0%) and high alcohol consumption (PAF = 2.2%). The smallest proportion of potentially avoidable cancer cases was found for selected environmental factors (PAF = 1.2%), but which reflects an underestimation given the lack of comprehensive identification and quantification of environmental risks in the research literature.

In addition, a macro-simulation approach was used to estimate numbers and proportions of potentially avoidable cancer cases under different tobacco and price-based alcohol control intervention scenarios by calculating cancer site-specific potential impact fractions (PIF) by age, sex, and year of study period (2020-2050) considering latency periods between reduction in risk factor prevalence and the manifestation in declining cancer excess risks. To obtain estimates of future incident case numbers, German cancer registry data were combined with forecasted population sizes, published effect sizes, and national prevalence data.

Over a 30-year horizon (2020-2050), an estimated 13.3% of smoking-related cancer cases could be prevented if a combination of different tobacco control policies (repeated cigarette price increases, comprehensive marketing ban, plain packaging) were to be implemented in Germany, with repeated price increases being the most effective single tobacco control policy (8.0%; 639,000 cases). Accordingly, with a combination of different tobacco control policies more than a million cancer cases could be avoided in the next three decades.

Of all alcohol-related cancer cases expected between 2020 and 2050, an estimated 164,000 cases (3.2%) are potentially preventable if alcohol intake above risk thresholds would be reduced to levels below risk thresholds. Approximately 70% of those cancers (114,000 cases) were estimated to be preventable through a 100% price increase in alcohol in Germany, the most effective price-based alcohol policy scenario in this work, followed by 5-yearly 25% price increases (70,000 cases), and a volumetric price increase according to the beverage-specific alcohol content (43,000 cases).

In conclusion, a considerable proportion of cancer cases in Germany are attributable to well-established modifiable cancer risk factors and thus potentially preventable by translating already existing knowledge on risk and preventive factors into effective primary prevention. More rigorous prevention efforts are required to achieve significant reductions in the prevalence of these risk factors and the related cancer burden. The implementation of evidence-based tobacco and alcohol control policies as part of a primary cancer prevention strategy has the potential to substantially contribute to such a reduction.