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Research Letter

Using the Lorenz Curve to Assess the Feasibility of Targeted Screening for Esophageal Adenocarcinoma

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Running head: Lorenz Curve Evaluating EAC Prediction

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To the Editor:

The incidence of esophageal adenocarcinoma (EAC) has been rapidly increasing in the Western societies in recent decades.[1] Gastroesophageal reflux disease, obesity, and tobacco smoking are the major risk factors.[1,2] EAC is characterized by a poor prognosis with an overall 5-year survival below 15-20%, which is even worse in patients diagnosed at late stages.[1] Upper endoscopy is increasingly utilized for detection of the premalignant condition of EAC, i.e., Barrett's esophagus with dysplasia. However, a universal screening strategy, even in patients with reflux, is infeasible given the considerable costs and risk of complications, and the low incidence (0.7 per 100 000 person-years globally, and the highest 7 per 100 000 years in men in the United Kingdom).[3,4] Risk prediction models for EAC combining information on risk factors have recently been developed. These have had good discriminative accuracy and have shown promising potential in identifying high-risk individuals who might benefit from targeted prevention and early detection strategies.[5,6]

In this study, we further assessed the feasibility of targeted screening based on a risk prediction model using the Lorenz Curve. The Lorenz Curve is a graphical tool widely used in econometrics to characterizing the distribution of wealth in the society, which has been suggested to be valuable in demonstrating the "concentration" of disease risks.[7] This tool may be particularly relevant when evaluating screening programs in the context of disease risk prediction.

We have developed a risk prediction model based on data from a nationwide population-based case-control study in Sweden in 1995-1997.[2,5] Participants included 189 histologically confirmed incident cases of EAC from all relevant hospital departments in Sweden, and 820 control subjects frequency- matched for age and sex and randomly selected from the Swedish population.

Detailed information on risk factors was collected via face-to-face interviews. This study was approved by all six regional ethical review boards in Sweden, and both written and oral informed consent was obtained from each participant. In brief, we ranked the estimated risks for all controls (representing the population at risk) obtained from the logistic regression model. For each of the risk levels, the cumulative proportions of controls and estimated risks having this level of risk or below were used to draw the curve. Methodological details can be found in the report by Mauguen and Begg.[7]

The constructed Lorenz Curve is shown in Figure 1. Based on a simple model, which only included information on reflux symptoms or use of antireflux medication, body mass index, and tobacco smoking, 37% of all EAC cases would occur in the 10% of the population with the highest risks, and 22% of all cases would be identifiable from the top 5% of the population based on risk. The estimated risks would be even more concentrated after also considering age and sex. For example, the risk concentration should be greater in men aged 50 years or older who contribute approximately 75% of all cases in the total population and thus represent a high-yield target for screening.

These results highlight the significant concentration of EAC risks in the population and the usefulness of risk prediction models in identifying high-risk individuals for targeted early detection and prevention strategies. However, there remains certain overestimation of the risk concentration, given that we used the same dataset to assess the model with the Lorenz curve as it was developed from. Using an external independent dataset would be preferable. Furthermore, necessary cut-off points of estimated risk for clinical and public health use need to be carefully determined, in which related costs, potential benefits and risks for patients, and the absolute risk in the population should be taken into account.

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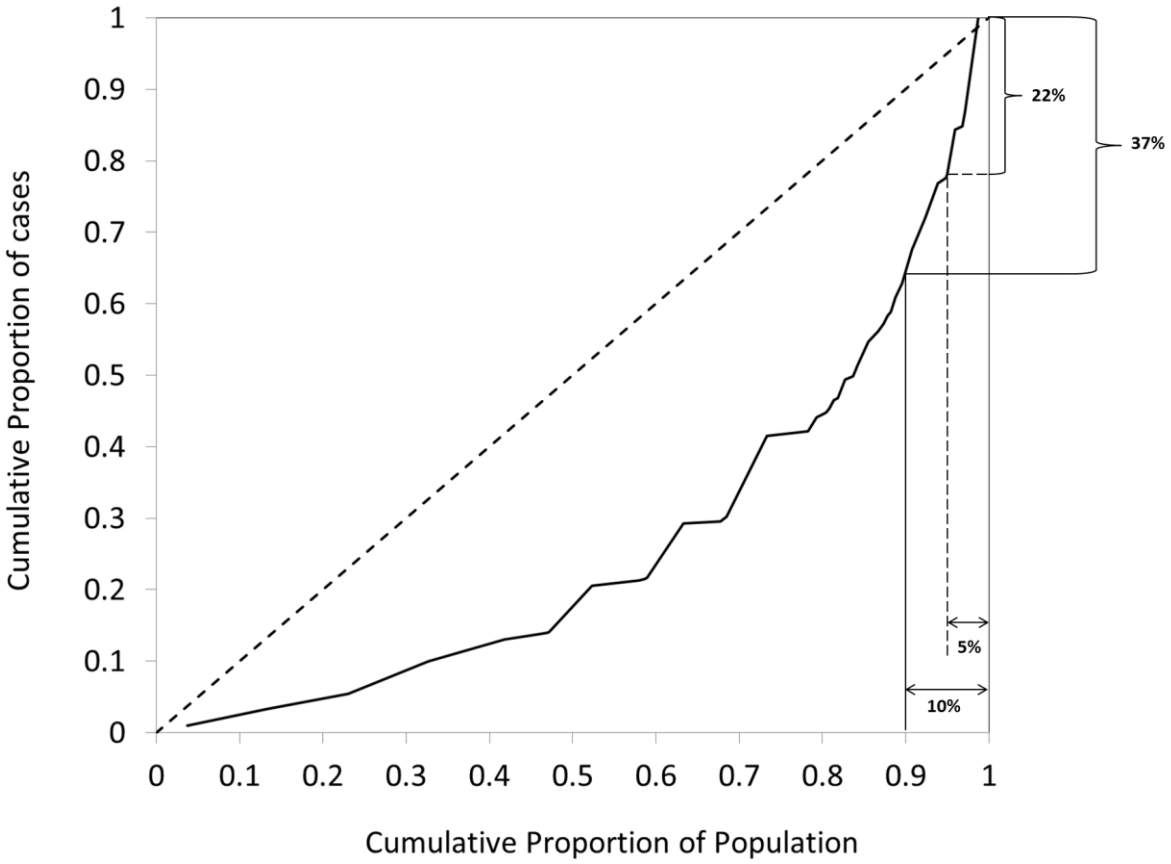

Figure 1. Lorenze curve for a model based on a case-control study on esophageal adenocarcinoma.