HEALTH RISK ASSESSMENT OF REDUCED AIR POLLUTION EXPOSURE WHEN CHANGING COMMUTING BY CAR TO BIKE

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Summary
In this study we have assessed the reduction in traffic emissions and population exposure assuming all potential car commuters would switch to biking if they live within 30 minute travel by bike. The scenario would result in more than 100 000 new bikers and due to the reduced traffic emissions 42 premature deaths would be avoided per year. This is almost twice as large effect as the congestion tax in Stockholm.

Introduction
Regular physical activity has important and wide-ranging health benefits including reduced risk of chronic disease, and physical inactivity is mentioned as perhaps the most important public health problem of the 21st century. At the same time, the direct effects of traffic emissions is a major health problem. Transferring commuting by car to bike will increase physical activity and reduce emissions and reduce population exposure to traffic pollution. The exposure of commuters will also change; new bikers may get higher exposure whilst old bikers and car drivers may get lower exposures, depending on commuting route and distance.

Methodology
In this study we have calculated the potential number of car-to-bike switching commuters depending on distance, travel time, age of commuters etc. We have made calculations for a 30-minute biking scenario, i.e. transferring all car commuters to bike if their travel time by bike is less than or equal to 30 minutes. The commuting distance depends on age and sex. For the travel and traffic modelling the LuTrans model was used. It includes all different modes of travel; walking, bicycling, public transport systems and car traffic. The model was developed based on travel survey data and is regularly calibrated using traffic counts. Emissions from road traffic were calculated based on HBEFA 3.2. A Gaussian dispersion model was used estimate exposures over the county of Stockholm.

Results
The 30 min scenario resulted in 106 881 more bikers, an increase of 2.6 times compared to base scenario. Of all bikers 50% were men and the mean age of all bikers was 42. The traffic emissions of NOx was reduced by up to 7%. Up to 20% reduction in traffic contribution to NOx concentrations was calculated as shown in Figure 1. The mean reduction in concentration for the whole area is 6% and the largest occur were most people live.

The population weighted mean NOx concentration for 1.6 million people in Greater Stockholm is estimated to be reduced by 0.41 µg m⁻³. Assuming that the premature mortality is reduced by 8% per 10 µg m⁻³ (Nafstad et al., 2004), this corresponds to 42 avoided premature deaths every year or 514 gained life years gained. This is even somewhat more beneficial than the effects of the congestion charge in Stockholm (Johansson et al., 2009), which was estimated to save 27 premature deaths per year. The gain in reduced mortality is almost as large as the gain in health of the increased physical activity.

Conclusions
Transferring car commuters to bike is not only beneficial for the physical activity, but will also lead to reduced traffic emissions and reduced population exposure. Our estimates show that it may be even more beneficial for mortality due to air pollution exposure than the congestion charge in Stockholm.

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References