Modelling the effect of food and smoking policies on the unequal distribution of the burden of coronary heart disease: IMPACT models.

Our work at the Department of Public Health and Policy (University of Liverpool) is driven by policy questions focused on what can be done to reduce social inequalities in health and their social determinants by elucidating and evaluating pathways on the social production of disease, policies and preventive interventions.

Although heart attack death rates will continue their decline, this will happen more slowly in socially disadvantage groups.(1)(2) That represents an important and urgent target for prevention policies. The evidence base suggest that in order to prevent heart disease deaths, and reduce inequalities, interventions aiming to improve diet and lifestyle across the entire population tended to be more effective and equitable than those interventions favouring individual behaviour change.

Therefore, we have developed a suite of models, IMPACT Food, NCD and SEC models, to explore several diet and smoking policies effectiveness to reduce the unequal burden of CHD mortality. A key feature in our models is that we design them using a well-known and accepted framework for the social production of disease, The Diderichsen-Evans-Whitehead model that describes pathways to generate health inequalities taking into account differential social exposure to disease determinants, differential vulnerability and differential outcomes.(3)

Our findings suggest that the potential reductions in the burden and equity gains are huge. For example, a regulatory policy to eliminate trans-fatty acids from processed foods in England would be cost-saving and equitable policy option to reduce the unequal social distribution of the burden.(4) A total ban on trans fatty acids in processed foods might prevent or postpone about 7200 deaths (2.6%) from coronary heart disease from 2015-20 and reduce inequality in mortality from coronary heart disease by about 3000 deaths (15%). Policies to improve labelling or simply remove trans fatty acids from restaurants/fast food could save between 1800 (0.7%) and 3500 (1.3%) deaths from coronary heart disease and reduce inequalities by 600 (3%) to 1500 (7%) deaths, thus making them at best half as effective. A total ban would have the greatest net cost savings of about £265m (€361m, $415m) excluding reformulation costs, or £64m if substantial reformulation costs are incurred outside the normal cycle. Similarly mandatory policies to reduce salt content in food was the most equitable and powerful strategy in our analyses(5)(6). Furthermore, increasing the intensity of current tobacco policies will have a substantial impact in smoking prevalence and to reduce mortality, particularly amongst the most deprived groups.(7)

Structural policies seem also to be better to reduce both the overall burden and its unequal social distribution when compared directly with high risk, targeted strategies. But the answer is not simple. Using a micro-simulation model we explore the comparative effectiveness in reducing the unequal burden of cardiovascular disease of structural dietary and smoking policies with universal cardiovascular screening strategy, similar to the intervention currently implemented in the UK.(8) Universal screening may prevent or postpone approximately 19 000 cases and 3000 deaths, while concentrating screening in the most deprived groups could prevent 17 000 cases and 2000 deaths. In contrast, population-wide intervention 67 000 cases and 8000 deaths, and the combination of the population-wide intervention and concentrated screening 82 000 cases and 9000 deaths. Thus, the most equitable strategy would be the combination of the population-wide intervention and concentrated screening, followed by concentrated screening alone and the population-wide intervention. Universal screening had the least apparent impact on socioeconomic inequalities in health.

In conclusion, our studies show that “Upstream”, structural policies and interventions aiming to benefit the entire population, could have the greatest potential to reduce deaths, reduce social inequalities and generate net savings, to reduce pressure on an already stressed healthcare system.

References:

1. Allen K, Gillespie DOS, Guzman-Castillo M, Diggle PJ, Capewell S, O’Flaherty M. Future trends and inequalities in premature coronary deaths in England: Modelling study. Int J Cardiol. 2016;203:290–7.

2. Pearson-Stuttard J, Guzman-Castillo M, Penalvo JL, Rehm CD, Afshin A, Danaei G, et al. Modeling future cardiovascular disease mortality in the United States. Circulation. 2016;133(10):967–78.

3. Diderichsen F, Evans T, Whitehead M. The Social Basis of Disparities in Health. Challenging Inequities in Health: From Ethics to Action. Oxford University Press; 2009.

4. Allen K, Pearson-Stuttard J, Hooton W, Diggle P, Capewell S, O’Flaherty M. Potential of trans fats policies to reduce socioeconomic inequalities in mortality from coronary heart disease in England: cost effectiveness modelling study. BMJ [Internet]. 2015 Jan [cited 2015 Sep 21];351:h4583. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4569940&tool=pmcentrez&rendertype=abstract

5. Kypridemos C, Guzman-Castillo M, Hyseni L, Bandosz P, Allen K, Buchan I, et al. An opportunity to reduce the burdens and inequalities in cardiovascular disease and gastric cancer caused by dietary salt: IMPACTNCD microsimulation study. Lancet [Internet]. Elsevier; 2015 Nov 13 [cited 2016 Mar 28];386:S47. Available from: http://www.thelancet.com/article/S0140673615008855/fulltext

6. Gillespie DOS, Allen K, Guzman-Castillo M, Bandosz P, Moreira P, McGill R, et al. The Health Equity and Effectiveness of Policy Options to Reduce Dietary Salt Intake in England: Policy Forecast. PLoS One [Internet]. 2015 Jan [cited 2015 Nov 6];10(7):e0127927. Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=4488881&tool=pmcentrez&rendertype=abstract

7. Allen K, Kypridemos C, Hyseni L, Gilmore AB, Diggle P, Whitehead M, et al. The effects of maximising the UK’s tobacco control score on inequalities in smoking prevalence and premature coronary heart disease mortality: a modelling study. BMC Public Health. 2016;16.

8. Kypridemos C, Allen K, Hickey GL, Guzman-Castillo M, Bandosz P, Buchan I, et al. Cardiovascular screening to reduce the burden from cardiovascular disease: microsimulation study to quantify policy options. bmj BMJ BMJ [Internet]. 2016 [cited 2016 Aug 31];353353. Available from: http://dx.doi.org/10.1136/bmj.i2793