Q&A: ARC Webinar Series 2021: Modelling cancer risk: regional and socioeconomic disparities

Q1: What do you mean by "impact"

--- We refer to the effect of average age-at-diagnosis on type-specific cancer mortality, i.e. changes in type-specific cancer mortality as a response to a change in average age-at-diagnosis (or more generally as a response to diagnosis delays).

Q2: What does the deprivation variable depend on? How was that decided?

--- The deprivation variable is mapped on income-deprivation, using the Index of Multiple Derivation (IMD) measure, as determined in 2015. Income deprivation is related to income level of families, e.g. low/high income in a given region, where this level is associated to several factors such as house ownership, closeness of the house to different services (postal office, school, hospital etc.) and so on.

Q3: One of the important factors raised was time. To what extend do you believe better capture of data over time by health organisations can have contributed to increased incidence?

--- This could possibly have a small contribution. However, there are good records of keeping cancer statistics in the last decades. There is also a question of completeness of data. The available data are 98% complete and the ONS is giving a 5-year period to complete the overall registrations backwards.

Q4: I've seen articles before saying that the incidence by deprivation is somewhat distorted. I.e. we can't assess TRUE incidence - instead we are assessing MEASURED incidence. This is true incidence * "likelihood of being picked up". We know that the less deprived are more likely to go for check-ups etc - so this impacts on the measured incidence. Thoughts ?

--- This can be a valid point and our findings actually reflect this. It is probably true that people in less deprived areas have better access to health services. It is also true that, for instance, cancer screening is more accessible by least deprived groups, and this could cause higher incidence rates. These could allow earlier diagnoses that could have a significant impact on survival rates. People in more deprived areas are more likely to be diagnosed with an advanced-stage cancer, especially when it comes to life-style related types, e.g. lung cancer. Yet it is possible that all these have a higher impact on cancer mortality/survival. We could look into this in more detail if the available data could be split by cancer stage along with the other variables.

Q5: Does the model take into account demographic changes that may occur in the future?

--- Currently no. Incorporating demographic changes in our analysis is very interesting and requires an additional level of modelling. We intend to do so in the future.

Q6: I'm only moderately familiar with a Bayesian model framework. Compared to a "more common" tool used in actuarial studies, i.e. GLMs, what are the key advantages of using Bayesian approach? Would you expect significant differences in results of theta parameter estimation, if it was done using a GLM? Thank you.

--- The Bayesian approach allows us to take into account uncertainty and extra-variation in the data in a more natural manner (e.g. through hierarchical modelling). The setting we have adopted gives us more flexibility by using distributions instead of point estimates for a given parameter. We would surely expect to see consistent results if we were comparing GLM and Bayesian model results.

Q7: When looking at IMD deciles within regions... this means that a 1 in South West is not equal to 1 in North East? The analysis is done within region to ensure that there are enough in each decile within the regions? Have we done the analysis across England deciles?

--- Income deprivation deciles are determined for the entire population and have the same reference points – therefore they are the same throughout all regions. With this in mind, our analysis suggests that there are differences in cancer rates for the same decile (say most deprived, decile 1), across regions. This is the case for certain cancer types, e.g. lung cancer. This may be explained based on, for example, the south of England being considered more affluent (in general) than the north, which could affect wellbeing of general population in those areas. Our analysis is performed per deprivation decile in each region. We have not carried out the analysis by aggregating the data over regions, as we were interested in comparing regions as well and give finding at a more granular level.

Q8: In addition to Markov model, are there other models that have been used to compare projections of cancer incidence?

--- We have not used the Markov model to project cancer rates at this point – rather we have used the Bayesian Poisson model to do so. There are certainly other methods that can be used, e.g. Lee-Carter- or CBD-type projection models, models based on machine learning approaches etc.

Q9: Has anything yet been published on the delays in diagnosis? So this can be referenced?

--- We have published our findings in:

- Arık A, Dodd E, Cairns A, Streftaris G (2021) Socioeconomic disparities in cancer incidence and mortality in England and the impact of age-at-diagnosis on cancer mortality. PLoS ONE 16(7): e0253854. https://doi.org/10.1371/journal. pone.0253854

There are other papers already published – see references in pubication above (e.g. 51).

Q10: Did you consider smoking and its impact on lung cancer? Projecting lung cancer

mortality/ morbidity without thinking more broadly about the stage we are at in the smoking epidemic and patterns in smoking prevalence results in a loss of important information, no?

--- We have not considered this impact we do not have relevant data available. It would be surely relevant and would add to the strength of the findings. It would also involve some additional challenges, e.g. how to describe smoking intensity per group, how to take into account the number of years since quitting (for the quitters subgroup) etc.

Q11: Lung cancer may occur after survival from breast cancer for example.

--- This is true. In our Markov model, a related point is considered (to some extent), in line with advanced-stage breast cancer. This cancer type involves metastatic cancer, e.g. cases referring to women that survive from breast cancer and develop another type of cancer at a later time.

Q12: There is marking data available on this. Public health have worked on this with the NHS. Happy to chat.

--- This is exciting to hear. It will be great to talk and establish availability and explore relevant work and possibilities.