EpiHealth Case Study: Nutrition- and genetic epidemiology (NGE)

Background

Based on previous population-based cohorts, most importantly the Malmö Diet Cancer (MDC) study from 1992-96, we have access to a rich data-base on dietary recordings. A new development in this research area is the focus on oral and gut microbiome that can be analysed by sequencing the microbiota. This is already underway within the Malmö Offspring Study (MOS) since 2013 and funded by the Swedish Research Council for 5 years. During early 2014 a first set of 167 microbiota samples were shipped to a lab in Germany for sequencing, now completed. Based on these data it will be possible to dissect the diet-host gene-microbiota interactions for disease patterns within families.

The evidence for contribution and regulation of gut and oral microbiota from humans living under normal conditions is largely unknown and unclear, and studies so far have been based on relatively small cohorts. Our collaborative study will investigate the role of dietary factors and genes in oral and gut microbiota for gastrointestinal health and cardiometabolic risk in a large number of individuals from MOS. The oral microbiome is analysed together with a research team at the Malmö University and researchers at NIH, USA.

NGE is of great relevance not only for academic research at the highest level, but also for society (public health problems) and the business sector (functional food products). Furthermore, this research area links LU and UU as there are many qualified researchers and PhD students on both sides to interact. Of special importance is the dialogue with the biotech and business sector for utilization and implementation of research as exemplified by the products from the Antidiabetic Food Center (ADFC) at LU and the "Healthy food bag" project (healthy products linked to the "Nordic Diet") offered to customers in a separate project with the business sector.

An extensive collaboration has started also with the Food Products Agency (FPA) for development of online methods to do extensive diet registrations. This means that up to four days of dietary registrations can now be obtained by use of the online services. We have also developed new tools such as short instruction films at www.youtube.com.

Finally, we have launched a media campaign during 2013-2014 with up to 25 advertisements to promote EpiHealth, MOS, and our new methods. This has attracted a considerable interest from the media and lay people. Food is something that everybody is concerned about, and in addition a most important part of lifestyle in general of relevance for public health.

Organization of the collaboration

EpiHealth has facilitated initiation of multi-disciplinary collaboration between several research groups within the project. The group of M Orho-Melander (LU) for diet-gene interactions, P Franks (LU and Harvard University) for lifestyle-gene interactions, F Fåk (LU) for microbiota analyses, D Jönsson (Malmö University) for oral microbiota data collection and analyses, PM

Nilsson (LU) and L Lind (UU) for leadership and coordination of the novel cohort collections (MOS, EpiHealth). Several international partners contribute (Harvard University, Broad Institute, Imperial Collage London, NIH, CHARGE consortium, etc.) with research contracts with EpiHealth partners. Additional important collaboration partners are ADFC and GATCBiotech in Germany, with signed contracts for the project. The EpiHealth case-study projects are partially financed by EpiHealth and partially by research grants to the PIs involved in the project. The multi-disciplinary nature of the project as well as the infra-structures in EpiHealth and Lund University Diabetes Center (LUDC) greatly strengthens the project.

Advances in higher education programs

P Franks is coordinating the "BLUE ScY project", intended to establish a bilateral exchange for mid- term PhD students and post-doctoral fellows who are primarily based at either LU or Umeå University, with departments of Epidemiology and Nutrition at the Harvard School of Public Health (HSPH) and the Broad Institute of Harvard and MIT. One LU student has already attended this program. Furthermore, during the project period two major symposia have been organized dedicated to NGE, bringing together researchers from LU and UU as well as from the industrial sector (ADFC, biotech SME´s). The impact of this research on higher education is visible as recruitment and training of a number of PhD-students, and advanced courses in epidemiology and biostatistics. During the project period several PhD theses described the influence of food patterns on disease developments. Of special interest is that nutrition in early life, breast feeding or formula feeding, links the research area with another high-priority area of EpiHealth, *reproductive epidemiology*, for investigations into early life influences on adult health (with SIMSAM).

Contribution to improved international status of the strategic research environment

Long-term follow-up analyses are carried out by a research team led by M Orho-Melander (LU) for diet-gene interactions, and with important contributions from P Franks for lifestyle-gene interactions. In addition, these data have contributed to international collaborations within the EPIC and EPIC-Interact consortia for analyses of the role of diet and lifestyle in the causal pathways leading to disease, i.e. cancer and DM2. The results of all these efforts are visible in a number of excellent publications, some of them reaching very high-impact scientific journals.

Major challenges in this research project

The challenges offered in this research area include the funding of research and the step from basic science (diet-gene interactions) to designing of functional food and testing in intervention studies. The functional food sector is growing and many good opportunities exist for research, development of products, as well as market analyses and campaigns. Collaboration with the business sector is facilitated in Skåne by the Medicon Valley infrastructure.

Summary

NGE serves as a good example to show our ambitions and achievements for: a) excellence in

scientific work and publications of highest international standards, b) addressing public health problems as food intakes is of great importance for development but also prevention of many diseases, c) linking LU and UU for a strong research collaboration, d) providing a good opportunity to work closely with the business sector (functional food industry, biotech) and the society (FPA), and e) addressing the "Third task" of universities (dissemination of knowledge) by interaction with the media and lay people via publications, advertisements, short video films and many interviews. We can conclude that NGE therefore has served all the purposes of the original EpiHealth application (2009) with documented impact and great future possibilities when we will benefit also from the new addition of microbiota research in a trans-generational perspective.