



Epidemiology is a discipline which establishes theoretic validity through large-scale population studies including biobanks with data on genes and other biomarkers. By upgrading regional infrastructure and pooling resources and data, Scandinavian researchers will become uniquely positioned to monitor thousands of citizens on their life journeys. Exposing the causal pathways which induce cardiovascular disease, the endeavour can inspire future remedies and propose new drug targets.

Exploring collaborative epidemiology to develop scandinavian cardiovascular research and treatment

As a prominent cause of global mortality, cardiovascular disease is, fittingly, at the heart of much recent medical research. Smoking, poor diet and inadequate exercise are widely perceived causes, although a comprehensive understanding of the numerous factors which may precipitate such conditions is yet to be realised.

Epidemiology, often assumed to exclusively scrutinise contagious maladies, in fact offers a means to fulfil this aim. The need for such analysis is obvious, as a basic comparison illustrates, according to Professor Peter Nilsson, a specialist in clinical cardiovascular research at Lund University, Sweden. “We know that two patients with almost identical ailments may be subject to radically different prognoses” he says. “Why?”

Epidemiology for Health, or ‘Epihealth,’ is a Strategic Research Area at Lund University which, in collaboration with former rivals Upsala University, seeks to discover key underlying differentials. Established in 2010, and currently supported by around 190 personnel, the project, funded by the Swedish National Research Council, embodies an evolving, modernised epidemiology. It rests, as Nilsson explains, on three fundamental pillars.

‘Basic’ epidemiology uses large volumes of data about healthy individuals or patients as well as blood samples – or ‘bio

banks’ – to consider how DNA and other ‘bio markers’ such as cholesterol and glucose levels may impact on the individual, through an analysis of the collective. Assessing these elements can facilitate a “gene and environmental interaction analysis (GxE)”, which reveals how external factors can subtly influence our biology, engendering health risks.

“‘Basic’ epidemiology uses large volumes of data about healthy individuals or patients as well as blood sample to consider how DNA and other ‘bio markers’ such as cholesterol and glucose levels may impact on the individual”

Numerous genes may actually be “passive agents” – until external (i.e. environmental) stimuli render them malign. “People are misled into assuming a DNA analysis is a crystal ball” reminds the Professor, also Epihealth’s Co-ordinator. “It is quite impossible, except for a few diseases, such as certain types of

familiar breast cancer, to anticipate their destinies”. Mendelian randomisation – a statistical method and technique which exploits bio-banks and genetic resources to test and consequently divulge the relevance of “true biological pathways” – is a vital tool in this quest. The strategy contrasts with earlier epidemiological approaches, which tried to navigate potentially thousands of often spurious associations. “We’re doing this to establish, biologically, what’s authentic and what’s untrue” relates Lund’s Co-ordinator. “Once defined, we can help to direct and orient future interventions, in the form of medicines and treatment. And yet, a key paradox is that the more we know about DNA itself, the more profound environmental factors seem to be.”

Confronted with such a vast, intricately knitted universe of related phenomena, Epihealth’s team decided to focus on three specific concerns. Looking at the bacteriological content of the gut, they aspire to determine whether some of the 2-3 kg of ‘friendly’ bacteria contained by the human body cause disease, by considering genetic ‘fingerprints’ gathered from individuals. Nutritional epidemiology (the effects of diet on obesity and ageing, and its relation to genetics) provides a second emphasis. Reproductive epidemiology, and an investigation into the lasting consequences of parental influences on unborn, foetal infants, offers another strand of research.

To rigorously examine these topics, vast resources and infrastructures (second pillar) are required. “The capacity of biobanks is so great that numbers and volumes become critical to the field. A study of 100 people is insignificant; 1000 trivial. 10,000 is more relevant – and 100,000 potentially valid. Collaborations



can increase the feasibility of working to these scales” contends Nilsson. Modernity, he opines, encourages such interconnects; despite “capitalist” competition, and urges to publish first and monopolise funding. In terms of human resources, gene interaction requires highly specialised skills in bio-informatics – so rare that these experts are often in short supply. An awareness of this deficiency is a cornerstone of Epihealth, which, after launching its venture to consolidate Swedish infrastructure and skill, perceived an opportunity to forge an international partnership.

‘Clinical’ epidemiology – the third pillar of the field – was a key motivator behind that decision. This facet of the science, details Nilsson, pertains to “everything concerning patients in the healthcare system: how they are treated, official clinical registers and records of their hospital and primary care.” Realising that their respective cultures, infrastructure and research interests were sympathetic, Epihealth, in conjunction with other Swedish institutions, applied for regional EU Interreg funding, alongside a number of local Danish partners from the Copenhagen area. Awarded 1.9 million Euros for a three year undertaking, the scheme, known as ‘Skarf’, aims to use epidemiology to improve cardiovascular disease prevention and treatment in the region of Øresund. Now entering its third year, the scheme will leave an important legacy after its official culmination – an improved infrastructure, which transforms the region into a centre of excellence for cardiovascular research.

This renaissance has partly been conceived online, through the implementation of a cloud-based website which allows university professors to work closely with their PhD students and juniors to pool information, across institutions and borders. “It makes it easier for researchers to initiate and track their projects, especially if they are overseeing multiple initiatives” comments Dr. Kristian Wachtell, an award-winning cardiologist based at Glostrup Hospital, Copenhagen. Facilitating virtual meetings and permitting users to co-author text documents, the platform operates independent of institutional IT

departments. A participant in the scheme, research assistant, Dr. Anders Greve, has already made some widely publicised discoveries, i.e. developing an electrocardiogram utility which helps to better gauge when patients require often risky heart valve replacement surgery.

What also lends the project an unusual, enviable potential is the composition of its subjects. In Denmark and Sweden, individuals possess a rare asset for scientists: a 10 digit personal ID number, which can be used to accurately track their internal movements and healthcare interactions. Comparatively, in the US, regulations – and regional variations – would preclude this. Also, in both Denmark and Sweden population movements are also notably stagnant, which encourages the possibility of linking a register-based analysis, potentially spanning a patient’s lifetime, to detailed bio-bank records – divulging hitherto unseen networks of correlations.

“This is a unique opportunity. What we are doing is testing the normal population with risk factors for cardiovascular disease, and examining relations and associations within these datasets” comments Dr. Wachtell. Due to the vast arrays of data the participants have shared, one completely separate silo of records can be used to generate a hypothesis, with another employed to test it. This is very important, says Wachtell, as it offers proof that ‘true biology’ has been discerned – rather than an aberration, or a national medical registration trend. Despite public fears over privacy concerns and Big-Brother like omnipotence, if ethically mined, these substantive informational assets have vast potential for stimulating regional – and indeed international – welfare improvement. “This resource has been under-exploited” ventures the Doctor. “What we need is more investment, and researchers to interrogate it. There’s so much latent knowledge there, just waiting to be brought into circulation.”★

Web-sites of interest

www.med.lu.se/epihealth
www.Skarf.eu



AT A GLANCE

Project Information

Project Title:

“Epidemiology for Health” EpiHealth, and “Cardiovascular Prevention” for EU-Interreg IV Project

Project Objective:

To establish an academic network for national and international excellence in epidemiology (EpiHealth) and to promote a joint infrastructure for cardiovascular prevention and epidemiology linking Denmark and southern Sweden (EU-Interreg project)

Project Duration and Timing:

The funding of the EpiHealth project comes from the Research Council of Sweden for the period 2010-2014 (Lead partner: Lund University, Sweden). The funding of the EU Interreg project is for 2011-2013 (Lead partner: Rigshospitalet, Copenhagen, Denmark).

Project Funding:

For EpiHealth a total of 42 million SEK will be paid to the Lund University for sharing between the Lund University (60%) and the Uppsala university (40%). The funding for the EU-Interreg project is for 2 million Euros to the Lead Partner and thereafter sharing with the collaborating centres.

Project Partners:

For EpiHealth: Lund and Uppsala Universities, Sweden

For the EU Interreg project: Rigshospitalet, Glostrup and Bispebjerg hospitals in Denmark, as well as two partners, Lund University and Region Skåne (county council of Scania), in Sweden.

Main Contact:



Peter M Nilsson, Professor

Peter M Nilsson, born in 1953, is a full Professor of Clinical Cardiovascular Research at the Lund University. He is also the Coordinator for EpiHealth and the Lund University representative within the EU Interreg project. He has published more than 250 original papers and 90 reviews, mostly in cardiovascular epidemiology, genetics, type 2 diabetes and insulin resistance.

Contact:

Tel: +46-40-33 24 15

Email: Peter.Nilsson@med.lu.se

Web: www.med.lu.se/epihealth
www.skarf.eu



LUND
UNIVERSITY

