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HEADLINE: Bad habits - or bad genes?

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The people of eastern Finland are famous for being ill. They have the dubious distinction of having one of the highest rates of heart disease in the world. They also suffer more than their fair share of diabetes, high blood pressure, schizophrenia and depression. In eastern Finland, the infant mortality rate is one of the lowest found in the developed world, yet by the time people reach middle age, their life expectancy falls well short of other Europeans.

The mystery of why the Finns - particularly those who live in the eastern province of Savo, close to the border with Russia - are so prone to some of the most lethal disorders of the Western world has been a longstanding conundrum. But it is one that is slowly being solved with the help of a meticulous study of local families, combined with the scientific power provided by the deciphering of the human genome.

Scientists involved in a 20-year project to unravel the role of genes and lifestyle on the health of the eastern Finns believe they are at last beginning to find possible answers to the question of why this isolated group is so prone to illness. Solving the problem has wide-reaching implications. It could help to explain why other areas of the world are also experiencing epidemics of heart disease, diabetes and the other serious disorders of later life.

Finland has for years come top - or close to the top - of the European league table of mortality rates from circulatory diseases such as heart disease and stroke. Its eastern province of Savo, around the small city of Kuopio, has historically fared even worse than the national average in potentially lethal diseases of middle age.

An obvious explanation was the notoriously fatty diet of the Finns, which has by necessity evolved to provide the body with vital sustenance during the long and bitterly cold Nordic winters. Full-fat milk is still regularly drunk with meals, and the people of Savo, the Savolainen, are partial to heart-attacks-on-a-plate, such as Karelian pies, a stodgy concoction of pastry filled with mashed potato or rice and liberally smeared with butter and chopped egg.

Then there are the notorious drinking habits of the eastern Finns. Although they do not drink that much per head (not as much, for instance, as do the French or Italians), what they do drink is almost always consumed in one sitting and for one purpose - to get drunk.

However, while the drinking and diet of the eastern Finns is not noted for being particularly healthy, neither is it so different from that of other Finns - or, indeed, the rest of northern Europe. Food and drink, in other words, cannot explain why this group of Europeans suffers so badly with the diseases of the Western lifestyle.

The real answer lies in the unique history of the eastern Finns, which has exacerbated their genetic isolation. A limited influx of genes from other parts of the world, and the resulting inbreeding, has exaggerated any genetic defects. This group of people is, therefore, the best population for geneticists to study in order to tease apart the complex interaction of genes and lifestyle on long-term health.

From her base at the University of Helsinki, Professor Leena Peltonen has spent much of her life contemplating the respective role of nature and nurture on the health of the eastern Finns. After many years of research, Professor Peltonen, a medical geneticist, has helped to explain how the history of the eastern Finns has led to the sharing of certain genetic traits that have predisposed them to the illnesses they suffer from today.

“The genes of this population are better known than any other population,” Professor Peltonen says. “The diseased genes of the Finnish population have definitely made what I would say is a landmark in disease genetics, simply because Finns are isolated and they have remained isolated for hundreds of years,” she explains.

Sandwiched between two powerful neighbours - Russia and Sweden - who have in the past both ruled Finland, the eastern Finns are in many way the medical victims of colonial conflicts stemming back many centuries. It really began in the 16th century when the Swedish King Gustavus of Vasa ordered the mass movement of Finnish-speaking families from the south and west of Finland into the sparsely populated eastern interior to act as a buffer against Russian encroachment.

Historians estimate that between 40 and 60 “founder families” made up this migration and that these people subsequently gave rise to the bulk of the population living in eastern Finland today. However, the growth of this pioneer population was not without its setbacks. Famine and plague ripped through the small rural community creating a “genetic bottleneck” - when the population

crashes and becomes small enough to limit the diversity of genes inherited in subsequent generations.

In scientific terms, this results in a dramatic shrinkage of the available gene pool. More simply, it means that the eastern Finns today are a relatively inbred population, made up of people with an unusually homogeneous array of genetic traits.

What is unusual is that this genetic homogeneity was maintained for centuries simply because so few people migrated into the region. The geographical, religious and linguistic isolation of the eastern Finns helped to maintain a common genetic inheritance that is still prevalent to this day.

"There is some inbreeding, but it's typically not recognised," Professor Peltonen says. "People don't know that they are related because their relationships are so old - people could have been related seven generations ago."

It is this combination of events - a small founder population, severe genetic bottlenecks and generations of intermarriage - that has turned the eastern Finns into perfect experimental material.

Professor Peltonen says that scientists have already identified 31 different disease-causing genes as a result of studying the Finns, especially those living in the eastern region of Savo. "The Finnish population is the best characterised population in the world with regard to these genes," she explains. "It's a unique setting. If you monitor all of these 31 disease mutations, one Finn in three carries at least one of them."

There is an additional factor that makes the eastern Finns such good study material. In 1634, the then Swedish king established detailed church records for taxation purposes. This record-keeping has continued with Finland's modern health service, which follows every Finn from birth to death and has the records to prove it.

"Finland is one of the best places on the globe to study these complex diseases because we have this wonderful, isolated population, but we also have high-quality, socialised healthcare that produces good records," Professor Peltonen says.

The study of human genes and the unravelling of the human genome still relies on piecing together the DNA jigsaw of life by studying people who are in some way related to one another, either as a family or as a relatively inbred, homogeneous population. It is a study that has produced important medical breakthroughs with potentially lucrative spin-offs.

A Finnish company called Jurilab, set up with the help of government money, has exploited this wealth of record-keeping and genetic information to discover the genes that could account for the poor health of the eastern Finns today. Professor Jukka Salonen, Jurilab's chief scientific officer, says that some 6,000 different items of health information have been collected on about 3,000 people since the project on heart disease first began in 1984.

"This was the first population to be studied where DNA was collected," Professor Salonen says. "The resulting wealth of medical and social information has resulted in the world's most comprehensive DNA and data bank."

Jurilab scientists are working on a gene involved in triggering type-2 diabetes, a gene that plays a role in hypertension and a genetic test to identify people whose livers are capable of breaking down prescription drugs too fast for the medicines to work properly. The potential income from a diagnostic test for just one of these could run into hundreds of millions of pounds.

Such breakthroughs have come out of studying the DNA of local Savo people such as Pekka Ropponen, a 56-year-old former construction foreman. Like his two sisters and three brothers, Ropponen suffers from high blood pressure - hypertension. One of the benefits of taking part in the study, he says, is recognising that if family members have hypertension, you are also at risk; and that you can do something to help yourself by taking exercise, cutting down on salt and watching your weight.

Professor Salonen said that Finns such as Ropponen take part in the research because they are interested in finding out about why their health is so poor. "These people know about these diseases a lot. They see their family members dying of coronary heart disease and diabetes. It affects their lives," says Professor Salonen.

Knowing that you, your family and your nearest community is at such a high risk of heart disease, hypertension or diabetes can have its negative side. Professor Salonen used to frequent a run-down petrol station owned by a man with three brothers who had all died of heart attacks before the age of 40. The reason the garage was run down was because the man believed there was no reason to invest in the future, Professor Salonen says.

Despite their history of disease, there are signs that the Finns are finally beginning to take note. Nationally, the rate of heart disease is falling as younger people take up a healthier lifestyle than their parents. Despite the disadvantages conferred by their genes, even the people of eastern Finland are beginning to show signs of learning a healthy lesson in the art of living well.