Can our DNA predict our illnesses?

Scientists are working to understand how each person's unique DNA profile suggests which diseases might affect them. Because our DNA profiles provide a recipe for shaping many elements of our biology, such as our height and eye color, scientists have sought to answer the question of how we might predict a person's risk of a disease, like lung cancer, from their DNA profile.

Recent research has pointed to mathematical strategies that, in the near future, may have clinical applications for assessing disease risk.

The human genome sequencing project of the 1990s and early 2000s ushered in a scientific effort to identify genes that contribute to different diseases, including heart disease, lung cancer, and schizophrenia. Large-scale studies have enrolled millions of people around the world to work towards this goal. Each study collects a tissue sample, such as a cheek swab, saliva collection, or blood draw, from each volunteer in the study. The collected tissue sample contains human cells, and, from those cells, scientists can isolate a person's DNA, the alphabet that provides the recipe for each person's biology, including their eye color, height, and their tendency to get sick.

A technology called "genotyping" provides scientists with each volunteer's DNA profile, a sequence of letters that specifies the chemical structure of their DNA.

Scientists then use statistical association tests to identify genes that contribute to a person's chances of getting a disease like lung cancer. The statistical association tests work by comparing the DNA profiles of people with lung cancer to the DNA profiles of people without lung cancer. Each difference in DNA profile between the two groups, 1) people with lung cancer and 2) people without lung cancer, points to a gene that contributes to lung cancer.

By looking across people's entire DNA profiles, scientists can identify many genes that influence lung cancer development. It's important to point out that, in nearly all cases, no single DNA profile dictates that a person will get lung cancer; however, a person's chance of getting lung cancer increases if they have a DNA profile that matches those of people who already have lung cancer.