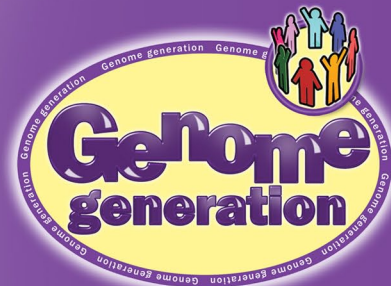


Genome generation

A Guide to Scenario 4



Heather, her risk for Alzheimer's and her reluctant twin

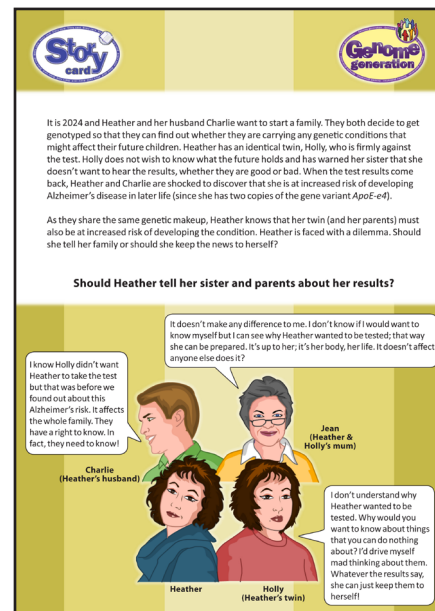
This scenario is set in the future and assumes that recreational genotyping has become commonplace.

Summary: This scenario presents a young woman (Heather) who has an identical twin. Heather wishes to start a family with her husband and has decided to get herself genotyped. Her twin objects to the test and does not wish to know the results. The results show that the twins are carriers of two copies of the gene variant *ApoE-e4*, which puts them at high risk of developing Alzheimer's disease. The group has to decide whether Heather should tell her sister or parents about the results.

As the twins are identical whatever is revealed about the genotype for one twin will match the genotype of the other. If the twins were non-identical the genetic similarities would only be as close as that of any other pair of siblings.

Initial question: Who should Heather tell about her results?

Key issues: *Incidental or unexpected findings; Impact on families; Who should have access to data? Issues of consent*



Complexity, sensitive issues & guidance on providing support

This scenario is appropriate for GCSE and A-level.

This scenario addresses the impact of unexpected findings revealed through genotyping and how this may affect an individual and their family who share their genes.

Many people have had some contact with Alzheimer's disease which may mean that some people are sensitive to the issues that are raised. However, the fact that many of us might know, or have experience of supporting, someone with the disease, may mean that this is a scenario that people can relate to, and will therefore feel confident to discuss.

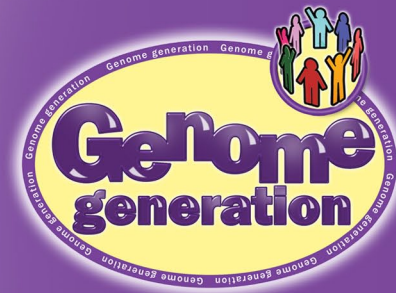
Some of the issues or questions that may be explored during discussions

Is your genome really your own?

The results of a genetic test or genotype do not only reveal information about you. They also reveal information about your parents, siblings and children. What is the impact of revealing that information to the rest of the family? Should you get the consent of your family? Conversely, should they be allowed to access your data without your permission?

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Identical twins have identical genotypes.

Is it fair for someone else to know your genotype if you have not given your consent? Should Heather have Holly's permission before taking the test? Should she have Holly's permission before sharing the information with other people, i.e. her husband or parents?

Should you share information with your family, even if they don't want to know?

If someone does not want to know what their genotype reveals, but you have information that you feel they need to know (i.e. a disease for which they can prepare themselves or take preventive action) should you tell them anyway?

What are the implications of sharing (or not sharing) your information?

What if Heather does not tell anyone, but one or both of her parents fall ill? She may feel guilty. The rest of the family may know that she had prior information that could have helped them prepare. Conversely, if her parents do not fall ill, Heather may worry unduly and look for signs that do not exist.

Can knowledge of your risk status of Alzheimer's disease be beneficial?

If a person knows that they are at high risk of developing Alzheimer's disease they may wish to make preparations for their future health needs.

Further information – what they might need to know

What is the relationship between the ApoE gene and Alzheimer's disease?

The protein Apolipoprotein E (APOE) is important in the metabolism of vital biological molecules called lipoproteins. There are a number of variants of the gene that encode for this protein – the common forms are *ApoE-e2*, *ApoE-e3* and *ApoE-e4*. The most common form of the gene is *ApoE-e3*. The *ApoE-e2* form of the gene is linked to high levels of fat in the blood and an increased risk of heart disease. It also seems to be associated with a reduced risk of developing Alzheimer's disease. The *ApoE-e4* version of the gene is associated with an increased risk of developing Alzheimer's disease. However, these associations do not determine whether or not an individual will actually develop the disease.

Genetics and Alzheimer's disease

Studies suggest that the development of Alzheimer's disease is about 60% genetic and 40% environmental. Genetic tests are more commonly used for deterministic genes for early onset Alzheimer's disease. For late onset disease, *ApoE-e4* remains the only accepted genetic link increasing risk, despite numerous studies reporting other risk factors.

Treatment and care of Alzheimer's disease

Alzheimer's disease is treated with drugs that enhance the action of the neurotransmitter acetylcholine (in the earlier stages of the disease), and drugs that block the effects of an excess of the chemical messenger glutamate (in moderate to severe disease). Early drug intervention has been shown to be effective in slowing the progress of the disease and evidence is growing to suggest that the same drugs continue to be beneficial as the disease becomes more advanced.

Genome generation

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Diagnosis of Alzheimer's disease

Assessment of patients who fear they may be developing dementia involves a combination of discussions with the patient and people close to them, physical examination, memory tests and brain scans. In early stages of the disease, it is difficult to distinguish between scans that show evidence of the disease and those that show normal brain ageing.

Further reading

The following news stories can be used in addition to the information cards to provide extra background information to help students understand the major issues raised in this scenario.

Five more Alzheimer's genes discovered, scientists say

<http://www.bbc.co.uk/news/health-12937131>

Would you really want to know you'd get Alzheimer's?

<http://www.bbc.co.uk/news/magazine-11741597>

Further information for students

Students can find out more information about Alzheimer's disease from the following websites:

NHS Choices

NHS Choices is produced by the National Health Service (NHS) and provides information on a range of different health issues. The page below provides information on Alzheimer's disease.

<http://www.nhs.uk/conditions/Alzheimers-disease/Pages/Introduction.aspx>

Alzheimer's Society

The Alzheimer's Society is a charity that funds research into dementia and provides support for people whose lives are affected by Alzheimer's disease.

http://alzheimers.org.uk/site/scripts/documents_info.php?documentID=100

Follow up activity

Ask the students to explain what *ApoE-e4* is and how it is linked to Alzheimer's disease. What other genes are associated with Alzheimer's disease and how do they function?

The following sources can be used as points of reference:

- <http://www.alzheimers.org.uk/factsheet/405>
- http://www.nia.nih.gov/sites/default/files/alzheimers_disease_genetics_fact_sheet.pdf
- <http://ghr.nlm.nih.gov/condition/alzheimer-disease>