

PHARMACOGENETICS (PGX) DEBATE KIT

CAN SCOTLAND IMPLEMENT PGX TESTING?

OVERVIEW OF ACTIVITY

Pharmacogenetics (PGx) is a complex scientific field bringing together both pharmacology and genetics. This debate kit is designed to provide another resource that teachers can use within a lesson on PGx and precision medicine. It is designed for **Scottish S5 pupils studying Higher Biology or Higher Human Biology**. It integrates into Unit 1 in both courses.

Rather than focussing on the science, this debate kit aims to introduce pupils to some of the political and practical issues of implementing PGx into our health system. It is designed to be incorporated into a lesson on PGx but **after** pupils have covered the basics of the science behind PGx.

The debate kit hopes to:

- Develop key transferable skills such as communication, critical analysis and teamwork.
- Challenge pupils' opinions about PGx.
- Introduce them to different points of view.

It is focused on the central question of: *Can Scotland implement PGx testing?*

Learning Objectives:

- To practise discussing and debating issues and evaluating opinions and facts.
- Understand the arguments for and against pharmacogenetic research.

Structure

The debate kit consists of several fictional characters, whether for or against the central question, that are all linked to the Scottish healthcare system in different ways, for example doctors, patients and researchers. This way pupils can be exposed to different points of view and be provided with the information and evidence to back these points of view up, rather than having to come up with these on their own. It also encourages pupils to *play Devil's advocate* and understand and evaluate opinions that may oppose their own. The debate kit has an accompanying PowerPoint that includes a brief summary of what PGx is and contains links to other sources of information as background for teachers.

Structure

The lesson would occur as follows:

1. The class would be introduced to each of the character's opening statements (see **bold** paragraphs below). They would then have to identify what side of the debate they think each character is on, **and why**.
2. The teacher then reveals the correct answers.
3. The class is split into smaller groups and each group is given a character. Each character has an associated **question** they can ask another character in the debate. The group decides which character on the opposite side of the debate they feel is the best person to answer this question.
4. The group whose character has been asked this question can use the **response** on their character card to answer the question. If they choose the correct character the response should link back up to the question. Many of these responses include facts to back up the statements.
5. Whilst there is only one question and response on the character cards, the teacher should encourage the discussion to continue.
6. The round continues until every character/group has asked/answered one question.
7. As a summary, the class is asked to answer the main question: Do they think Scotland *can* implement PGx testing? If so, what are some of the main challenges that may be faced.

Characters

For Implementation	Against Implementation
<ul style="list-style-type: none">• Dr Samantha Smith – NHS Doctor and Spokesperson• Prof. Raj Singh – Professor of Pharmacogenetics• Rt. Hon. Andrew MacDonald – Politician (Member of the Scottish Parliament)• John Coleman – Car accident victim	<ul style="list-style-type: none">• Jane Wilson – Data Privacy Campaigner• Dr Eilidh Carpenter – Private GP, Scottish Highlands• Ajay Atwal – Researcher for Equality, Diversity and Inclusion in health• Prof. James Smythe – Health Economist

For shorter sessions, only the 4 core characters (2 on each side) in **bold** are necessary. The correct sequence of questions and answers are below:

<p>Samantha Smith: Question to Jane Wilson. Response to Eilidh Carpenter.</p> <p>Raj Singh: Question to Eilidh Carpenter. Response to Jane Wilson.</p> <p>Andrew MacDonald: Question to Ajay Atwal. Response to Ajay Atwal.</p> <p>John Coleman: Question to James Smythe. Response to James Smythe.</p>	<p>Jane Wilson: Question to Raj Singh. Response to Samantha Smith.</p> <p>Eilidh Carpenter: Question to Samantha Smith. Response to Raj Singh.</p> <p>Ajay Atwal: Question to Andrew MacDonald. Response to Andrew MacDonald.</p> <p>James Smythe: Question to John Coleman. Response to John Coleman.</p>
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JOHN COLEMAN

Car accident
victim



I was recently in a car accident, and I needed an operation. I was in a lot of pain after the procedure, so the doctor gave me a painkiller called codeine to help. But every time I took the pill, it made me really sick, it made recovery longer. The doctor had to change my dose 3 times before the side effects stopped.

Question: If there is a better way to prescribe drugs that would mean less people like me suffer side effects, we should definitely spend money on implementing it, right?

Response: This sort of research is inevitably going to be done somewhere, and I would rather it was our scientists, our work, and people like me who benefit in the long-term.

DR. SAMANTHA SMITH

NHS Doctor and
Spokesperson



Many drugs I prescribe for patients can be affected by patients' genetics. Sometimes my patients can experience ADRs forcing them to come back into hospital. This uses time, money and hospital beds, all of which the NHS has little of. A PGx test for patients taking drugs prone to ADRs would help me and other doctors prevent ADRs by using that information to inform prescribing, preventing patient readmission.

Question: The estimated cost of ADR admissions in NHS England is £2.21 billion per year. Shouldn't we be investing in research that could help people and save money?

Response: New PGx trials could be designed to focus on rural or isolated communities if local doctors were willing to be involved.

PROFESSOR RAJ SINGH

Professor of
Pharmacogenomics



We use a specific type of genetic test called a gene panel test. This does not sequence your whole DNA, only specific regions related to drug response. The scientific potential of PGx is very exciting. We could use early genetic test to inform a patient's medication across their life, preventing any ADRs. One set of test results can be used for the person's whole life.

Question: The potential for PGx is massive. What benefits of PGx could we be missing if we don't invest now?

Response: We can use a panel genetic test which does not sequence all of your DNA but only specific regions which allows a higher level of privacy.

RT. HON. ANDREW MACDONALD

Politician
(Member of the
Scottish Parliament)



Scotland is the world-leader in Precision Medicine and PGx research. But if our country's scientists don't get enough government funding to drive their research, we'll fall behind. The research will still be done in another country, or by private companies who are only interested in profit. I want Scotland to have the best health care for its citizens, that doesn't come with a massive cost.

Question: We have been world-class leaders in PGx research. Why shouldn't we continue to lead the way?

Response: To fill the gap of scientific knowledge on minority ethnic groups, we need to perform more genetic tests on a more diverse sample, Scotland has a growing diverse population and is a great place to start.

JANE WILSON

Data privacy
campaigner



I have big worries about my DNA sample being taken. Who will have access to my sample or my PGx report? I worry that large companies would use my DNA for other projects that I haven't consented to. Also, I worry that a lab researcher would be able to identify me from my sample. This undermines my patient confidentiality, and it is not right.

Question: Is there a risk of a patients' data being stolen or misused? What steps can researchers take to avoid this?

Response: Privacy is still a big concern and protection of data is expensive and time consuming.

PROF. JAMES SMYTHE

Health Economist



There is no study that has evaluated the cost effectiveness of a PGx test yet. Also, we don't know that this will save money. We need to wait until more research is done before we start rolling it out across the country. Also, how will it work? Will the test be done at the time of a diagnosis, before it or after?

Question: PGx is a developing field, and the government will need to invest some money into research which may be expensive. How can Scotland afford this research?

Response: Devoting funding to developing a genetic test for prescribing drugs would mean taking funding away from other areas.

DR EILIDH CARPENTER

Private GP,
Scottish Highlands



The practicality of PGx testing in rural communities has not been considered. As a private GP in a very remote area, we don't have quick access to major healthcare centres. I don't have time to wait for samples to be transported! The benefits of PGx in urban areas may be useful but in smaller communities the local doctors, like me, can make better decisions.

Question: How will PGx be used in small communities? What's the big picture?

Response: The benefits should be accessible for all of Scotland but most trials on PGx testing have not considered how testing will be implemented in rural communities.

AJAY ATWAL

Researcher for
Equality, Diversity
and Inclusion in
health



I study the diversity of the UK population, looking at how medical treatment varies between different ethnic groups. Research has shown that different genetic variations occur between ethnicities. Often, previous research has been biased towards white populations in the past with most studies sampling white people. This means that scientific evidence on other ethnicities is low. PGx tests used currently might be biased and only show relevant results for white populations.

Question: Can we be sure that current genetic tests would show the important results for everyone in the UK, not just white people?

Response: But leading the way for who? There is a lack of genetic studies completed in minority ethnic populations so some communities may not benefit as much as others.