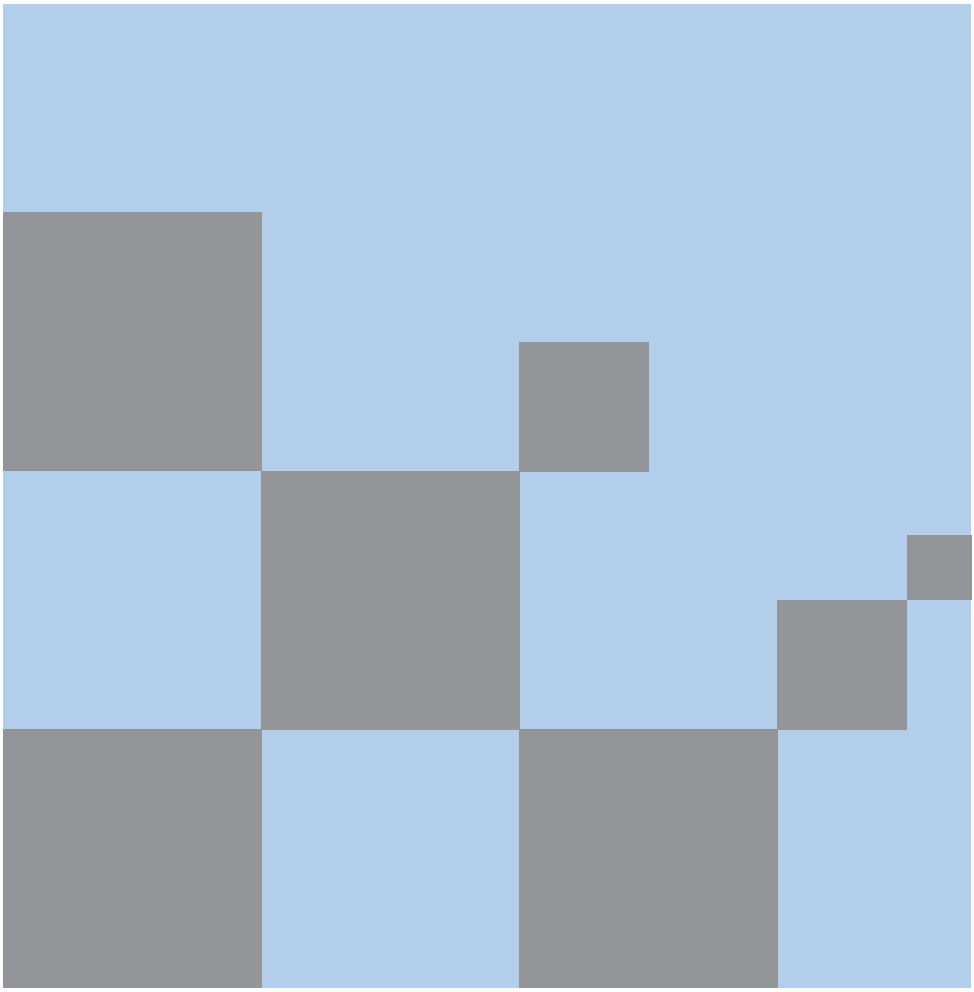
Oxford University Hospitals
NHS Foundation Trust

Carriers of Haemophilia

Information for patients



You have been given this leaflet to explain what being a carrier of haemophilia means and the screening tests which are available.

What is haemophilia?

Haemophilia is a bleeding disorder. People with haemophilia bleed for longer than normal, because their blood does not contain enough clotting factors. Clotting factors are proteins in the blood that help to control bleeding.

There are two types of haemophilia:

- haemophilia A
- haemophilia B.

People with haemophilia A do not have enough factor VIII (8) and people with haemophilia B do not have enough factor IX (9).

Genetics and inheritance of haemophilia

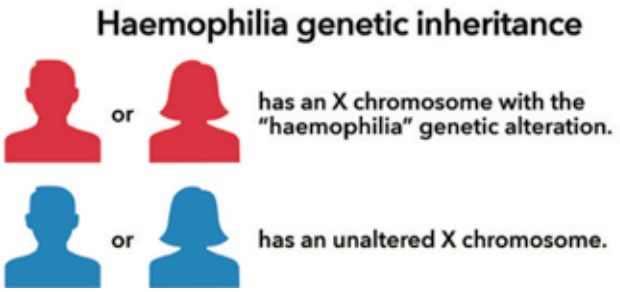
Haemophilia is an inherited disease, which means that it is passed from parent to child through the parents' genes. Genes carry messages about the way the body's cells will develop. In people with haemophilia, the genes responsible for the production of clotting factors are altered. As a result, their body will either produce very little or no factor VIII or factor IX.

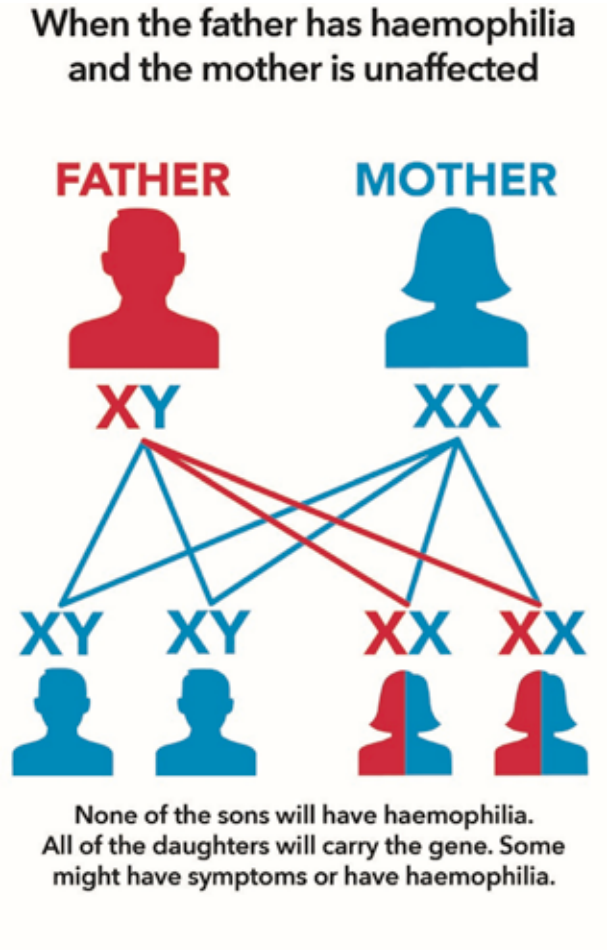
Genes are packaged within the body's cells in chromosomes. The genes involved in haemophilia are found on the 'X' chromosome.

Boys have one 'X' chromosome, which they inherit from their mother, and one 'Y' chromosome, which they inherit from their father. If the 'X' chromosome that a boy inherits from his mother has the altered clotting gene, he will have haemophilia.

Girls have two 'X' chromosomes, one from each parent. If a girl inherits a copy of the altered gene from either of her parents, she is said to 'carry' the haemophilia gene and is therefore called a 'carrier'.

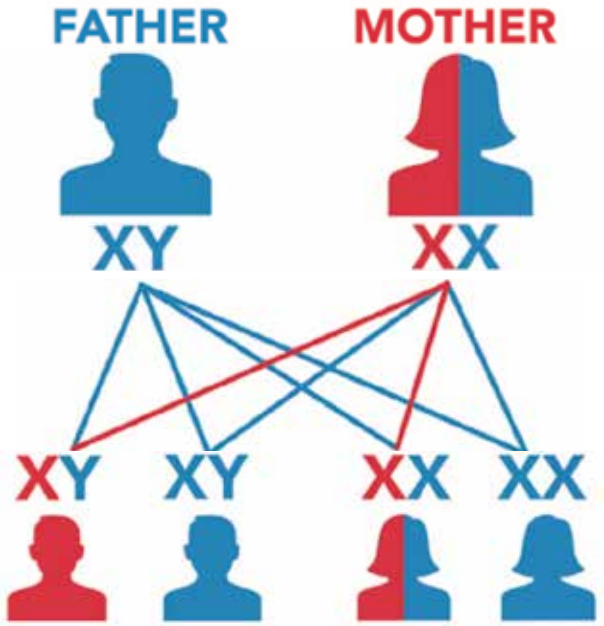
This is explained in the following diagram.





Source: Haemophilia Foundation Australia (www.haemophilia.org.au), 2017

When the mother carries the altered gene causing haemophilia and the father is unaffected



There is a 50% chance at each birth that a son will have haemophilia.

There is a 50% chance at each birth that a daughter will carry the gene. Some might have symptoms or have haemophilia.

Source: Haemophilia Foundation Australia (www.haemophilia.org.au), 2017

Due to the genetics of haemophilia, girls who are daughters of men who have haemophilia will be carriers (sometimes called obligate carriers). Girls who are daughters of female carriers have a 50% chance of being a carrier (sometimes called potential carriers). The only way of confirming carrier status is by genetic testing.

Factor levels

The normal amount of clotting factor in a person's blood ranges from 50%-200%. Some carriers of haemophilia will have factor levels that are normal and some will have levels below normal. However, the levels in female carriers will not be as low as a person with haemophilia. Females with low factor levels can experience some bleeding symptoms.

All carriers (both obligate carriers and potential carriers) will have their factor VIII or factor IX level checked. This test can be arranged either at the adult or children's Haemophilia Centre (depending on which one you might usually go to) and involves taking a blood sample.

It is useful to know your specific clotting factor level if, for example, you were to need surgery or a dental procedure. The clotting factor test will not confirm whether you or your daughter is a carrier of haemophilia.

Factor levels in females can vary among family members; this is due to lyonization (see next section). Males in a family who have haemophilia will have similar factor levels.

Lyonization explained

In each cell in the female body, one of the two 'X' chromosomes is turned off, or 'suppressed'. This process is called 'lyonization', after Mary Lyon, who first described it.

Lyonization is a random process, the cause of which is not fully understood. If the chromosome that's turned off has the altered gene, that cell will produce clotting factor. If the chromosome with the normal gene is turned off, the cell will not produce clotting factor, or the clotting factor it makes won't work properly.

On average, female carriers of haemophilia will have about 50% of the normal amount of clotting factor, because about half of their cells will have the 'good' gene turned off. Some carriers have far lower levels of clotting factor, because more of the 'X' chromosomes with the normal gene are switched off.

Factor levels can vary. Stress, inflammation, infections, pregnancy and certain medications can all cause factor VIII levels to rise, which can affect the test results. Factor IX levels are not affected by these things.

National Haemophilia Database

Confirmed carriers will be registered on the National Haemophilia Database (please see the leaflet attached). If you are female and have low factor levels, you will also be given a bleeding card, which you should carry with you at all times. The bleeding card will state your diagnosis and any treatment you would require in the event of an injury/accident.

Genetic testing

A genetic test to confirm carrier status is generally offered to girls when they reach 16 years of age (when they become legally able to consent for genetic testing), or to any adult who could be a carrier. The test looks at either the factor VIII or factor IX gene, to look for changes in the gene that can cause haemophilia.

If the change (or alteration) in the gene has already been found in your family, the genetic test can directly look at this specific area of the gene. If the alteration in the gene has not been found in your family, you will need to have a full analysis of the gene.

If you have received this leaflet because you are being offered testing to confirm whether you are a carrier for haemophilia, you will be able to discuss the process for genetic testing (and what this might mean) in detail with the haemophilia specialist, or with a genetic counsellor. This will help to make sure you are fully informed of the risks and benefits of having genetic testing.

Bleeding symptoms

If you are female and a haemophilia carrier with a lower than normal factor level, you may experience the symptoms below:

- easy bruising
- prolonged bleeding after cuts and grazes
- prolonged bleeding after tooth extraction
- increased bleeding following trauma, i.e. accidents or injury
- heavier and prolonged bleeding during menstrual periods.

Treatment of bleeding symptoms

Bleeding symptoms may be treated with:

- **Tranexamic acid**

  This is an antifibrinolytic agent, which is used to prevent the breakdown of fibrin, which helps with the forming of blood clots. It can be used to control nose bleeds, heavy menstrual bleeding and also during minor surgeries and dental procedures.

- **Desmopressin (DDAVP)**

  This is a synthetic (manufactured) hormone, which may help control bleeding in an emergency or during surgery by raising the factor VIII level. It is usually injected under the skin (subcutaneously).

  It does not work for every person with a lower than normal factor VIII level, so a DDAVP trial will be needed to assess your response to this medication before it is prescribed.

  DDAVP is not effective in carriers of haemophilia B, as it does not raise the factor IX levels. It can also be given as an intra-nasal spray (up a nostril), and is useful for heavy periods for some women.

- **Clotting factor concentrates**

  These may be needed when the risk of severe bleeding is high, such as before major surgery or there has been a head injury.

Psychosocial issues

Most carriers of haemophilia do not experience problems that impact on their health, school and social life (psychosocial issues). However, if bleeding symptoms are causing you any concerns, please contact your local Haemophilia Centre, where we can offer you support.

Appointments

If you are an obligate carrier or a potential carrier of haemophilia, you will not need to come for regular follow-up appointments at the Haemophilia Centre, unless you have bleeding symptoms. However, if you would like to make an appointment or wish to contact us for advice, we would be very happy to speak with you. Our contact details are on the next page.

Further information

World Federation of Hemophilia (Haemophilia)

Website:
www.wfh.org/en/abd/carriers/carriers-and-women-with-hemophilia-en

NHS Choices

Website:
www.nhs.uk/conditions/Haemophilia/Pages/Introduction.aspx

The Haemophilia Society

Website: http://haemophilia.org.uk/

Haemophilia Care

Website: www.haemophiliacare.co.uk/

How to contact us

Paediatric/Adolescent Haemophilia Centre

Tel: **01865 226 562**
(Monday to Friday, 9.00am to 5.00pm)

Email: paediatric.haemophiliaclinic@ouh.nhs.uk

Oxford Haemophilia and Thrombosis Centre

Tel: **01865 225 316**
(Monday to Friday, 9.00am to 5.00pm)

Email: haemophilia.reception@ouh.nhs.uk

Out of hours

Please contact the On-Call Haematology Registrar through the Hospital switchboard.

Tel: **0300 304 7777**

If you have a specific requirement, need an interpreter, a document in Easy Read, another language, large print, Braille or audio version, please call **01865 221 473** or email **PALS@ouh.nhs.uk**

Authors: Sarah Pool
Joanne Burke
Dr Nicola Curry
Dr Neha Bhatnagar
Dr Georgina Hall

January 2018
Review: January 2021
Oxford University Hospitals NHS Foundation Trust
Oxford OX3 9DU
www.ouh.nhs.uk/information

Haemophilia inheritance diagrams reproduced with permission from Haemophilia Foundation Australia (www.haemophilia.org.au)

OMI 33923P