The Role of Genetics in Pancreatic Cancer

An introduction to genes, genetic testing and genetic conditions that heighten the risk of pancreatic cancer.

pancreatic cancer action

Understanding pancreatic cancer booklet 9

In this booklet, you will learn about genes, the decision to be genetically tested and what support is available if you are eligible. You will also learn about the different genetic conditions that have an increased risk of pancreatic cancer and the signs and symptoms you should be aware of.

Understanding Pancreatic Cancer – Patient Information Booklets

Receiving a diagnosis of pancreatic cancer can be an upsetting, stressful and confusing time. We have listened to patients, relatives and carers to understand what information is useful. Our patient information booklets are easy to understand and beneficial to have at hand to answer any questions or concerns you may have.

All of these publications are produced under the Information Standard certified scheme and are reviewed by medical professionals and patients/carers who have been affected by pancreatic cancer.

To order further patient information, please visit: **panact.org/patient-booklets**

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Introduction to pancreatic cancer

What is cancer?

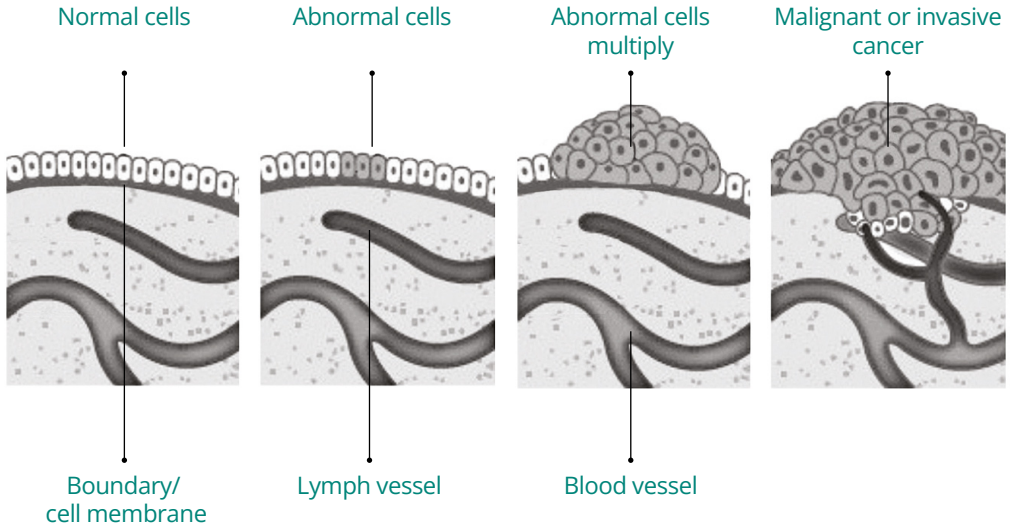
All cancers begin with changes in a cell or group of cells. The body is made up of many types of cells, which usually grow and divide in a controlled way to make more cells. These new cells are needed to keep the body healthy. When cells become old or damaged, they die and are replaced with new cells.

The way a cell grows, divides and dies is controlled by its genes (DNA). Sometimes DNA gets damaged or changed. If this damage affects genes that tell a cell when to grow, divide or die, cells do not die when they should. Then, new cells form when the body does not need them. These extra cells, change the composition of the blood, or form a lump, called a tumour, which is the beginning of cancer.

1 in 2
of us will **develop cancer** in our **lifetime**

Approximately **10,500 people** are **newly diagnosed** with pancreatic cancer in the UK **each year**

How tumours develop



Benign tumours are not cancerous. They can often be removed and, in most cases, do not come back. Cells in benign tumours do not spread to other parts of the body.

Malignant tumours are cancerous. Cells in these tumours can invade nearby tissues and spread to other parts of the body. Sometimes cells move away from the original (primary) cancer site and spread to other organs and bones where they can continue to grow and form another (secondary) tumour at a new site. This process is called metastasis. Secondary cancers keep the name of the original cancer location and are made up of the same type of cells. For example, pancreatic cancer that has spread to the liver is still called pancreatic cancer.

Cancer cells are dangerous because they will continue to grow and divide, even if they cause damage to the tissues around them.

Introduction to pancreatic cancer

What is the pancreas?

The pancreas is an organ about 6 inches long and shaped like a thin pear lying on its side. The wider end of the pancreas is called the head, the middle section is called the body, and the narrow end is called the tail. The pancreas is found deep inside your body, behind the stomach and in front of the spine.

The pancreas has two main jobs in the body, it makes:

Enzymes

These help to digest (break down) foods.

Hormones

Such as insulin and glucagon, which control blood sugar levels.

The pancreas helps the body use and store the energy it gets from food. It does this through two types of glands:

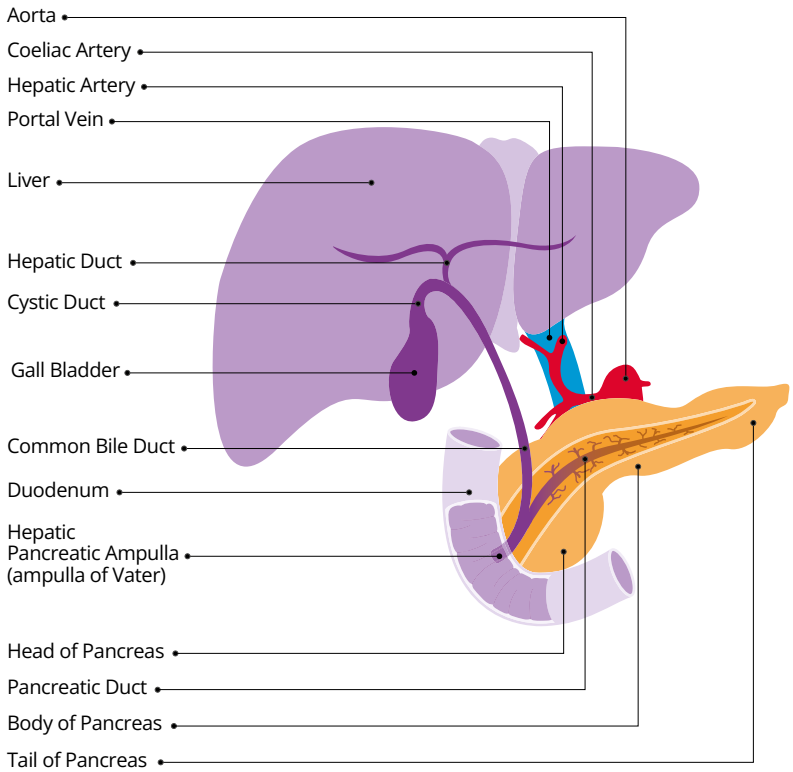
Exocrine glands

Create the enzymes which help digest (break down) foods.

Endocrine glands

Create the hormones such as insulin and glucagon, which control blood sugars.

The location of the pancreas



A tube called the pancreatic duct connects the pancreas to the first part of the small intestine, known as the duodenum. Digestive enzymes pass through this tube to help break down food. Another tube, called the common bile duct, passes through the head of the pancreas. This tube carries bile (a substance that helps to digest fats) from the liver and gall bladder to the small intestine. The bile duct may get blocked when a pancreatic tumour invades it. This causes jaundice (yellowing of the eyes and skin and dark urine).

Introduction to pancreatic cancer

What is pancreatic cancer?

Pancreatic cancer occurs when a malignant tumour forms in the pancreas.

Worldwide there are around 496,000 new cases each year; in Europe that figure is more than 104,000. In the UK, approximately 10,500 people are newly diagnosed each year.

Pancreatic cancer affects men and women equally, with incidence increasing from the age of 45. The average age at diagnosis is 72.

There are two main types of pancreatic cancer:

Exocrine tumours

These make up most of all pancreatic cancers (around 95%) and come from the cells that line the ducts in the pancreas which carry digestive juices into the intestine.

These are called pancreatic ductal adenocarcinomas.

Other exocrine tumours of the pancreas are rarer and include adenosquamous carcinomas and undifferentiated carcinomas.

Endocrine tumours

These are also known as neuroendocrine tumours (NETS) and are much less common. The neuroendocrine tumours we discuss here are found in the pancreas and are called pancreatic neuroendocrine tumours (PNETS).

These are tumours that develop in our endocrine glands that release hormones (which regulate some processes in our bodies); these are then circulated around the body.

Other rare tumours that can affect the pancreas include pancreatic lymphoma, a cancer that arises from the lymphatic tissue in the pancreas; various cystic tumours and pancreatic sarcomas, which develop in the tissue that holds cells in the pancreas together.

Tumours that arise from tissues close to the pancreas, such as the bile duct (cholangiocarcinoma), Ampulla of Vater (ampullary adenocarcinoma), or duodenum (duodenal adenocarcinoma), may cause similar symptoms to pancreatic cancer but have different treatments and outcomes.

Pancreatic endocrine tumours

In the pancreas, there are a group of cells, which are called the Islets of Langerhans. These cells produce hormones including insulin, glucagon and somatostatin which are involved in the control of sugar in the blood. PNETS are tumours found in these cells so are sometimes referred to as islet cell tumours.

There are two types:

1. Non-functional (non-secretory) PNETS. These tend to be cancerous, and **DO NOT** produce hormones.
2. Functional (secretory) PNETS. These tumours are less likely to be cancerous. These **DO** produce hormones such as insulin and glucagon to control blood sugar levels. Although they are less likely to be cancerous, they can produce symptoms due to the excessive production of hormones or the effects of the tumour displacing and pushing the surrounding tissue.

For more detailed information on the types of neuroendocrine pancreatic cancers, and their symptoms please visit **panact.org/PNETS**

This booklet focuses on exocrine tumours, mainly pancreatic ductal adenocarcinomas, the most common form of pancreatic cancer.

80% of **pancreatic cancers occur** in the **head of the pancreas** less commonly in the body (15%) and tail (5%)

Symptoms of pancreatic cancer

Jaundice

Jaundice is common in people with pancreatic cancer. It develops when the bile duct becomes blocked by the tumour and yellow pigment (bilirubin) that is normally excreted (passed) builds up in the body. Jaundice may be painless, but it can be very itchy and irritating. It can also make the skin feel hot and uncomfortable leading to itchiness; this is called pruritis. Jaundice can also cause nausea and vomiting as well as digestive problems and tiredness.

How do I know I have this?

The most obvious sign is yellowing of the skin and whites of the eyes: Jaundice may also cause your urine to be dark yellow and/or itching of the skin. You should seek **urgent medical advice** if you are worried that you have the signs of jaundice. You will need to be referred for tests to identify the cause. NICE (The National Institute for Health and Care Excellence) guidelines suggest that anyone with jaundice should be investigated further.

Upper abdominal pain or discomfort

Abdominal (tummy) pain or discomfort is one of the most common symptoms and one of the first symptoms to often present itself.

The pain or discomfort can be caused by the tumour invading nerves or organs that lie near the pancreas. The pain or discomfort is usually felt above the belly button and below the breast area (called the epigastric region). However, some patients report they have pain and discomfort without a specific location.

Having tummy pain or discomfort is a common symptom for many diseases and does not mean you have pancreatic cancer. However, if this is new and unusual for you or combined with other symptoms you should visit your GP to check.

Mid-back pain or discomfort

The pain can be caused by a tumour invading nerves or organs that lie near the pancreas. Some people also report that they feel pain in their shoulder or under their shoulder blade. Other people feel pain in their back and abdomen (tummy) at the same time.

Back pain is often experienced by people in the population and having mid-back pain does not mean you have pancreatic cancer. However, if you are experiencing mid back pain (in the region just below your shoulder blades) that is not normal for you, there is no harm in checking with your GP – especially if you are experiencing any of the other symptoms described here. If you are experiencing any of the other symptoms described here, you should tell your GP to reinforce your concern of pancreatic cancer.

Changes in bowel habit

People with pancreatic cancer sometimes experience constipation (when your stools are very firm and difficult to pass, sometimes accompanied by stomach pain) or diarrhoea (passing of watery stools more than 3 times a day). Stools can also be large, pale, smelly and float. This is because there is too much fat in the stool as food is not digested properly.

Constipation and diarrhoea are quite common. However, if a change in your bowels keeps happening or lasts longer than a week, discuss this with your GP. It does not mean you have pancreatic cancer but is important to investigate and your GP may be able to resolve your symptoms easily.

Symptoms of pancreatic cancer

Indigestion

After you eat or drink you may feel a burning or uncomfortable feeling in your chest. This may be accompanied by feeling or being sick or you may feel bloated and repeatedly burp or pass wind. Most people experience this from time to time and it is not something to worry about. However, if indigestion continues despite treatment from a pharmacy or your GP it could be a sign of pancreatic cancer.

The above symptoms are signs of indigestion. If you keep having this, and it is unusual for you or you are experiencing it alongside other symptoms described here, discuss this with your GP. If treatments for indigestion are not working, it is also important to discuss this with your doctor.

Loss of appetite

This is when you don't really feel like eating, or you feel full after eating only a very small amount of food.

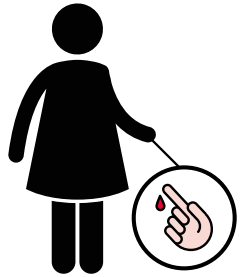
Loss of appetite does not mean you have pancreatic cancer; it is a common symptom of many diseases. Many of the symptoms of pancreatic cancer can cause loss of appetite. However, these are often not caused by cancer. For example, constipation, weight loss or vomiting and diarrhoea. However, if you experience this, together with any of these other symptoms, it is worth going to your GP to try to find out the cause.

Nausea and vomiting

Nausea (feeling sick) is when you feel uneasy, discomfort and disgust towards food like your stomach is churning. Sometimes you can also have a mild headache feeling. Vomiting is when you uncontrollably release the contents of your stomach out of your mouth. Often these symptoms will pass in a few days and are not anything to worry about.

If this is not normal for you and keeps happening, this may be something to start being aware of and monitor. Using our symptoms diary may be helpful and you can show this to your GP.

Diabetes



Diabetes is when the body is not regulating its blood sugar levels properly. When we eat, the pancreas makes enzymes and hormones to digest food and sugar (glucose) is produced. Blood sugar levels are regulated by insulin, a hormone generated in the pancreas. If your body cannot use its own insulin effectively, type 2 diabetes develops. Your blood sugar becomes too high.

If your type 2 diabetes has developed recently and cannot be explained by your lifestyle or diet (you are not overweight), it can be a symptom of pancreatic cancer. Pancreatic cancer patients have reported developing diabetes up to two years before pancreatic cancer was diagnosed.

What are the signs you may have diabetes?

- Urinating more often than usual, particularly at night
- Extreme tiredness/fatigue
- Unexplained weight loss
- Cuts or wounds that heal slowly
- Blurred vision
- Itching around the penis or vagina and frequent episodes of thrush

Symptoms of pancreatic cancer

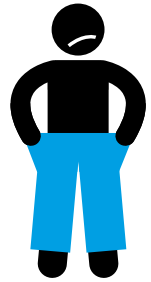
Diabetes is not always a symptom of pancreatic cancer; the two diseases are linked but exactly how remains unclear. However, if you do have any of the symptoms of diabetes it is still important to see your GP as untreated diabetes can be a risk to your health. Pancreatic cancer can also cause type 3c diabetes which may be misdiagnosed as type 2. This is diabetes caused by damage to the pancreas, such as surgery.

Fatigue

This is when you feel very tired or exhausted most, if not all, of the time. This can be described as a lack of energy and motivation (physical and mental). It also does not go away with sleep, and people describe it as different to tiredness they have experienced before.

Fatigue can be a consequence of many medical conditions, such as depression, as well as cancer. Fatigue can also range in its severity. If your fatigue is not normal for you and is not being caused by a stressful or upsetting period in your life this may be a sign of cancer, and you may wish to discuss this with your GP.

Unexplained weight loss



This is often one of the first problems patients tell their doctors about. Losing weight is cause for concern if it is unintentional or you do not know why it has happened. The unexpected weight loss associated with pancreatic cancer can occur without any pain or apparent change in digestion. You may have a good appetite but still be losing weight.

How do I know if I have this?

You may be able to tell if you have lost weight without weighing yourself on scales. If clothing or jewellery feels loose or people comment on your weight loss. Unexpected weight loss can be a sign of several diseases, so you should see your GP to investigate why this is happening to you. Guidelines suggest that those over 60 with weight loss and any of the following should be sent for a CT scan:

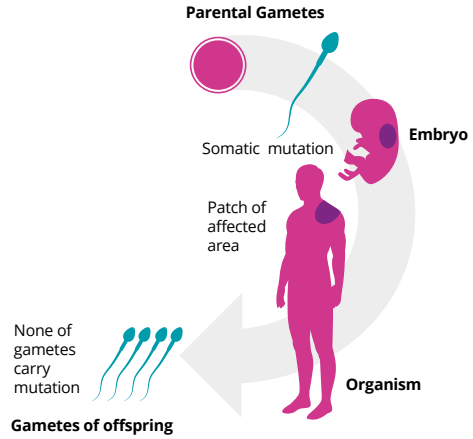
- Diarrhoea
- Back pain
- Abdominal pain
- Nausea
- Vomiting
- Constipation
- Diabetes that has developed recently.

If any of these symptoms apply to you, it is important you see your GP to investigate the cause. What is most important to note is the combination of these symptoms. These symptoms in isolation are somewhat harmless but a combination of a few of these symptoms (2 or more) that get progressively worse could be a sign of pancreatic cancer and you should visit your GP as soon as possible.

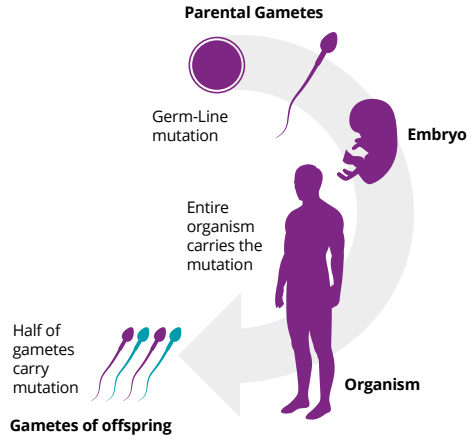
An Introduction to Genes

What are genes

Genes are sections of DNA inherited from our parents. A DNA sequence gives your cells the information they need to perform their functions. Everyone has two copies of each gene, one from their father and one from their mother. Everyone is unique, and small variations in our genes create the differences seen between people. Genes act as a code to every process in the body. We have thousands of genes, each with its own function. There is a group of genes that helps protect us from cancer; these are called tumour suppressor genes.



Somatic Mutations



Germline Mutations

Genetic Variations

A genetic variation is a change in a sequence of your DNA. Some changes in your DNA do not cause any problems at all; these are called benign variants. But sometimes DNA changes can cause genetic conditions, such as hereditary cancer, Down's syndrome, or Cystic Fibrosis. We call these DNA changes pathogenic variants.

Genetic variants are split into two categories: somatic and germline. Somatic variants can occur at any time after conception in any cells e.g., a variation that develops in a tumour when it begins to grow. This means that they are not hereditary. However, germline variants are a gene variant that you are born with and are present in all cells in your body. The body's ability to prevent cancer is compromised and can be passed from parent to child.

If the tumour suppressor genes are not working properly as a result of a pathogenic variant, cells can grow uncontrollably and cause cancer. If these variants are passed onto the next generation, then they may have an increased chance of developing cancer, including pancreatic cancer.

Genetic variants and pancreatic cancer

Pancreatic cancer runs in some families. People with first degree blood relatives (mother, father, brother, sister) diagnosed with pancreatic cancer may have an increased chance of pancreatic cancer themselves. The greater the number of relatives with pancreatic cancer in a family, the greater the risk is that pancreatic cancer is more likely in that family. Alternatively, some cases may occur by chance.

A family history of pancreatic cancer is suggestive of the possible presence of a genetic link to pancreatic cancer, although lifestyle factors also play a role, such as smoking and obesity.

Familial Pancreatic Cancer

This is when pancreatic cancer runs in families, however, **this is very rare, only affecting between 5-10% of all cases.** Most cases of pancreatic cancer occur unexpectedly with no family history of the disease. Familial pancreatic cancer is when a certain gene is passed on from a parent to their child, this gene then increases the chance of developing certain cancers. Indicators of familial pancreatic cancer are below:

- Families with two or more first-degree relatives (parent, sibling, offspring) with pancreatic cancer.
- Families with three or more relatives with pancreatic cancer.
- Families with an associated cancer syndrome and at least one case of pancreatic cancer. This includes families with gene variations.
- Families where there is an individual diagnosed with pancreatic cancer very young (under 60 years of age).

Another inherited risk of pancreatic cancer is if an individual has hereditary pancreatitis (often with a PRSS1 gene variation).

The European Registry of Hereditary Pancreatitis and Familial Pancreatic Cancer (EUROPAC) is an internationally renowned academic, collaborative study involving pancreas specialists from the University of Liverpool and across Europe in addressing global health issues of pancreatic diseases, which present some of the most critical of unmet clinical needs.

EUROPAC

EUROPAC recruit people with a family history of pancreatic cancer and people who have been diagnosed with hereditary pancreatitis. They offer secondary pancreatic cancer screening to those who are at a higher risk of developing pancreatic cancer.

You will be asked to complete a detailed personal and family history questionnaire and the team will assess your pancreatic cancer risk based on this. Should you be eligible for screening, EUROPAC will normally start this at the age of 40 (though may start screening prior to this in certain circumstances).

If you think this is something you could participate in, you will need to meet the following criteria:

- You have a family history of pancreatic cancer (typically 2 or more affected close relatives on the same side of your family).
- You have a variation in a gene known to increase your risk of pancreatic cancer and have at least one case of pancreatic cancer in the family.
- You have been diagnosed with Peutz-Jegher syndrome or hereditary pancreatitis.

Genetic Testing

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Genetic testing is used to find changes in your genes that can cause health problems. It is mainly used to diagnose rare and inherited health conditions as well as identifying those at greater risk of cancer.

Why would I be offered Genetic Testing?

There are many reasons why your clinician may offer you a genetic test. In families with pancreatic cancer there may be two types of tests:

- Your doctor suspects you might have a hereditary condition. For people who have pancreatic cancer at a young age, or have a personal and family history of it, doctors may suggest genetic testing. This is called diagnostic testing.
- You may be offered a genetic test to confirm whether you have inherited a genetic condition that is known in your family. This is called predictive testing.
- If testing in the family has identified a pathogenic variant linked with cancer risk.

What can a genetic test tell me?

A genetic test can:

- Help to understand whether an inherited health condition may affect you or any of your family.
- Show if you are at a higher risk of developing certain health conditions, including some types of cancer e.g., pancreatic, breast, ovarian or prostate cancers.
- Help doctors to decide what medicine or treatment is right for you.
- Tell doctors whether you are suitable for a clinical trial.

How do I get tested?

Genetic testing can be organised by your treatment teams or through clinical genetics. Speak to your GP or hospital specialist about whether testing is right for you. You will only be offered a genetic test if you meet relevant clinical criteria or if there is a known gene problem in the family.

Is genetic testing free on the NHS?

Genetic testing is only free on the NHS for eligible patients and families. To determine if genetic testing is available in your family, it would help to have information about your family history such as ages of diagnosis and types of cancer in first- and second-degree relatives. Clinical geneticists can let you know if you or a relative are eligible for a test. You can choose to pay for a private test, but please make sure this is from a reputable company. Speak to your doctor for advice.

Genetic Testing

What happens?

To help understand if there is a genetic condition that runs in the family, a genetic test is usually done using a sample of blood or saliva. This test can help relatives access screening and management if necessary.

If you've been referred for a genetic test because you have cancer, the test can also be done on a sample of the tumour that has already been removed as part of your treatment (a biopsy). Usually, this test cannot confirm if there is a genetic condition in the family. What it will do is check how your cancer is made up, so that your oncologist knows how to best treat you. The sample of blood, saliva or tissue is sent to a genetic testing laboratory to be analysed for genetic variants.

Getting the results

You'll be told when to expect the results of your test. Depending on the reason for your test, it could be weeks or months. You may need further tests.

The results from a germline genetic test may show:

- You do have a genetic variant associated with a syndrome.
- You do not have a particular genetic variant linked to pancreatic cancer. This reduces the likelihood you have a hereditary cause of pancreatic cancer but does not exclude it. Your doctor can advise you and your family based on your personal and family history.
- You have a variant of unknown significance, which means that scientists do not know if the variant in your genes can cause disease or is benign.
- The results are inconclusive but that doctors may understand more in the future.

After you get the results, you may be referred to a genetic counsellor to help you understand what they mean for you and your family.

Genetic Counselling

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A genetic counsellor or trained clinician can help you understand:

- The pros and cons of having a genetic test.
- The potential results of your test and what they mean.
- How your family members may be affected should the results show a potential heritable health condition.
- The potential risk of you passing this health condition on to your children.
- Your options if you have a child with an inherited health condition. You can also get further information on family planning options.
- How to manage such a condition. In many cases there are screening, management, and treatment options.

The Choice to Test

If you are eligible, having a genetic test is a personal decision. However, there are some things worth considering to help you make your decision:

Some advantages of predictive gene testing to consider	Some disadvantages of predictive gene testing to consider
You may be able to find out if your personal risk is high and make changes to your lifestyle to reduce it.	The test could be inconclusive (not give any useful information).
If a certain type of cancer runs in your family, a negative test result can give you peace of mind that **you have not inherited certain** gene variations associated with cancer.	If you receive a positive result, you may suffer from the worry or anxiety about the health and wellbeing of yourself and your family members.
The test could help gain access to personalised medicine.	It is possible you may feel guilt after receiving a negative result for a gene variation that is present in other members of your family.

If you have any questions or doubts prior to getting tested, it is important you speak to your doctor or genetics counsellor.

Some individuals find it helpful to know more about their cancer risks as they may be able to plan their screening and management and inform relatives. Some individuals may find it stressful to know about such risks and will worry about family members. Similarly, when dealing with negative results (no gene variant found), some people may feel relieved, while others may feel overwhelmed if they cannot identify the cause of their family history.

Questions to Ask your Genetics Counsellor

- What is the test looking for?
- What does the procedure involve? Are there any risks?
- Based on my results, are my family members at risk of developing cancer?
- Are clinical trials an option for me?
- How do I get a copy of my results?

What's next?

Following the positive results of genetic testing, you may be left wondering 'what now?'. You have a range of options to manage your risk. Ultimately, only you can decide what is best for you but there is support available. A positive result for a gene variant does not mean you are guaranteed to get cancer – your genes only partly influence your future health risks. Other factors such as medical history, environment, and lifestyle may add to your risk. **To reduce your cancer risk, it is recommended that you avoid:**

- Drinking more than the maximum recommended daily limits of alcohol.
- Being overweight.
- Smoking tobacco.

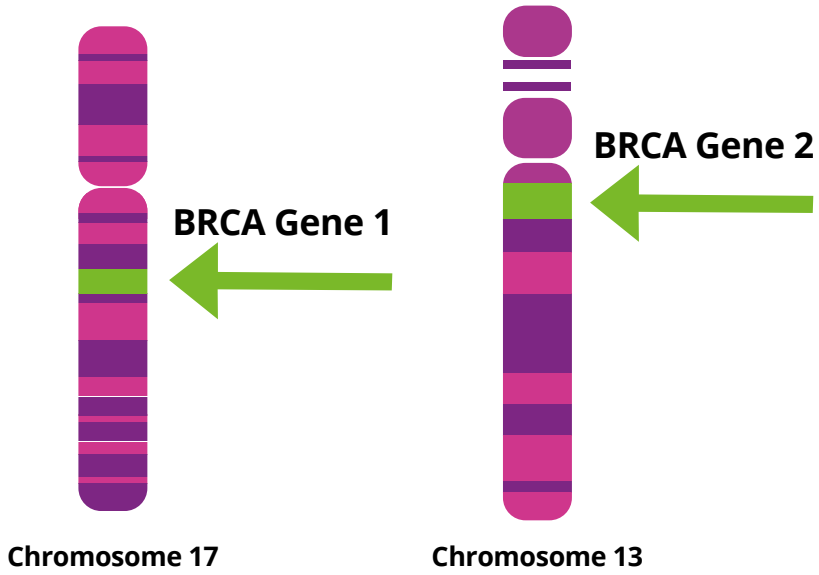
It is also important to be aware of the symptoms of pancreatic cancer which can be found on page 10.

Genetic Variation Types

BRCA-1 and BRCA-2

The BRCA-1 and BRCA-2 genes are tumour suppressor genes. This means that these genes prevent cells from growing and spreading too rapidly. When this gene is damaged, this can affect your cell's ability to repair damaged DNA, and this makes you more likely to develop certain cancers. BRCA-1 is a germline variation and can be inherited. Whereas BRCA-2 is both germline and somatic, meaning it can be both inherited and acquired.

BRCA-1 and BRCA-2 genes have similar roles but are different genes. BRCA-2 is more associated with the risk of pancreatic cancer; therefore, BRCA-2 is the gene most concerned with hereditary pancreatic cancer.



A chromosome is a structure within a cell that is made up of proteins and DNA organised into genes. Each cell typically contains 23 pairs of chromosomes.

PALB2

Normally in our cells, BRCA-2 and PALB2 work together to repair any DNA damage. The PALB2 gene helps to make a protein that works with the BRCA-2 protein to repair damaged DNA and tumour growth. When this protein is not functioning normally, DNA damage is not fixed and cells can become abnormal, sometimes leading to cancer. PALB2 can have a germline variation that can be inherited.

ATM

The ATM gene helps to make a protein that is in the nucleus of cells, where it helps to control how quickly cells grow and divide. This protein is also important for normal development and activity of several body systems, including the nervous system and immune system. It also helps cells to recognise damaged or broken DNA strands. Breaks in DNA strands occur naturally during cell division but if the DNA damage cannot be repaired, you are at a greater risk of cancer. ATM can have a germline variation that can be inherited.

RAD-51

The RAD-51 gene provides instructions for making a protein that is essential for repairing damaged DNA. This protein binds to the DNA at the site of a break and encases it in a protein sheath, which is an essential first step in the repair process. The BRCA-2 protein helps the RAD-51 protein by transporting it to sites of DNA damage in the nucleus of the cell. If DNA damage cannot be repaired, you are at a greater risk of cancer. RAD51 can have a germline variation that can be inherited.

CDKN2A

The CDKN2A gene provides instructions for making several proteins. Most commonly, these proteins are tumour suppressors which keep cells from growing and dividing too rapidly. However, when the CDKN2A gene is damaged, these proteins cannot form properly. They then fail to suppress any tumours, which means you are at a greater risk of cancer. CDKN2A can have a germline variation that can be inherited.

Genetic Syndromes

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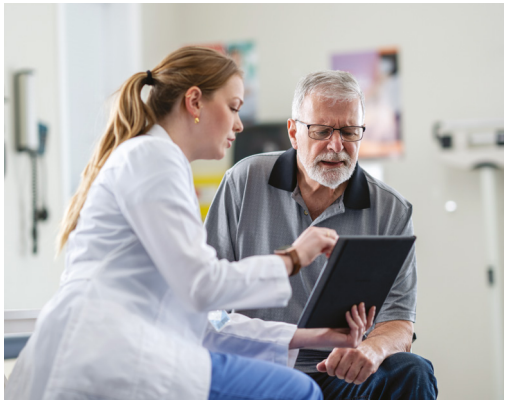
A genetic syndrome, which can also be called a genetic disorder, is a disease caused by a change or variation in a person's DNA sequence.

Familial Adenomatous Polyposis (FAP)



Familial adenomatous polyposis (FAP) is a rare inherited syndrome that makes a person more susceptible to cancer. It is characterized by precancerous colorectal polyps (adenomatous polyps). A polyp is the result of genetic changes in the cells of the colon lining that affect the normal cell life cycle. These present as small growths, affecting around 1 in 4 people over the age of 50. On average 50% of children of an affected parent will have the disease passed on to them. Risk is equal for males and females.

Familial Atypical Multiple Mole Melanoma (FAMMM syndrome)

Familial Atypical Multiple Mole Melanoma (FAMMM syndrome) is a disorder characterised by the presence of multiple large moles of variable size and colour. The syndrome is characterised by:

- One or more first- or second-degree relatives (parent, sibling, child, grandparent, grandchild, aunt, or uncle) with malignant melanoma.
- Many moles, some of which are atypical (asymmetrical, raised, and/or different shades of tan, brown, black, or red) and often of different sizes; and
- Moles that have specific features when examined under a microscope.

Peutz-Jeghers Syndrome

This is a very rare inherited syndrome that generally presents itself in childhood. It often causes fleshy non-cancerous growths called 'hamartomatous polyps', which develop on the surface of the digestive tract, most commonly in the small intestine, but can also incur in the large intestine and the stomach. Polyps often present themselves in adolescents, although the polyps are usually non-cancerous.

What causes Peutz-Jeghers Syndrome?

Peutz-Jeghers Syndrome is an inherited genetic condition and therefore cannot be caught or caused by lifestyle factors. The condition is caused by a malfunctioning gene. You only need one faulty copy of the gene from your mother or father to develop the condition.

How common is Peutz-Jeghers Syndrome?

Peutz-Jeghers Syndrome is extremely rare, but, if you do have this syndrome, regular cancer surveillance is highly recommended.

If you have or think you may have Peutz-Jeghers, it is especially important to discuss this with your doctor.

Lynch Syndrome

Lynch syndrome is an inherited condition which causes increased risk of cancers of your gut. There are two types of Lynch syndrome, one of which seems to be exclusively of cancers of the gut. But there is another type which involves other cancers including pancreatic.

Taken as a single syndrome, Lynch gives a 1% to 6% chance of developing pancreatic cancer, but this may be much higher in certain families.

Genetic Syndromes

Hereditary Pancreatitis

Hereditary pancreatitis is a rare genetic condition characterized by recurrent episodes of pancreatic attacks, which can progress to chronic pancreatitis.

Symptoms include:

- Abdominal pain.
- Nausea.
- Vomiting.

Onset of attacks usually occurs within the first two decades of life but can begin at any age. Individuals with hereditary pancreatitis also have a 40% lifetime risk of developing pancreatic cancer. This increased risk is heavily dependent upon the duration of chronic pancreatitis and environmental exposures to alcohol and smoking.

Further Information

Pancreatic Cancer Action

We are a national charity dedicated to saving lives through early diagnosis and improving the quality of life for those affected by pancreatic cancer.
Please call or go to our website for more free information on pancreatic cancer.

Tel: 0303 040 1700, panact.org

Clinical trials information

For further information about clinical trial types, pros and cons and how to find and take part in a trial.

panact.org/clinicaltrials

EUROPAC (European Registry of Hereditary Pancreatitis and Familial Pancreatic Cancer)

This is a collaborative study based at the University of Liverpool with pancreatic specialists from around Europe. They are investigating hereditary pancreatic cancer diseases.

Tel: 0151 706 4168, Email: europac@liverpool.ac.uk, panact.org/EUROPAC

RareCan

RareCan is the only organisation in the UK that specialises in finding clinical trials for patients with rare and less common forms of cancer.

Tel: 0191 249 8555, Email: info@rarecan.com, rarecan.com

Macmillan Cancer Support

Resources and information designed to provide physical, financial and emotional support to cancer patients and their families.

Tel: 0808 808 0000, macmillan.org.uk

Maggie's Centres

Maggie's centres provide free practical, emotional and social support to people with cancer and their family and friends. They are often built next to NHS cancer hospitals.

Tel: 0300 123 1801, maggiescentres.org

Glossary

Adenocarcinomas
Cancer that forms in the glandular tissue, which lines certain internal organs and makes and releases substances in the body, such as mucus, digestive juices, and other fluids.

Adenosquamous Carcinoma
A type of cancer that contains two types of cells: squamous cells (thin, flat cells that line certain organs) and gland-like cells.

Ampulla of Vater
A small opening that enters the first portion of the small intestine, known as the duodenum. The ampulla of Vater is the spot where the pancreatic and bile ducts release their secretions into the intestines.

Bile
Bile is a fluid that is made and released by the liver and stored in the gall bladder. It breaks down fats into fatty acids, which can be taken into the body by the digestive tract and helps digestion.

Bile duct
A tube that carries bile from the liver and gall bladder through the pancreas and into the small intestine.

Cell
The smallest unit of information that makes up all living things.

Clinical trial
A type of research that studies new tests and treatments and evaluates their effects on human health outcomes.

DNA – Deoxyribonucleic acid (DNA)
This is the molecule that carries genetic information responsible for our development and function.

Duodenum
The first part of the small intestine. It connects to the stomach. The duodenum helps to further digest food coming from the stomach.

Gall bladder
A small pouch-like organ found underneath the liver. Its main purpose is to store and concentrate bile.

Genes
Genes are sections of DNA inherited from our parents. Everyone has two copies of each gene, one from their father and one from their mother.

Genetic counselling
The process of working with patients and their families, offering genetic information and support, allowing them to make health decisions. This is carried out by a highly trained **genetics counsellor.**

Genetic variation
A genetic variation is a change in a sequence of your DNA. Your DNA sequence gives your cells the information they need to perform their functions. If part of your DNA sequence is in the wrong place, incomplete or damaged, you may experience symptoms of a genetic condition, e.g., cancer or they could help you adapt better to your environment over time.

Hereditary
The passing of traits from parents to their children.

Hormones
Chemical substances that act like messenger molecules in the body. After being made in one part of the body, they travel to other parts of the body where they help control how cells and organs function.

Malignant
A term used to describe a cancerous tumour.

Melanoma
A type of skin cancer that develops when melanocytes (the cells that give the skin its tan or brown colour) start to grow uncontrollably.

Oncologist
A doctor who treats cancer and provides medical care for a person diagnosed with cancer.

Screening
The process of checking for disease when there are no symptoms. Unfortunately, a pancreatic cancer screening programme is yet to be developed.

Syndrome
A condition characterised by a set of symptoms.

Tumour
An abnormal mass of tissue that forms when cells grow and divide more than they should or do not die when they should. Tumours may be benign (not cancer) or malignant (cancer).

Tumour suppressor genes
A gene that regulates cell division and replication, preventing it from growing uncontrollably.

Undifferentiated carcinomas
Cancers that do not have specialised structures.

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For sources and references used in the compilation of this booklet, please contact us at the address overleaf.

Pancreatic Cancer Action

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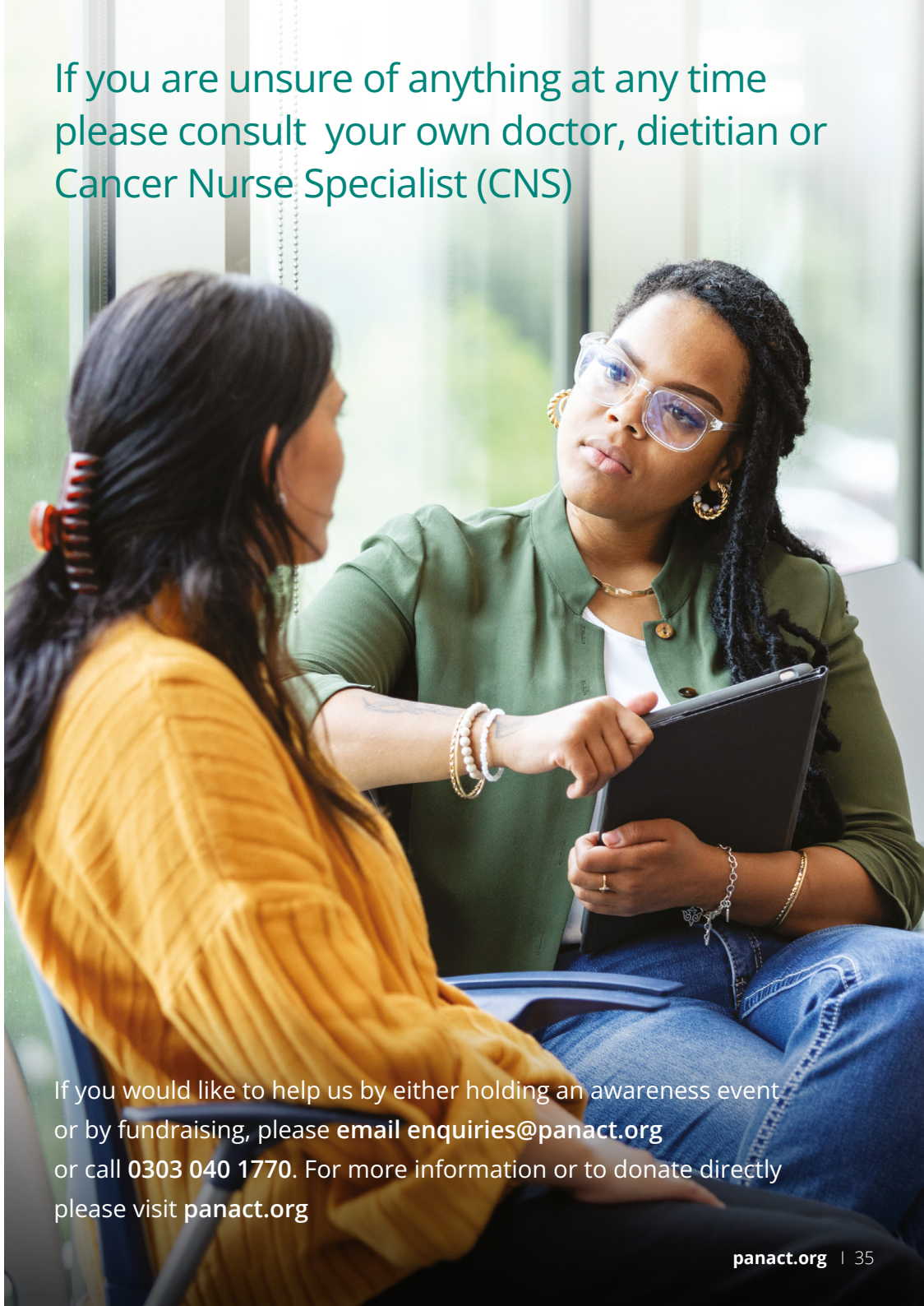
If you would like to support us or find out more, please contact us at:
enquiries@panact.org or visit panact.org

If you are unsure of anything at any time please consult your own doctor, dietitian or Cancer Nurse Specialist (CNS)



If you would like to help us by either holding an awareness event or by fundraising, please **email enquiries@panact.org** or call **0303 040 1770**. For more information or to donate directly please visit **panact.org**

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