You may have heard of diabetes? In case you haven't, it's a serious disease involving an important hormone called insulin. Insulin usually helps to make sure our bodies have enough energy from glucose—a type of sugar broken down from carbohydrates in our food (things like rice and potatoes). When things go wrong it can be an emergency and people with diabetes need treatment to help them stay well.

In 1980 there were 108 million people with diabetes worldwide. By 2017 there were 425 million.

The main types of diabetes are called ‘type 1’ and ‘type 2’ and although they cause lots of the same symptoms, they happen for different reasons.

You can use this game to explore what treatments might work for type 1 and type 2 diabetes and to explain them to anyone in your family who doesn't know the difference.

To make the glucose challenge game you will need:

A cardboard box; some card; tape; a pair of scissors; a pencil; table tennis balls (or improvise with balls of paper!); some scrunched up paper or an old sock!
To make the game

STEP 1  Start by cutting out or tracing the template on pages 4 and 5. Tape 2 pieces together to make one large template and cut out 2 from bendy card. We have used red card but you can use any colour. Bend the shapes round to form 2 funnels. The diameter of the smaller hole should be big enough for the balls you will use to fit through. Tape each funnel up along the join. If you don’t have table tennis balls, make at least 12 out of scrunched up newspaper.

STEP 2  Take 2 smaller pieces of card (about A4) and roll them into two tubes each with a diameter just smaller than the base of the funnel. Roll along the shorter sides so that the tubes are as tall as the longer sides. Before taping them, check that one of the balls is able to fit easily through the tubes. Use tape along the whole length of the tube to hold it.

STEP 3  At both ends of the tube make several cuts about 5cm in length and splay the ends.

STEP 4  Find a medium sized cardboard box. Cut the flaps off the short sides of the box. Make a shallow fold of about 1cm along the longer side of one of them and then make a short cut in the middle of the fold. Bend the folded part to different sides so it can stand up.

STEP 5  Use tape to stick down the folded piece inside the box so that it divides the box into two sections.
STEP 6  Cut two holes, slightly larger than the diameter of the tubes into one of the flaps that is still attached to the box, one on each side. Make sure the centres of the holes are spaced at least 20 cm apart or the funnels will not fit.

STEP 7  Tuck the splayed ends of the tubes into the holes and tape them on the inside of the box so that the tubes will stand upright on the box when the lid is closed. Use plenty of tape to make sure they stay in place.

STEP 8  Tuck the splayed ends at the top of the tubes into the bottom hole of each funnel and tape the two together on the inside. This bit might be a bit fiddly!

STEP 9  Close the box, using small pieces of tape if necessary. Write the names ‘Alex’ and ‘Sam’ on the box (see p6). These will be the character names for the game.

STEP 10 Cut out the 8 game card shapes on pages 4 and 5 and use one as a template to cut out 4 rectangles from spare card. Tape each pair to either side of a card to make 4 game cards. A good way to stick the paper and card together is roll some tape into a loop.

STEP 11 Use scrunched up paper or something like an old sock to block the tubes so that balls will not fall through into the box. Put this into the bottom of the tubes so that you can take it out easily. Turn to ‘how to play’ on page 7 to see why we’re doing this!

Now turn to p7 for how to play
Make two. You could either cut out this template and draw around it or trace it onto thin paper to make a pattern before transferring the shape to the red card.

TIP: If you do cut it out, read the instructions on the other side first!

Diet & exercise

Run on the spot for 10 seconds!

Sam has Type 1 diabetes so this would not fix their symptoms at all. But they will need to change their diet and exercise is good for you anyway!

Medication

Sam has Type 1 diabetes. The only treatment is injections of insulin, which Sam will have to have every day.
Alex has Type 2 diabetes. Some people with this can manage their symptoms with changes to diet and exercise.
When you have finished making the game, it should look something like this.

Put the box on the floor or onto a low table. You will be throwing the balls at it. They are very light but make sure there is nothing valuable nearby that might be knocked over or broken!

The game is for 2 players. If you have 2 people to play you can be the game-master. If you only have one you can play too.

In **type 1 diabetes**, blood sugar levels are too high as the cells in the pancreas do not produce insulin. This is because these cells are attacked by the body’s immune system, and therefore the body cannot produce insulin any more.

Type 1 diabetes is commonly diagnosed in children but can occur later on in life. It cannot be prevented but can be managed effectively by the injection of insulin.

In **type 2 diabetes**, cells become resistant to insulin, so the pancreas tries to compensate by making more and more of it. The pancreas can eventually wear out and then the body cannot remove sugar effectively from the blood.

Type 2 diabetes is usually diagnosed in adults over 40. Risk factors include: genetics, diet and being overweight. The onset of type 2 diabetes can be postponed or prevented by changes in diet and exercise.
How to play

1. Divide the balls equally between players. Make sure that your tubes are blocked but that the players cannot see this.

   Tell players that in the game:
   - the box is **body cells**
   - the funnels and tubes are **the bloodstream**
   - the balls are **glucose**, a type of sugar that the body cells need for energy
   - the aim is to get glucose into the body cells by throwing the balls into the funnels

2. Give each player one of the names. They must try to throw balls into their funnel only!

   **TIP:** practise before you start to find the best place for players to stand so that it’s not too hard or too easy.

3. When they have thrown all the balls, check the cells (open the box). Show the players that no glucose has got into the cells—it’s all stuck in the bloodstream. Explain that when blood glucose (or blood sugar) is high, this is very unhealthy so we need to fix it!

4. Offer each player the game cards with their name on. Show the darker side of the cards and ask them to choose one.

   For **Sam** (blue cards, type 1 diabetes):
   - If they pick diet and exercise, ask them to run on the spot while you count to 10.
     Leave the blocker in place in the ‘bloodstream’ tube
   - If they pick medication, remove the blocker from the tube (try to do it when they’re not looking!)

   For **Alex** (orange cards, type 2 diabetes):
   - Whichever card they pick, ask them to run on the spot while you count to 10 and also remove the blocker

   Let the players look at the cards while you carefully tip the balls out of the tubes.

5. Divide up the balls again and let the players have another try. Show them that the glucose goes through into the body cells when Sam or Alex have had a treatment appropriate to their type of diabetes!

**Q:** do people with type 2 diabetes ever need insulin?
**A:** yes, some people might need insulin if their type 2 diabetes has got worse
If you are pleased with what you make, send us a picture and your first name.

We'll put it on our website!

Email:

jms80@medschl.cam.ac.uk

Advisory

Parents/guardians: Please note that children under 10 years should be supervised by an adult while using scissors.

Do not leave loose balls on the floor as they pose a slip hazard.

This game was developed by our first year PhD students in 2019 and comes to you from the IMS-MRL at the University of Cambridge.

See lots of other fun stuff on our website at: www.mrl.ims.cam.ac.uk/find-out-more-2

Find more on the Cambridge Festival website: www.festival.cam.ac.uk