Hypoglycaemia affects the quality of life of patients with diabetes and can be fatal.
glucagon, another hormone produced by the pancreas from the alpha cells, which causes the liver to release glucose.

In individuals without diabetes there is a balance between the production of glucagon, which causes a rise in blood glucose, and insulin, which lowers blood glucose. This maintains the blood glucose within the normal range and avoids hypoglycaemia.

In someone with diabetes using insulin or treatments that stimulate the beta cells to produce insulin, this balance is over-ridden and the blood glucose level can fall below normal, inducing signs and symptoms of hypoglycaemia.

**Signs and symptoms**

These can be categorised into autonomic – the early “stress response” – and neuroglycopenic, where brain function and behaviour is affected by diminishing blood glucose levels. Ideally, people at risk of hypoglycaemia should be able to recognise the early symptoms and treat themselves promptly to prevent neuroglycopenic effects occurring, but without overcompensating and causing high blood glucose levels afterwards.

In someone unable to self-treat or those who have frequent hypoglycaemia, treatment should be sought. Examples are listed in Box 2. The blood glucose should be checked after about five minutes and the rapid-acting treatment should be repeated every 5-10 minutes until the blood glucose has risen to 4mmol/L or greater (or, if no blood glucose monitoring is available, until symptoms have resolved). The person should then eat some starchy carbohydrate if they are not due to eat a meal within the next hour.

If someone is unable to self-treat competently, these treatments can be given by another person. However, if a person is unconscious or unable to swallow safely, glucagon has an opposite effect to insulin – it raises blood glucose by mobilising glycogen stored in the liver. It takes approximately 15-20g of rapid-acting carbohydrate should be taken orally.

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**BOX 2. CARBOHYDRATE TREATMENTS**

Examples of 15-20g rapid-acting carbohydrate treatments for hypoglycaemia include:

- 150ml non-diет Coca-Cola (small tin)
- 100ml of Lucozade Original
- 5-6 dextrose tablets
- Four GlucoTabs
- 200ml smooth orange juice (small carton)

**BOX 1. SIGNS AND SYMPTOMS OF HYPOGLYCAEMIA**

At the early stage (the autonomic stage) blood glucose is usually between <4mmol/L and 2.8mmol/L.

**Symptoms**

- Blurred vision
- Difficulty concentrating
- Slurring of speech
- Confusion
- Change in behaviour (such as being aggressive, acting as if drunk)
- Convulsions
- Coma

Later signs and symptoms, at the neuroglycopenic stage, where blood glucose is below 2.8mmol/L include:

- Coma

**Management of hypoglycaemia**

Hypoglycaemia is mild when people are able to self-treat and severe when they require the help of a third party (DCCTRG, 1993). The aim of treatment is to bring the blood glucose level rapidly back up to target before neuroglycopenic effects occur, but without overcompensating and causing high blood glucose levels afterwards.

**Prevention**

- Potentially, these treatments can be given by another person. However, if a person is unconscious or unable to swallow safely, glucagon has an opposite effect to insulin – it raises blood glucose by mobilising glycogen stored in the liver. It takes approximately 15-20g of rapid-acting carbohydrate should be taken orally.

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**BOX 3. CAUSES OF HYPOGLYCAEMIA**

The insulin action did not match the expected rise in blood glucose after a meal
- This can occur if a meal is delayed after an insulin injection or sulphonylurea has been given and has started to be effective
- The carbohydrate portion of the meal is smaller than required by the dose of insulin given
- The insulin works too rapidly because it was injected into a muscle instead of subcutaneous fat
- Too high a dose of insulin or oral hypoglycaemic agents was given
- The wrong insulin was given. If rapid-acting insulin is given instead of long-acting insulin, as the large dose at bedtime without food, sudden hypoglycaemia will occur within an hour or so at the beginning of the night

**Lifestyle issues**
- Unusual or unplanned physical activity. Exercise increases the body’s sensitivity to insulin, lowering blood glucose more than usual unless the dose is reduced or additional carbohydrate is consumed to compensate for this
- Excessive alcohol, especially when combined with increased physical activity. People’s sensitivity to the effects of alcohol will vary, depending on whether they consume alcohol regularly

**Frequent low blood glucose levels**
- Hypoglycaemia symptoms may be dulled or lost if blood glucose levels are frequently below target. This increases the risk of severe hypoglycaemia as the person with diabetes gets few or no warning symptoms of their blood glucose dropping and is unable to treat it in time to avoid coma

**Reduced renal function**
- Insulin and oral hypoglycaemic agents need to be taken regularly as they are eliminated from the body by the kidneys. Where renal function is deteriorating, medications can accumulate, leading to a gradual increase in the frequency of hypoglycaemic episodes

**Weight loss**
- Losing weight, intentionally or through loss of appetite or illness, means less insulin is required to maintain normal blood glucose. If the dose of sulphonylureas or insulin is not adjusted, the patient is at risk of hypoglycaemia about 10 minutes to be effective and patients may be nauseated and vomit as they recover. A rapid-acting carbohydrate followed by some starchy longer-acting carbohydrate needs to be consumed as the liver will need to replenish its glycogen stores, potentially causing another episode of hypoglycaemia within a short period of time.

Glucagon may not be effective, especially in patients with liver disease or if the hypoglycaemia is associated with excessive alcohol consumption. If patients have not recovered after 10 minutes, 50ml of IV glucose 20% infusion will be required, given into a large vein through a large-gauge needle. Once a person has regained consciousness and is able to eat or drink some carbohydrate, it is not usually necessary for them to be admitted to hospital unless the hypoglycaemia is caused by a sulphonylurea.

A severe hypoglycaemia episode is likely to affect people’s confidence in their diabetes treatment significantly. The National Institute for Health and Clinical Excellence’s quality standards for diabetes recommends all people with the condition should be referred to a diabetes specialist team following an episode of severe hypoglycaemia to have counselling, a medication review and education (NICE, 2011).

After treating a hypoglycaemia episode, ask the question: why did it happen? The cause is the amount of insulin injected or the effect of oral hypoglycaemic agents that are greater than those needed for the prevailing blood glucose. Possible causes of hypoglycaemia are listed in Box 3.

Unfortunately, hypoglycaemia can occur through mistakes made by health professionals giving the incorrect dose. The National Patient Safety Agency (2010) issued an alert and e-learning package about the safe use of insulin to highlight common mistakes made through incorrect prescribing of insulin dose. For example, the use of “u” instead of “units” resulted in one case where a person was injected with 40 units when the dose was written as 4u. The e-learning about safe use of insulin can be accessed at tinyurl.com/safe-use-insulin.

**Prevention**

Anyone using a treatment that can cause hypoglycaemia should be warned about this risk and the circumstances in which it can occur. They should be informed about the signs and symptoms, advised to carry glucose with them at all times, and given instructions about treatments to alleviate hypoglycaemia. People should be questioned on their understanding of hypoglycaemia as part of their annual diabetes review, and information gained regarding any episodes of, for example, dizziness or sweating that may be unrecognised hypoglycaemia.

There are several oral and injectable treatments for blood glucose control that do not stimulate insulin production as sulphonylureas do and, therefore, have a low risk of inducing hypoglycaemia. These include pioglitazone, DPPIV inhibitors and GLP-1 mimetics. These alternative agents may be preferable, especially in people who drive regularly or older people in whom an episode of hypoglycaemia can have particularly devastating effects.

**Conclusion**

Hypoglycaemia is common and can occur in people with either type 1 or type 2 diabetes who use insulin or oral medications that stimulate insulin production. Nurses can help address this condition by ensuring people at risk are aware of symptoms, carry glucose with them at all times, and know how to treat hypoglycaemia promptly before low blood glucose levels affect brain function.