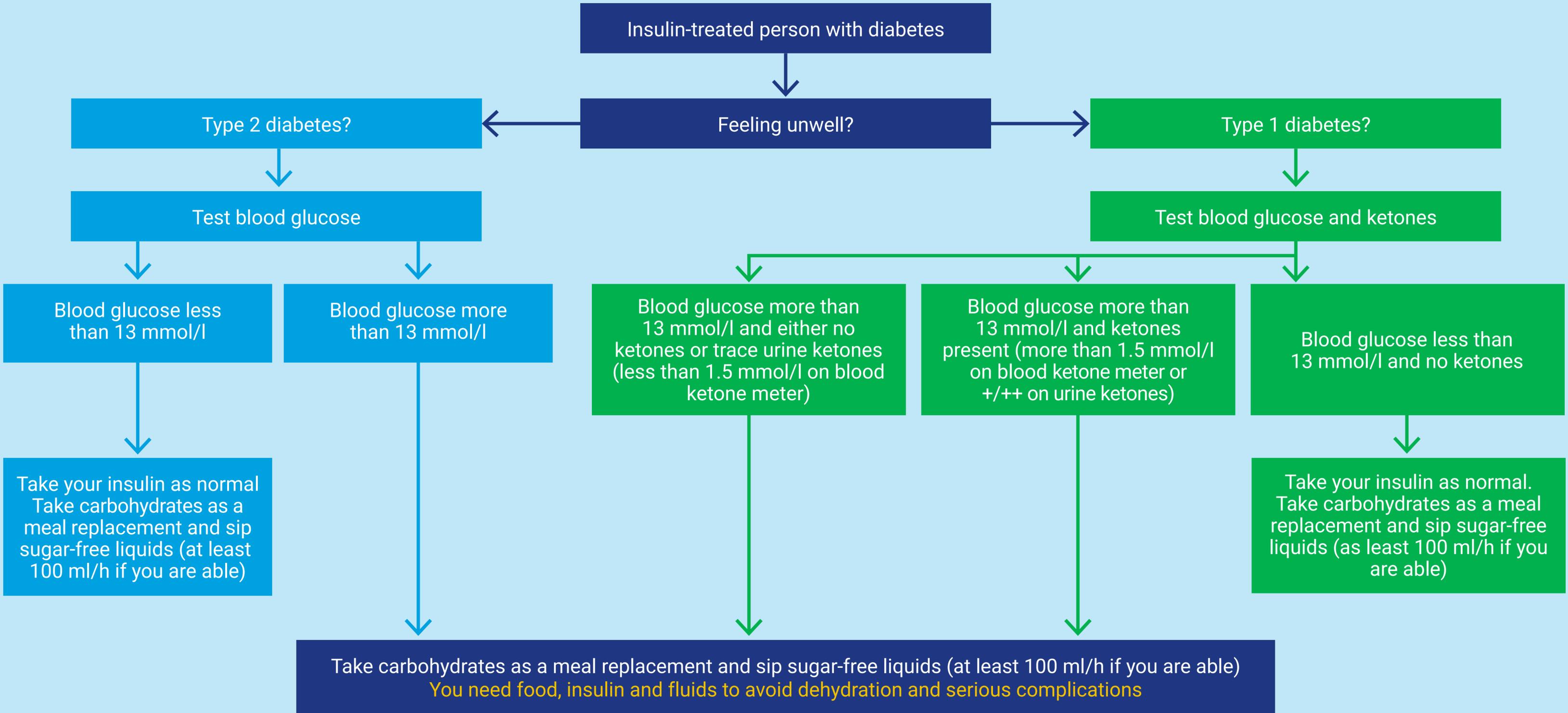


COVID-19 case studies

RESOURCES DOCUMENT



*Note: recent guidance has blood glucose cut off as 11 mmol/l instead of 13 mmol/l

Managing your insulin dose when your blood ketones are less than 1.5 mmol/l

Glucose more than 11 mmol/l and/or you feel unwell, either with no ketones or blood ketones less than 1.5 mmol/l (negative or trace of urine ketones).

Sip sugar-free fluids, at least 100 ml/l. Eat as normal if possible. If not, see meal replacement suggestions. **You need food containing carbohydrate (carbs), insulin and fluids to avoid dehydration and prevent diabetic ketoacidosis.**

Test glucose and blood ketones **every 4 to 6 hours**, including during the night.

Aim to take your usual insulin dose. However, if your glucose is above 11 mmol/l, take additional insulin as below.

Glucose	Insulin dose
11–17 mmol/l	Add 2 extra units to each dose
17–22 mmol/l	Add 4 extra units to each dose
More than 22 mmol/l	Add 6 extra units to each dose

Managing your insulin dose when your blood ketones are 1.5 mmol/l or higher

Glucose more than 11 mmol/l and/or you feel unwell, either with blood ketones 1.5 mmol/l or higher (+ or more of urine ketones).

Sip sugar-free fluids, at least 100 ml/h. Eat as normal if possible. If not, see meal replacement suggestions. **You need food containing carbohydrate (carbs), insulin and fluids to avoid dehydration and prevent diabetic ketoacidosis.**

1.5 to 3 mmol/l on blood ketone meter
(+ to ++ urine ketones)

More than 3 mmol/l on blood ketone meter
(+++ to ++++ urine ketones)

Give an additional <u>10%</u> of your TDD as rapid-acting or mixed insulin every 2 hours	Total daily insulin dose: TDD	Give an additional <u>20%</u> of your TDD as rapid-acting or mixed insulin every 2 hours
1 unit	Up to 14 units	2 units
2 units	15–24 units	4 units
3 units	25–34 units	6 units
4 units	35–44 units	8 units
5 units	45–54 units	10 units
If you take more than 54 units or if you are unsure how to alter your dose, contact your specialist team or GP		

Test glucose and blood ketones **every 2 hours** including during the night

Glucose **more than 11 mmol/l** and ketones present?

NO

As your illness resolves, adjust your insulin dose back to normal

YES – REPEAT PROCESS



Useful links

 UK's rules on 'shielding'

<https://www.gov.uk/government/publications/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19/guidance-on-shielding-and-protecting-extremely-vulnerable-persons-from-covid-19#what-is-shielding>

Managing diabetes during intercurrent illness in the community

February 2013



Supporting, Improving, Caring

Rationale and remit

This document has been developed to provide information and guidance on the community management of diabetes in adults during episodes of illness. It is intended to serve as a helpful resource for a range of groups, including medical professionals (e.g. nurses, GPs) and non-medical professionals (e.g. those working in residential care, prisons, young offender institutes or mental health units).

The recommendations have been developed by Training, Research and Education for Nurses in Diabetes (TREND-UK); the authors are listed below. Other diabetes organisations have been involved in the development of the guidance via a process of review, and are listed below as the document reference group. The document has also been reviewed and endorsed by NHS Diabetes.

When implementing any advice in the document, full account should be taken of the local context and any action taken should be in line with statutory obligations required of the organisation and individual. No part of the publication should be interpreted in a way that would knowingly put anybody at risk.

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Introduction: The challenge of diabetes and intercurrent illness

Although people with diabetes do not necessarily become ill more often than anybody else, if their diabetes is inadequately controlled they may be more prone to certain infections (American Diabetes Association, 1998). They may also respond differently to illness according to the type of diabetes they have and the illness they are experiencing.

However, when a person with diabetes is unwell, it is likely that their blood glucose levels will rise (this is known as hyperglycaemia; Fowler, 2009). The signs and symptoms of hyperglycaemia (which may occur even if the person is not eating) include (NHS Choices, 2012):

- Increased thirst.
- Dry mouth.
- Passing more urine than usual.
- Tiredness or lethargy.
- High glucose levels in the urine or blood.

Examples of illnesses that may cause hyperglycaemia include:

- The common cold.
- Influenza.
- Stomach upset.
- Urinary infection.
- Chest infection.
- Abscesses.
- Injury, such as a broken bone.

If someone does not know how to manage their diabetes during periods of illness, other problems may arise, such as dehydration or the development of certain serious acute diabetes conditions. The correct advice can prevent this happening.

Potential acute diabetes conditions which occur when a person with diabetes is unwell

In some circumstances during illness, the serious conditions of diabetic ketoacidosis (DKA) or hyperosmolar hyperglycaemic state (HHS) can develop.

Diabetic ketoacidosis

DKA is a condition that requires urgent hospital treatment. It occurs when there is not enough glucose entering the cells for energy owing to insufficient insulin being available. As a result, the body begins to use fat stores as an alternative source of energy, which results in acidic ketones being produced. These disrupt

the normal functioning of the body's processes. This may be more likely during intercurrent illness. Although most cases of DKA occur in people with type 1 diabetes, it can develop in people with type 2 diabetes during times of severe illness (Diabetes UK, 2012a).

The signs and symptoms of DKA include (Hansen and Møller, 2010):

- Excessive thirst.
- Passing frequent large volumes of urine.
- Dehydration.
- Shortness of breath and laboured breathing.
- Abdominal pain, leg cramps.
- Nausea and vomiting.
- Mental confusion and drowsiness.
- Ketones (which smell like pear drops) can be detected on the person's breath or in the blood or urine.

If left untreated, DKA can lead to coma and even death.

Hyperosmolar hyperglycaemic state

HHS is a potentially life-threatening emergency, which requires hospital treatment. It occurs in people with type 2 diabetes, particularly the elderly, who develop very high blood glucose levels (often over 40 mmol/L) over a period of several days or weeks. It leads to severe dehydration, confusion and coma if not identified and treated correctly.

The signs and symptoms of HHS include (Stoner, 2005):

- Disorientation or confusion.
- Passing frequent large amounts of urine.
- Thirst and dry mouth.
- Nausea.

In the later stages of HHS the person becomes drowsy and gradually loses consciousness.

General principles of managing diabetes during intercurrent illness

Aims

When managing a person with diabetes during intercurrent illness the aims are to:

- Continue to manage the person's diabetes and blood glucose levels.
- Ensure the person receives sufficient calorie intake and address dehydration with fluid replacement.
- Test for and manage any ketones present in the body.
- Recognise whether the person requires additional medical attention.

Table 1. Advice for those taking (non-insulin) diabetes medication during illness.

Drug class	General recommendations for carers and healthcare professionals based on the authors' experience	Relevant advice from drug Summaries of Product Characteristics
General advice for all people with diabetes	Blood glucose levels should be tested if a meter is available. If it is not available, be mindful of the symptoms of hyperglycaemia.	Not applicable.
Biguanides (metformin)	The person should continue to take their medication while the blood glucose level is normal or high unless they are feeling severely unwell (e.g. vomiting, diarrhoea or fever) or are dehydrated, in which case, metformin should be temporarily stopped. The dose should be restarted once the person is feeling better. Metformin should also be stopped in individuals where the severity of their illness requires hospitalisation or confinement to bed.	Contraindicated in people with DKA and in those with acute conditions with the potential to alter renal function such as dehydration and severe infection (Merck Serono, 2010).
Alpha-glucosidase inhibitors (acarbose)	The person should continue to take their medication while the blood glucose level is normal or high. Acarbose should not be used in people who are vomiting or experiencing severe diarrhoea. It should also not be used in cases of inflammatory bowel disease or DKA.	No relevant information identified in the Summary of Product Characteristics.
Sulphonylureas (glibenclamide, gliclazide, glimepiride, glipizide, tolbutamide)	The person should continue to take their medication while the blood glucose level is normal or high. If they are unable to eat or drink, they may be at risk of hypoglycaemia (low blood glucose levels) and the medication may need to be reduced or stopped temporarily.	Contraindicated in people with DKA (Accord Healthcare Ltd, 2012; Actavis UK Ltd, 2011; Pfizer Ltd, 2012; Servier Laboratories Ltd, 2012; Zentiva, 2012).
Meglitinides (nateglinide, repaglinide)	The person should continue to take their medication while the blood glucose level is normal or high. If they are unable to eat or drink, they may be at risk of hypoglycaemia (low blood glucose levels) and the medication may need to be reduced or stopped temporarily.	Contraindicated in people with DKA (Novartis Pharmaceuticals UK Ltd, 2011; Novo Nordisk Ltd, 2012).
Thiazolidinediones (pioglitazone)	The person should continue to take their medication while the blood glucose level is normal or high. Medical advice should be sought if the person experiences unusual shortness of breath or localised swelling as this may be a sign of possible heart failure, particularly in the elderly.	Contraindicated in people with DKA and can cause fluid retention and oedema (Takeda UK Ltd, 2013).
Dipeptidyl peptidase-4 (DPP-4) inhibitors (linagliptin, saxagliptin, sitagliptin, vildagliptin)	The person should continue to take their medication while the blood glucose level is normal or high. Medical advice should be sought if the person is vomiting, dehydrated or experiencing severe abdominal pain. Severe abdominal pain may indicate pancreatitis.	Patients should be informed of the characteristic symptom of acute pancreatitis: persistent, severe, abdominal pain. If pancreatitis is suspected, potentially suspect medicinal products should be discontinued (Boehringer Ingelheim Ltd, 2012; Bristol Myers Squibb-AstraZeneca, 2012a; Merck Sharp & Dohme Limited, 2013; Novartis Pharmaceuticals UK Ltd, 2013).

Management of a person's diabetes and blood glucose levels

When a bacterial or viral infection (such as a common cold) is present, blood glucose levels may rise in response, even if no food is eaten. For this reason, during times of illness, people with diabetes who have access to blood

glucose monitoring should monitor and record their blood glucose levels at least four times a day (that is, at mealtimes – even if they are not eating – and at bedtime). Those who do not have access to blood glucose monitoring should be mindful of the symptoms of hyperglycaemia.

Table 1 (continued). Advice for those taking (non-insulin) diabetes medication during illness.

Drug class	General recommendations for carers and healthcare professionals based on the authors' experience	Relevant advice from drug Summaries of Product Characteristics
Glucagon-like peptide-1 (GLP-1) receptor agonists (exenatide once weekly, exenatide twice daily, liraglutide once daily)	The person should continue to take their medication while the blood glucose level is normal or high. Medical advice should be sought if the person is vomiting, dehydrated or experiencing severe abdominal pain. Severe abdominal pain may indicate pancreatitis.	Patients should be informed of the characteristic symptom of acute pancreatitis: persistent, severe abdominal pain. If pancreatitis is suspected, potentially suspect medicinal products should be discontinued (Eli Lilly and Company Ltd, 2012a; b; Novo Nordisk Ltd, 2013). Use of exenatide once weekly and exenatide twice daily is not recommended in patients with severe gastrointestinal disease (Eli Lilly and Company Ltd, 2012a; b). Patients treated with liraglutide should be advised of the potential risk of dehydration in relation to gastrointestinal side effects and take precautions to avoid fluid depletion (Novo Nordisk Ltd, 2013).
Sodium glucose co-transporter 2 (SGLT2) inhibitors (dapagliflozin)	As this agent has only recently become available, the authors have limited clinical experience of using the drug during intercurrent illness and recommend that readers refer to the Summary of Product Characteristics (see information in the right hand column).	For patients receiving dapagliflozin, in case of intercurrent conditions that may lead to volume depletion (e.g. dehydration), careful monitoring of volume status (e.g. physical examination, blood pressure measurements, laboratory tests including haematocrit) and electrolytes is recommended. Temporary interruption of treatment with dapagliflozin is recommended for patients who develop volume depletion until the depletion is corrected (Bristol Myers Squibb-AstraZeneca, 2012b).

People with type 2 diabetes who do not manage their diabetes with insulin should generally continue to take their medication as usual. Manufacturer's guidance and specific advice based on the experience of the authoring panel is provided in *Table 1*.

If a person is taking insulin and his or her blood glucose levels are higher than usual, the insulin dose may need to be increased (see *Figure 1*). If their blood glucose levels are lower than usual, the insulin dose may need to be reduced.

Ensure sufficient calorie intake and address dehydration

If the individual is unwell and unable to eat their usual meals, it is important that they continue to eat or drink some carbohydrate (starchy or sugary foods) as a source of energy. *Table 2* provides a list of food alternatives that can be used. As a rough guide, the person should try to take two to three servings from the list provided approximately four to five times a day. They should also be encouraged to drink at least 4 to 6 pints (2.5 to 3.5 L) of sugar-free fluid in 24 hours (at least 100 mL each hour) in order to avoid dehydration.

However, if the individual starts vomiting or is unable to keep fluids down, urgent medical advice should be immediately sought.

Testing and management of ketones

During illness a simple blood or urine test can be used to show if the body is producing ketones. People with type 1 diabetes should always test for ketones if they feel unwell and their blood glucose is more than 13 mmol/L. People with type 2 diabetes do not usually test for ketones. However, healthcare professionals should test for ketones in anyone with type 1 or type 2 diabetes who is acutely unwell and vomiting. *Figure 1* provides advice on how to interpret the ketone test result in those who are taking insulin.

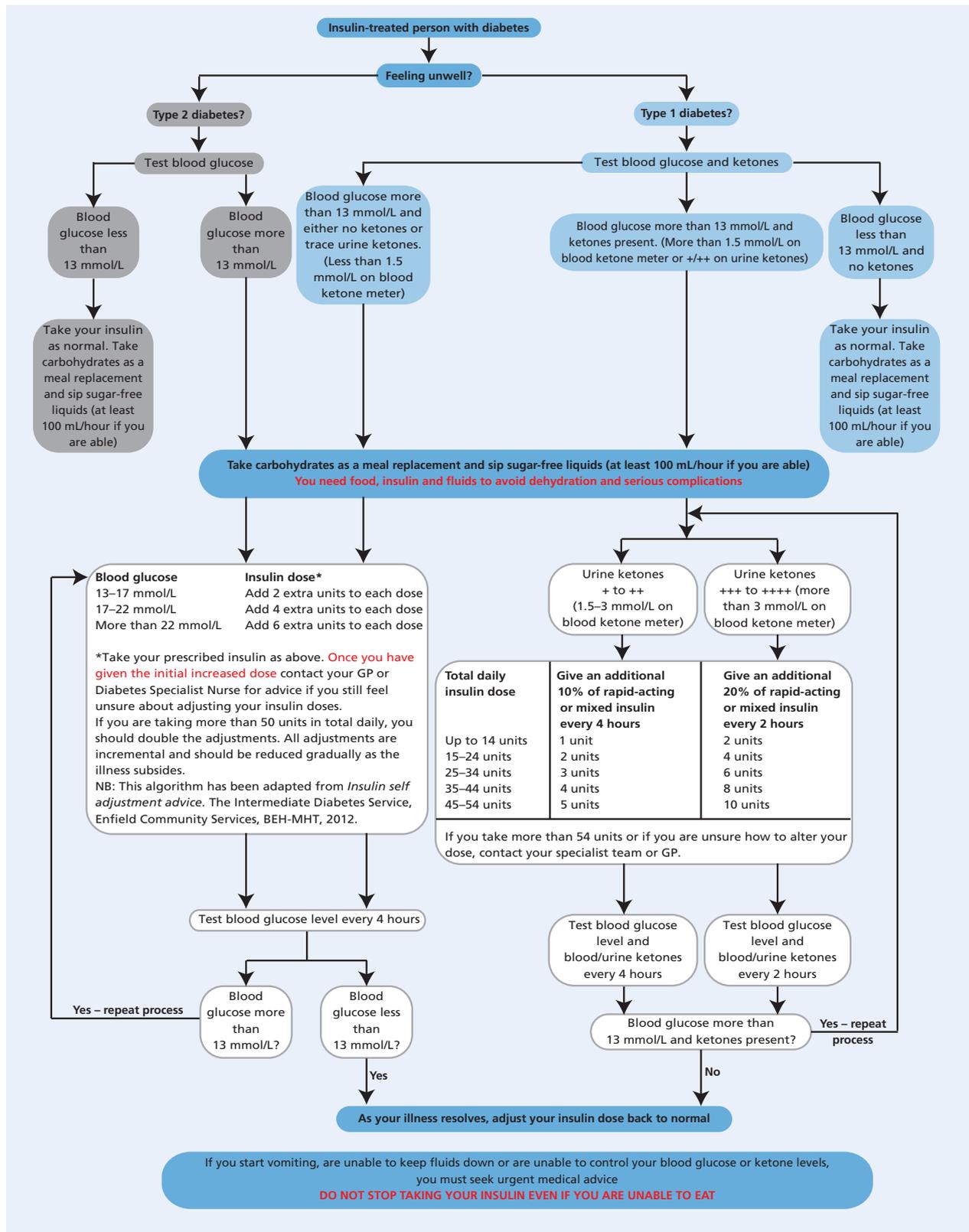
Treatment of special groups of people with diabetes

Table 3 provides an overview of specific advice regarding intercurrent illness for particular groups of people with diabetes. It is important that advice about what to do when feeling unwell is reinforced regularly by a healthcare professional so that the person with diabetes knows what to do when the situation arises.

Conclusions

Intercurrent illness in people with diabetes should be taken seriously because it may increase the risk of hyperglycaemia and other diabetes complications.

Figure 1. Advice given to people with type 1 or type 2 diabetes for managing their insulin doses during illness.



It is important that people with diabetes are regularly reminded of what to do when they feel unwell in order that they know what to do if blood glucose levels rise. Such precautions may prevent the development of serious hyperglycaemia, DKA and HHS.

Accord Healthcare Ltd (2012) *Glimepiride 2 mg Tablets – SPC*. Available at: <http://bit.ly/UZCCN4> (accessed 05.02.2013)

Actavis UK Ltd (2011) *Tolbutamide Tablets BP 500 mg – SPC*. Available at: <http://bit.ly/U0TsKA> (accessed 05.02.2013)

Table 2. Food alternatives (University Hospitals of Leicester NHS Trust, 2009).

Type of food alternative	Amount*		
Lucozade™ Energy	50 mL	2 fl oz	¼ glass
Fruit juice‡	100 mL	4 fl oz	½ glass
Cola (NOT diet)‡	100 mL	4 fl oz	½ glass
Lemonade (NOT diet)‡	150–200 mL	5–7 fl oz	¾–1 glass
Milk	200 mL	7 fl oz	1 glass
Soup‡	200 mL	7 fl oz	1 mug
Ice cream‡	50 g	2 oz	1 large scoop
Complan®	–	–	3 level tsp (as a drink)
Drinking chocolate‡	–	–	2 level tsp (as a drink)
Ovaltine® or Horlicks®	–	–	2 level tsp (as a drink)

*Each serving provides approximately 10 g of carbohydrate.
 ‡Sugar quantities may vary widely according to brand.

American Diabetes Association (1998) *Diabetes Care* 21 (Supplement 1): s23–31

American Diabetes Association (2008) *Diabetes Care* 31 (Supplement 1): s87–93

Boehringer Ingelheim Limited (2012) *Trajenta 5 mg film-coated tablets – SPC*. Available at: <http://bit.ly/QnJlnq> (accessed 05.02.2013)

Bristol Myers Squibb-AstraZeneca (2012a) *Onglyza 2.5 mg & 5 mg film-coated tablets – SPC*. Available at: <http://bit.ly/UTOVN8> (accessed 05.02.2013)

Bristol Myers Squibb-AstraZeneca (2012b) *Forxiga 5 mg & 10 mg film coated tablets– SPC*. Available at: <http://bit.ly/UZCUU9> (accessed 05.02.2013)

Clinical Knowledge Summaries (2012) *Insulin therapy in type 1 diabetes – Management. Scenario: Periods of illness*. Available at: <http://bit.ly/ToIPUK> (accessed 05.02.2013)

Diabetes UK (2010) *Good clinical practice guidelines for care home residents with diabetes*. Available at: <http://bit.ly/HQ8tKV> (accessed 05.02.2013)

Diabetes UK (2012a) *Diabetic ketoacidosis*. Available at: <http://bit.ly/f9RtFa> (accessed 05.02.2013)

Diabetes UK (2012b) *End of life diabetes care – Clinical care recommendations*. Available at: <http://bit.ly/Z2hlXd> (access 05.02.2013)

Eli Lilly and Company Ltd (2012a) *Bydureon 2 mg powder and solvent for prolonged-release suspension for injection – SPC*. Available at: <http://bit.ly/U0TC4K> (accessed 05.02.2013)

Eli Lilly and Company Ltd (2012b) *Byetta 5 micrograms solution for injection, prefilled pen. Byetta 10 micrograms solution for injection, prefilled pen – SPC*. Available at: <http://bit.ly/V4ayIP> (accessed 05.02.2013)

Fowler MJ (2009) *Clinical Diabetes* 27: 82–5

Hansen TK, Møller N (2010) *Acute metabolic complications of diabetes: diabetic ketoacidosis and hyperosmolar hyperglycemia*. In: Holt RG et al. *Textbook of Diabetes* (4th edition). Wiley-Blackwell, Chichester

Intermediate Diabetes Service, Enfield Community Services, BEH-MHT (2012) *Insulin self adjustment advice*. BEH-MHT, Enfield

Merck Serono (2010) *Glucophage 500 mg and 850 mg film coated tablets – SPC*. Available at: <http://bit.ly/Ts15O4> (accessed 05.02.2013)

Merck Sharp & Dohme Limited (2013) *Januvia 25 mg, 50 mg, 100 mg film-coated tablets – SPC*. Available at: <http://bit.ly/QnJGq9> (accessed 05.02.2013)

NHS Choices (2012) *Symptoms of hyperglycaemia*. Available at: <http://bit.ly/9gD0KN> (accessed 05.02.2013)

NICE (2008) *Diabetes in pregnancy: Management of diabetes and its complications from pre-conception to the postnatal period. Clinical Guideline 63*. Available at: <http://www.guidance.nice.org.uk/cg63> (accessed 05.02.2013)

Novartis Pharmaceuticals UK Ltd (2011) *Starlix 120 mg film coated tablets– SPC*. Available at: <http://bit.ly/UpLJdE> (accessed 05.02.2013)

Novartis Pharmaceuticals UK Ltd (2013) *Galvus 50 mg Tablets – SPC*. Available at: <http://bit.ly/QJ7rdC> (accessed 05.02.2013)

Novo Nordisk Ltd (2012) *Prandin 0.5 mg, 1 mg, 2 mg Tablets – SPC*. Available at: <http://bit.ly/U9HCAk> (accessed 13.11.2012)

Novo Nordisk Ltd (2013) *Victoza 6 mg/ml solution for injection in pre-filled pen – SPC*. Available at: <http://bit.ly/V4aTLB> (05.02.2013)

Pfizer Ltd (2012) *Minodiab 5 mg Tablets – SPC*. Available at: <http://bit.ly/Yn18yv> (accessed 05.02.2013)

Servier Laboratories Ltd (2012) *Diamicon 80 mg Tablets – SPC*. Available at: <http://bit.ly/UpM4Ns> (accessed 05.02.2013)

Stoner GD (2005) *Am Fam Physician* 71: 1723–30

Takeda UK Ltd (2013) *Actos Tablets – SPC*. Available at: <http://bit.ly/Yn1PYD> (accessed 05.02.2013)

University Hospitals of Leicester NHS Trust (2009) *Type 1 diabetes and coping with illness*. Available at: <http://bit.ly/RgdOFe> (accessed 05.02.2013)

Zentiva (2012) *Amaryl 1 mg Tablets – SPC* Available at: <http://bit.ly/UTR5fQ> (accessed 05.02.2013)

Table 3. Advice for specific groups of people with diabetes during illness.

Group of people	General recommendations based on the authors' experience	Relevant advice for healthcare professionals
Pregnant women	It is vital that pregnant women with diabetes who feel unwell seek specialist medical advice immediately. These patients will be under joint obstetric and specialist diabetes care and therefore will have an emergency contact telephone number. Do not be falsely assured by normal or mildly elevated blood glucose levels.	Please refer to NICE (2008) <i>Diabetes in pregnancy: Management of diabetes and its complications from pre-conception to the postnatal period. Clinical Guideline 63</i> . Available at: http://www.guidance.nice.org.uk/cg63
End of life care	The aim of end of life care for people with diabetes is to ensure that, as far as possible, they remain symptom free. Any care given should reduce symptoms and ideally improve the person's experience of their final days, along with avoiding thirst, dehydration, and diabetes emergencies.	Please refer to Diabetes UK (2012b) <i>End of life diabetes care – Clinical care recommendations</i> . Available at: http://www.diabetes.org.uk/About_us/Our_Views/Position_statements/End-of-Life-Care/
Chronic kidney disease	People with diabetes and chronic kidney disease (CKD; stages 4 or 5) should seek specialist advice if they feel unwell. People with diabetes and CKD who are taking a sulphonylurea (e.g. glimepiride, gliclazide) or insulin are more prone to low blood glucose levels (hypoglycaemia) than those without CKD due to the kidney's inability to excrete insulin efficiently.	The authors were not able to identify any published guidelines relating to illness in those with diabetes and CKD.
Insulin pumps	Insulin pump users can rapidly develop diabetic ketoacidosis (DKA) if their insulin pump fails. If a person's blood glucose level rises rapidly they should: <ul style="list-style-type: none">● Monitor for blood or urine ketones.● Check the pump to ensure that it is working properly.● Check to see if the pump tubing is blocked or disconnected.● Check that the cannula is in the correct place and is secure. All pump users should be advised to carry an insulin pen device with them containing quick-acting insulin that is in date for use in emergencies. Insulin pump users will be under specialist diabetes care and will have an emergency contact telephone number to use should any issues arise.	Please refer to Clinical Knowledge Summaries (2012) <i>Insulin therapy in type 1 diabetes – Management. Scenario: Periods of illness</i> . Available at: http://www.cks.nhs.uk/insulin_therapy_in_type_1_diabetes/management/scenario_periods_of_illness/view_full_scenario
People with diabetes in residential care	The symptoms of DKA in people with diabetes who live in care and nursing homes can be easily confused with hyper- or hypoglycaemia. Staff may not be skilled in the area of diabetes and may not recognise the symptoms. If there are any concerns about a patient becoming unwell while taking insulin, specialist medical advice should be sought immediately.	Please refer to Diabetes UK (2010) <i>Good clinical practice guidelines for care home residents with diabetes</i> . Available at: http://www.diabetes.org.uk/Documents/About%20Us/Our%20views/Care%20recs/Care-homes-0110.pdf
People with diabetes in prisons or young offender institutions	People working in prisons or young offender institutions need to know how to recognise the signs and symptoms of DKA and hyperosmolar hyperglycaemic state (HHS) in people with diabetes, and seek medical help as soon as possible.	Please refer to American Diabetes Association (2008) <i>Diabetes management in correctional institutions. Diabetes Care 31</i> (Supplement 1): s87–93
People taking other medications	Steroids prescribed during intercurrent illness may be associated with worsening hyperglycaemia. Immediate medical advice must be sought from the person prescribing the additional medication. Angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) should also be stopped in those needing to be admitted or confined to bed to lessen the risk of acute kidney injury.	Please refer to the specific Summary of Product Characteristics for further information.