Guidelines for the Safe Prescribing and Administration of Insulin and the Monitoring of all Antidiabetic Drugs

(Version 4 – January 2019)

Insulin is a medicine that staff working in mental health, substance misuse and learning disability services may be less familiar with and therefore particular caution should be used when prescribing and administering it. The National Patient Safety Agency (NPSA) has identified errors in the use of insulin that have caused harm to patients and in some cases have caused death. Four errors in particular have been identified by the NPSA as common\textsuperscript{1,2}:

- The use of abbreviations such as ‘U’ or ‘IU’ for units. When these abbreviations are added to the intended dose, the prescribed dose may be misread, e.g. 10U may be read as 100.

- The inappropriate use of non-insulin (IV) syringes, which are marked in millilitres (mls) and not in insulin units. Use of these syringes may lead to the administration of incorrect volumes / doses of insulin.

- Patients being prescribed or dispensed the wrong insulin product.

- Doses being omitted or delayed.

If an overdose of insulin occurs due to prescriber abbreviations (of “units” or “international units”) or if an incorrect dose is administered due to an incorrect syringe device being used, this is considered a DoH/NHS “Never Event”.\textsuperscript{3}

If you require this document in an alternative format, i.e. easy read, large text, audio or Braille please contact the pharmacy team on 01243 623349.
Prescribing

1. Prescribers must ensure that the type and dose of insulin is described accurately and completely. Adults should have been provided with an ‘Insulin Passport’ or an equivalent local insulin safety chart, which provides an accurate identification of their current insulin products. Prescribers should ask to see the patient’s ‘Insulin Passport’ or ‘Insulin Safety Record’ to ensure the right insulin product, the right dose and the right frequency.

2. Particular care must be taken when prescribing insulin with very similar names – e.g. Humulin-S, Humulin-I, Humulin-M3. Where any doubt exists, e.g. if there is no ‘Insulin Passport’ or record available, prescribers must check with the patient or carer (where appropriate), with the patient’s GP or with the diabetes clinic before prescribing.

3. High strength insulins are now available as prefilled pens – to avoid potential errors the strength of insulins should always be stated on the prescription e.g. Lantus solosta® 100units/ml, Tresiba® prefilled pen 200 units/ml etc.

4. Prescribers should be aware that not all brands of the same insulin are bioequivalent. Toujeo® (insulin glargine) is not bioequivalent to Lantus® (insulin glargine). Care should therefore be taken to prescribe the brands that a patient has been stabilised on and seek advice from pharmacy or the local diabetes team if switching brand is necessary, e.g. due to product shortages.

5. Prescribers must never use abbreviations instead of the word “units”, which must always be written in full. Use of abbreviations such as “U” or “IU” are a major cause of insulin dosing errors and a large overdose due to this is regarded as a ‘never event’ by NHS England 3.

6. All insulin prescribers must be aware of the signs and symptoms of hyperglycaemia and hypoglycaemia. (See appendix 1).

7. All insulin prescribers must ensure that they are competent in the safe use of insulin before prescribing.

Administration

1. If feasible and safe, patients should be allowed to self-administer insulin under the supervision of a nurse. This is to ensure the patient does not lose their skills during their inpatient admission.

2. Nurses administering or supervising subcutaneous insulin must satisfy themselves that the type and dose of insulin prescribed is correct according to the patient’s insulin chart. Adults should have been provided with an ‘Insulin Passport’ or ‘Insulin Safety Record’ from their diabetes clinic, which provides an accurate identification of their current insulin products. The ‘Insulin Passport’ or ‘Insulin Safety Record’ should be cross checked against the prescribed insulin, type, regime and dose on the individual’s drug chart. Information on the different types of insulins at the time of publication is available in appendix 2. Further information is available in the BNF or eBNF.

3. Where any doubt exists, e.g. if there is no ‘Insulin Passport’ or ‘Insulin Safety Record’ available, the prescription that is indicated on the patient’s drug chart must be checked
with either; the prescriber, the ward pharmacist, the patient / carer (where appropriate),
the patient’s GP, the diabetes clinic, the duty doctor or the on-call pharmacist.

4. Nurses should not administer insulin or supervise its self-administration unless the
patient’s drug chart has been written fully and clearly in accordance with the Trust’s
Medicines Code. In particular, the word “units” must be written in full and must never be
abbreviated to “U” or “IU”. Where abbreviations have been used, the prescription
must be brought to the attention of a prescriber at the earliest opportunity, where
possible before any insulin is administered.

5. Where the prescription has been queried, the outcome of any discussions should be
recorded in the patient’s clinical notes and the patient’s drug chart amended accordingly.

6. At each nursing shift handover, information regarding the patient’s insulin type, regime
and dose should be specifically communicated to the nurse in charge of the following
shift. All nurses should ensure that they are familiar with the prescribed insulin regime
and the patient’s drug chart at the start of each shift.

7. Wherever possible, the administering nurse should check the insulin type and dose with;
the patient (if appropriate), a second registered nurse, a member of the pharmacy team
or a doctor, immediately prior to each administration. The drug chart must be signed
upon or immediately after insulin administration by the nurse administering insulin or
observing the patient self-administering insulin. In the event of any concerns the
prescriber or duty doctor should be contacted immediately.

8. Before administering a dose of 30 units or more, the dose must always be checked with
a second person, either the patient (if competent), a second registered nurse, a member
of the pharmacy team or a doctor, immediately prior to each administration to ensure
that the dose is correct. In the event of any concerns the prescriber or duty doctor
should be contacted immediately.

9. The nurse in charge must ensure that the ward/unit maintains an adequate supply of
insulin syringes and needles.

10. Non-insulin syringes, (e.g. those normally used for intramuscular or intravenous
injection), must never be used for the administration of subcutaneous insulin. These
will be calibrated in millilitres rather than units and will greatly increase the risk of dosing
error.

11. Nurses should NEVER attempt to draw up insulin from a prefilled pen/refill cartridge into
an insulin syringe. Apart from the hazards of needle stick injury, insulin syringes are
designed for use with 100 unit/ml strength insulins only. Some prefilled pens
preparations are at a higher concentration (e.g Tujeo® 300 units/ml, Humalog Kwikpen®
200 units/ml) and attempting to administer via any other device or syringe can result in a
fatal overdose.

12. All nurses must be aware of the signs and symptoms of hyperglycaemia and
hypoglycaemia. (See appendix 2).

13. All nurses must ensure they are competent in the safe use of insulin. Online training
courses are available and should be used as part of Continuing Professional Development.
Diabetes and illness/stress

Part of the body’s defence during periods of illness, infection and stress is to release glucose into the bloodstream. This raises blood glucose levels and the body’s normal response is to increase the production of insulin. In diabetes, this does not happen as the body does not produce insulin (Type 1) or it is insulin resistant (Type 2). Symptoms of hyperglycaemia (increased thirst, passing of urine and dehydration) occur and can make the individual feel much worse. Illness can affect how an individual would normally manage and monitor their condition and may omit insulin as they associate it with eating. It is important that insulin regimes and carbohydrate intake are maintained during such times to avoid hyperglycaemia and reduce the risk of diabetic ketoacidosis. Blood glucose levels should be monitored more frequently to assess a patient’s diabetic state and control.

Monitoring and managing diabetes during illness

1. For monitoring advice see appendices 1 and 3.

2. For management of diabetes and monitoring of blood glucose in illness see appendix 4.

References


2. The adult patient’s passport to safer use of insulin. NPSA/2011/PSA003.


Version 4 – January 2019 Review no later than: January 2022
**Blood glucose monitoring in diabetic patients**

Diabetes mellitus is a condition where the body either does not produce enough insulin or does not respond appropriately to it. Two different types of diabetes mellitus are considered here. Patients with type-I usually cannot produce their own insulin, whereas in type-II either too little insulin is secreted and/or it does not have the normal effect on the body. Management of these conditions aims to achieve blood glucose levels that are as near to normal as possible.

**Why is blood glucose monitoring important?**

Prolonged high blood glucose level (hyperglycaemia) is associated with disabling and life-threatening long-term complications. It can lead to retinopathy (blindness), nephropathy (kidney damage) and neuropathy (nerve damage), which arise from cumulative damage to small blood vessels. It can also lead to ischaemic heart disease and peripheral vascular disease, which are due to the cardiovascular consequences of metabolic abnormalities. More acutely, hyperglycaemia can cause diabetic ketoacidosis (DKA), which is a medical emergency.

Hyperosmolar non-ketotic syndrome (HONK) occurs in type-II diabetes and is characterised by blood glucose levels in excess of 35 mmol/l. This develops over several weeks and has a mortality of approximately 30%.

Hypoglycaemia (low blood glucose level) leads to a shortage of glucose in the brain and can cause symptoms such as confusion, irritability, seizures, and unconsciousness.

**Signs and symptoms of hyperglycaemia.**

Thirst, dry mouth, increased frequency of urine, tiredness, recurrent infections (such as thrush). If prolonged may also cause weight loss, and blurred vision.

- DKA: nausea or vomiting, stomach pain, fruity smell on the breath (like pear drops or nail varnish), drowsiness or confusion, hyperventilation, dehydration, unconsciousness.
- HONK: (Blood glucose>35mmol/l): marked dehydration, intense thirst, polyuria, drowsiness and eventual loss of consciousness.

**Signs and symptoms of hypoglycaemia.**

Hunger, trembling or shakiness, sweating, anxiety or irritability, pallor, fast pulse or palpitations, tingling of the lips. More severe cases may include difficulty concentrating, dizziness, light-headedness, confusion, disorderly or irrational behaviour.

In type 1 diabetes blood sugars must be closely monitored and not drop below 4mmol/l.

**Target levels**

Ideally, the blood glucose level should be kept within the following ranges:

<table>
<thead>
<tr>
<th></th>
<th>before meals</th>
<th>two hours after meals</th>
</tr>
</thead>
<tbody>
<tr>
<td>adults with type-I</td>
<td>4-7 mmol/l</td>
<td>&lt;9 mmol/l</td>
</tr>
<tr>
<td>children with type-I</td>
<td>4-8 mmol/l</td>
<td>&lt;10 mmol/l</td>
</tr>
<tr>
<td>in type-II (5)</td>
<td>4-7 mmol/l</td>
<td>&lt;8.5 mmol/l</td>
</tr>
</tbody>
</table>
References


2. Skelton L. CPPE Hospital Pharmacy Learning program: learning@lunch Diabetes: booklet one: Type I Diabetes. Stetton (GB): Centre for Pharmacy Postgraduate Education; 2007.


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Review by: January 2022
### Summary of insulins available at time of publication

Table 1 (below) provides examples of the different types of insulin used and table 2 gives examples of the medication that may be used in diabetes type-II.

#### Table 1

<table>
<thead>
<tr>
<th>Type of insulin</th>
<th>When to inject</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid-acting insulin analogue</td>
<td>During or immediately after a meal</td>
<td>NovoRapid®, Fiasp® (both insulin aspart), Apidra® (insulin glulisine), Humalog® (insulin lispro),</td>
</tr>
<tr>
<td>Short-acting insulin</td>
<td>15 to 30 minutes before meals</td>
<td>Actrapid® and Humulin® S (both soluble human insulin)</td>
</tr>
<tr>
<td>Intermediate or long-acting insulin</td>
<td>Once (or twice) daily, 15 to 30 minutes before meals</td>
<td>Insulatard®, Humulin® I and Insuman Basal® (all isophane human insulin)</td>
</tr>
<tr>
<td>Long-acting insulin analogue</td>
<td>Once (or twice) daily at the same time each day. (Time of day not important).</td>
<td>Levemir®, Abasaglar®, Lantus®, Toujeo® (all insulin glargine), Tresiba® (insulin degludec ▼), Xultophy® (insulin degludec with liraglutide – licensed for use in type 2 diabetes only)</td>
</tr>
<tr>
<td>Biphasic insulin</td>
<td>Usually twice daily: just before, with, or immediately after meals.</td>
<td>Humalog® Mix 25, Humalog® Mix 50 (insulin lispro with insulin lispro protamine), Novomix® 30, Mixtard® 30 and Humulin® M3 (both human insulin with human isophane insulin, Insuman® Combi 15, Insuman® Combi 25, Insuman® Combi 50 (all isophane human with soluble human insulin)</td>
</tr>
</tbody>
</table>

#### Table 2

<table>
<thead>
<tr>
<th>Type of antidiabetic medication used in type-II</th>
<th>Examples</th>
<th>How does it work?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphonylureas</td>
<td>Glibenclamide, gliclazide, glimepiride, glipizide</td>
<td>Stimulate insulin secretion</td>
</tr>
<tr>
<td>Biguanides</td>
<td>Metformin</td>
<td>Reduction of hepatic glucose production, increase of insulin sensitivity in muscle, delay of glucose absorption from the gut</td>
</tr>
<tr>
<td>Glitazones</td>
<td>Pioglitazone</td>
<td>Reduction of insulin resistance at adipose</td>
</tr>
<tr>
<td>Post-prandial regulators glucon-like-peptide-1-receptor agonists (given by SC injection)</td>
<td>Repaglinide, nateglinide liraglutide, exenatide</td>
<td>Tissue, skeletal muscle and liver stimulate insulin secretion increase secretion of insulin, suppress secretion of glucagon</td>
</tr>
<tr>
<td>Dipeptidyl peptidase (DPP-4) inhibitors</td>
<td>Sitagliptin, saxagliptin, vildagliptin</td>
<td>Increase secretion of insulin, suppress secretion of glucagon</td>
</tr>
</tbody>
</table>

Reviewed January 2019 Review January 2022
# Appendix 3

## Blood Glucose Monitoring Recommendations

<table>
<thead>
<tr>
<th>Diet &amp; exercise, metformin, acarbose, pioglitazone, saxaglaptin, sitagliptin, vildagliptin, exenatide, liraglutide, (alone or in combination)</th>
<th>Sulphonylureas (e.g. glibenclamide, gliclazide, glimepride, glipizide, tolbutamide). Nateglinide and repaglinide</th>
<th>Insulin</th>
<th>Pregnancy. Pre-existing diabetes (treated by diet / oral antidiabetics, or insulin). Gestational</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Need for blood tests?</strong></td>
<td>No</td>
<td>Assess on individual basis</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Hypoglycaemia risk?</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Considerations.

<table>
<thead>
<tr>
<th>Testing can be a useful tool to allow patients to learn the effects different foods and different activities have on their blood glucose. May also be used during medication dose titration.</th>
<th>Consider risk of hypoglycaemia. Does patient have good hypo awareness? Does patient drive? Do they have an intercurrent illness? Is the patient using the results to self monitor or titrate dose?</th>
<th>Consider risk of hypoglycaemia. Does patient have good hypo awareness? Does patient drive? Do they have an intercurrent illness? Patient on weight loss programme? Is the patient using the results to self monitor or titrate dose?</th>
<th>Close monitoring required. Advice required from diabetic clinic regarding target blood glucose levels and monitoring frequency. Advice on post delivery testing also required.</th>
</tr>
</thead>
</table>

### Test frequency.

**Note:** Blood glucose levels should be tested at varying times during the day – e.g. pre-meals, before bed, two hours after a meal.

| If testing, aim for once or twice per week. Test HbA1c every 3 months if found greater than 58 mmol/l IFCC* (7.5%). Routine testing may be required during illness. | If testing, aim for once to twice per day. Test HbA1c every 3 months if found greater than 58 mmol/l IFCC* (7.5%). | Normally once daily on OD insulin and once or twice daily if on BD. If on a basal bolus regimen and carbohydrate counting may need at least 4 blood tests a day. Test HbA1c every 3 months if found greater than 58 mmol/l IFCC* (7.5%). | Test HbA1c every 3 months if found greater than 47.5 mmol/l* (6.5%) in first trimester only. |

*Change in units of measurement from DCCT to IFCC as from October 2011 to allow easier comparisons between the UK and Europe

Based on guidance developed by the Western Sussex Hospitals NHS Trust

Reviewed October 2015

Review by: October 2018
The Management of Diabetes during illness or stress – using the ‘Sick day rules’

Sick day rules should be provided to the individual from their diabetes team to support them during a period of illness or stress. It is very important that these are adhered to prevent further illness/complications and unnecessary hospital admission.

1) Insulin therapy should not be stopped.
2) The dose of insulin may need to be altered during periods of illness; advice should be sought from the patient’s diabetes team or a prescriber if the individual is unsure of how to adjust insulin doses.
3) Blood glucose levels should be monitored more frequently — at least every 3–4 hours, including through the night and sometimes every 1–2 hours. Results should be recorded by the individual or healthcare professional.
4) The insulin dose should be titrated according to the blood glucose results and the written sick day rules from their diabetes team.
5) Monitor their urine ketones (or blood ketones if appropriate) — this should ideally be checked at least every 3–4 hours (at least eight times in 24 hours), including through the night and sometimes every 1–2 hours, depending on results.
6) If the urine ketone level is greater than 2+, contact the GP or diabetes care team immediately.
7) Blood ketone monitoring is preferred for people on insulin pump therapy and may be indicated for some other groups from whom it is more difficult to obtain a urine sample (for example young children).
8) At least 3 L of fluid (5 pints) should be drunk daily by the individual to prevent dehydration.
9) If vomiting or diarrhoea is persistent, medical advice should be sought as intravenous fluids may be required.
10) Maintain the normal meal patterns if possible. However, normal meals could be replaced with carbohydrate-containing drinks (such as milk, milk shakes, fruit juices, and sugary drinks) if appetite is reduced.
11) Seek urgent medical advice if they are violently sick, drowsy, or unable to keep fluids down.
12) When feeling better, continue to monitor their blood glucose carefully until it returns to normal.
13) It may take some time for blood glucose levels to return to normal. Seek medical advice if their blood glucose remains uncontrolled.

The following applies to those individuals using oral anti-diabetic agents:

1) Tablets and normal dosage should be maintained, providing carbohydrate intake continues in solid or liquid form and blood glucose monitoring continues at least 4-hourly.
2) If blood glucose level > 13mmol/l and the individual feels unwell, medical advice should be sought/consult diabetic team.
3) Metformin should be stopped if dehydration is present - hospital admission/sliding scale of insulin may be considered. Consult medical advice or individual’s diabetic team.

Reviewed October 2015

Review October 2018