MIL

Oxford University Hospitals NHS
NHS Trust

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This Medicines Information Leaflet is produced locally to optimise the use of medicines by encouraging prescribing that is safe, clinically appropriate and cost-effective to the NHS.

Safe initiation, administration, and titration of subcutaneous insulin in adult patients with diabetes

The aim of this MIL is to provide practical guidance on initiation, administration, and titration of subcutaneous (sc) insulin in adult patients with type 1 and type 2 diabetes mellitus (DM).

Insulin is available in various strengths (number of units per ml) and preparations based on the duration of action (rapid, short, intermediate, mixed and long acting). There are several different administering devices e.g. vials, pre-filled pens, insulin pumps. This increases the risk for potential medication errors.

The National Diabetes Inpatient Audit (NaDIA) collates data regarding patients with diabetes across England. Between 2011-2018 the prevalence of patients with diabetes increased to as high as 30% of admissions. In 2019 1 in 3 patients experienced a medication error relating to insulin, with two fifths of drug charts for insulin treated inpatients showing 1 or more insulin errors[1].

Maintaining good glycaemic control in hospital has been associated with a reduction in harm. Improvements in insulin safety can always be made. Errors occur due to several factors e.g. unfamiliarity of insulin names and profile of actions as well as problems with similar sounding insulin names resulting in prescribing, dispensing and administration errors.

Safe Prescribing – General principles

- Insulin must always be prescribed by 'BRAND' name (e.g. - Lantus instead of glargine) and free text prescribing should **not** be used. This is because increasing numbers of biosimilar insulins are being produced.
- Some insulin preparations are now available in **strengths** other than 100units/ml (e.g. Tresiba 200 units/ml, Toujeo 300 units/ml). Extra care should be taken when prescribing, dispensing, and administering to ensure the correct product is selected.
- It is important to select the correct medicine AND device on ePMA (see 'Right Insulin Right Pen' Appendix 1).
- Do not continue a insulin from a patients medication history on EPMA without first confirming the patient is still on this insulin.
- If the patient has not brought insulin from home or you are unsure what device the patient uses then prescribe a **pre-filled pen.**
- Insulin must be documented and prescribed in 'UNITS' in full (U or IU should **never** be used).
- Take care when prescribing sound alike insulin names to ensure you have selected the correct insulin on EPMA e.g. Insulin Humalog or Humalog MIX 25

Safe prescribing - If no information on insulin type or dose available

- Patients may have an insulin passport or previous prescriptions (this will give the type but not dose).
- Review Health Information Exchange for details of insulin type (will not give dose).
- Ask the patient or contact a relative or next of kin.
- Contact carers or district nurse if they routinely administer insulin in the community.

If unable to obtain details on type and dose of insulin, use following regimen until further information is available:

Give a total daily dose of 0.5units of insulin per kg body weight e.g. 35 units for 70kg person

- 50% should be basal insulin e.g. Levemir twice a day E.g. 8 units twice a day, morning and evening
- 50% should be rapid acting insulin e.g. NovoRapid three times a day before each meal. E.g. 6 units with each meal

NEVER omit a basal (long acting) insulin dose in patients with type 1 diabetes.

Insulin initiation

For patients with type 2 diabetes who require insulin as an inpatient:

- Start Humulin I (pre-filled pen) 6 units twice a day

Helpful checks:

- HbA1c to determine duration of DM and longstanding control
- GAD and IA2 antibodies if uncertain type of DM (Antibodies not recommended over the age of 40)
- Discuss with on call diabetes SpR if unclear on insulin dose requirement

Monitoring and dose titration

Inpatients on subcutaneous insulin should have their capillary blood glucose (CBG) monitored at least four times a day (before meals and before bed).

If CBG is **persistently** above target (usually 4-12mmol/L). → Increase evening dose of intermediate/long-acting insulin e.g. Humulin I, Insulatard, Levemir, Lantus. Adjust doses by 10% every 2 days until CBG in range.

If CBG is above target (usually 4-12mmol/L) **before lunch, dinner or bedtime** → Increase the rapid/short acting insulin e.g. NovoRapid, Actrapid, Humalog at the meal before the rise of CBG. Adjust doses by 10% every 2 days until CBG in range. E.g. if pre-dinner CBG is 15mmol/L then increase lunchtime rapid / short acting insulin by 10%.

Capillary blood ketones should be checked if CBG above 12 mmol/L.

- **ketones more than 3mmol/L**, check pH or bicarbonate and start DKA protocol if in DKA.
- **ketones 1-3 mmol/L** ensure adequate hydration and consider additional correctional dose of s/c NovoRapid. This should not be repeated within 4 hours of previous NovoRapid insulin dose.
- **ketones less than 1 mmol/L**, consider a 10% increase in regular insulin dose.

Corrective Doses

Only use a correction single dose of insulin if tighter blood glucose control is required quickly e.g. raised ketones and the patient is eating and drinking.

- If a patient fulfils the criteria for a single correction dose of insulin then sc NovoRapid (or patient's own rapid-acting insulin instead of NovoRapid) can be used. Dose according to patient's CBG as table below (or patient's own correction dosing where applicable).

Subcutaneous Insulin Correction Dose Table	
CBG (mmol/L)	Insulin units
12 – 14.9	1
15 – 17.9	2
18 – 20.9	3
21 – 23.9	4
24 – 27	5
Above 27	Contact Diabetes Team

- After 2 consecutive correction doses (4hrs apart) consider IV insulin. Long-acting insulin should be continued if patient is switched to intravenous insulin infusion.
- Avoid giving single doses of rapid/short acting insulin especially after 2100hrs. This frequently leads to hypoglycaemia and the patient missing their regular dose of insulin the following morning.
- If correction dose insulin is used, consider increasing the usual insulin dose before the rise in blood glucose by 10%.
- Single doses of insulin must be stopped at discharge, unless the patient is going to a community hospital, where it may be continued if appropriate.
- **If the long-acting insulin is more than 4 hours overdue, prescribe a 50 % reduced dose and then prescribe the normal dose at the next injection time.**

Insulin Therapeutic substitution

If a patient does not have their own insulin with them and it is unavailable from pharmacy in the correct device then an insulin from the same group can be prescribed temporarily e.g. prescribe Lantus if patient does not have Abasaglar (see *appendix 2*). Contact pharmacy to ensure supply of the insulin.

Administering insulin

All insulin must be independently (double) checked. This must be documented on the prescription (use "witnessed by" option in ePMA). The patient/carer can be one party.

Patients should be encouraged to self-administer insulin under supervision of a nurse.

If a patient has brought in their own supply of insulin, ensure this matches the insulin prescribed. Alert the prescriber to any discrepancies.

Insulin syringes

- Insulin must **ONLY** be given using an insulin syringe, insulin pen device or continuous subcutaneous insulin infusion (CSII or insulin pump).
- Intravenous syringes must **NEVER** be used to give insulin
- Insulin **MUST** only be withdrawn into an insulin syringe from a vial. Insulin should **NEVER** be withdrawn from a cartridge or pen device.
- Insulin syringes should be stored alongside insulin vials in the fridge

Diabetes team referral

- Refer to diabetes team via Requests & Prescribing on EPR if starting insulin in a patient previously on oral agents
- Diabetes Specialist Nursing team can be contacted in hours on bleep number 4433
- Diabetes/Endocrine registrar can be contacted via switchboard 24hrs a day.

Patient information

- Patient information booklets and diabetes education should be provided if initiated on insulin.
- If patient with new diagnosis is discharged from ambulatory unit a review should be arranged to see DSN next day.
- All patients should have a sharps bin or other safe way of disposing of insulin needles.

Separate guidelines for the use of insulin in adults are available in the following MILs:

1. Diabetes – management before, during & after operations & procedures
2. Diabetic Ketoacidosis (DKA) management
3. Hyperosmolar Hyperglycaemic State (HHS) management
4. Insulin – intravenous infusions
5. Hyperkalaemia - management

References:

1. NHS *National Diabetes Inpatient Audit (NaDIA) - 2019*. NHS Digital, 2020. https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-inpatient-audit/2019

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With special thanks to Alex Edwards & Ruthie Jones, Diabetes Specialist Nurses for creating the 'Right Insulin – Right Pen' chart in Appendix 1.

Minor revision, 05.03.2019: R Rea, G Tan, A Lumb, C Crowley

Reviewed 4.3.2022: A. Lumb, D.Jones, J.Bailey, K.Kildonaviciute.

Appendix 1: Right Insulin – Right Pen

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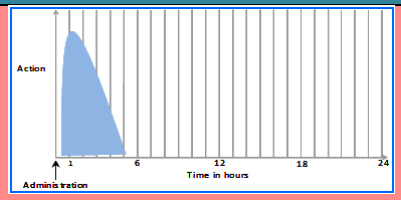
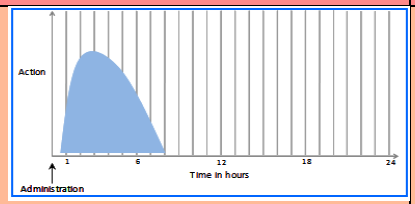
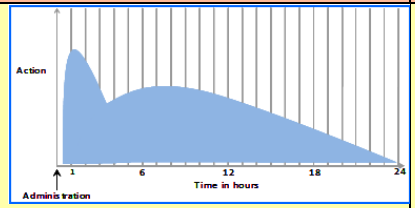
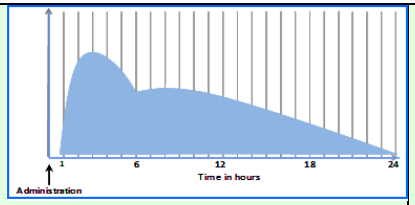
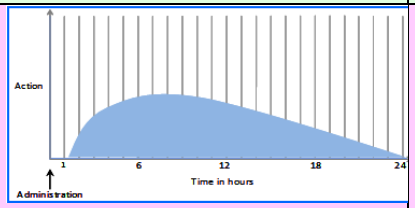
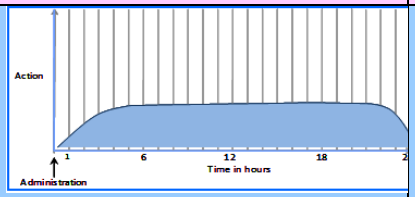
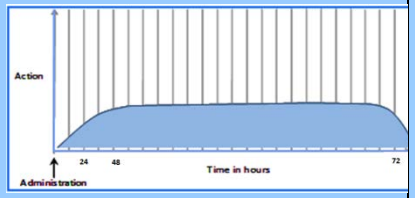
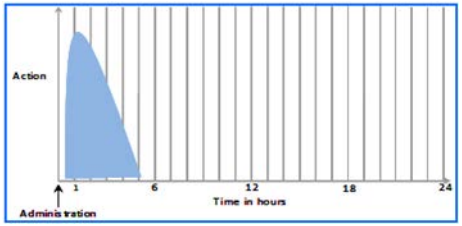
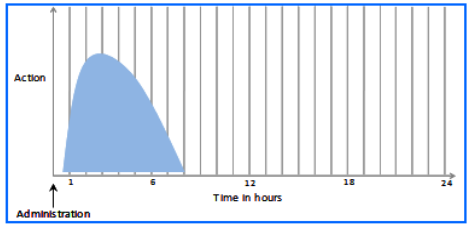
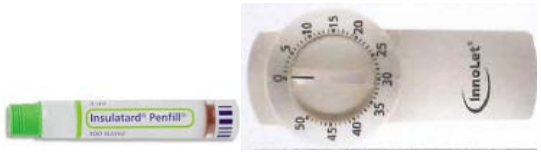
Right Insulin – Right Pen** This list is not exhaustive but is a selection of the most common insulin and pen devices stocked by the OUH (if a patient is on a non-stock insulin seek advice from Pharmacy). There is a pharmacist available out of hours via switchboard. **ALWAYS USE BRAND NAME FOR INSULIN.

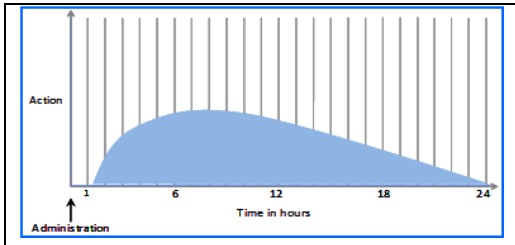
Insulin type	Pens	Brand name to be used when prescribing INSULIN (manufacturer)	Approved name	Form: VIAL (10 ml)	Form: Pre-filled pen device (disposable)	Form: Cartridge	Compatible pen for cartridge	Approximate time action profile	Administration and Typical dosing schedules
RAPID ACTING: Insulin Analogue		NovoRapid (Novo Nordisk)	Insulin aspart	√	FlexPen & NovoRapid FlexTouch pen	√	**Novopens:** NovoPen Echo NovoPen 6	 **Onset:** 10-20 minutes **Peak**: 1 hour **Duration**: up to 4 hours	**Give just before/with/just after food.** Usually three times a day subcutaneously (s/c) give 10- 20 minutes before food **Corrective rate:** 4 hourly.
		Humalog (Lilly)	Insulin lispro 100 units/ml	√	KwikPen Available in 200 units/ml (BUT not supplied by OUH).	√	**HumaPens:** HumaPen Savvio HumaPen Luxura HD Autopen Classic		
		Fiasp (NovoNordisk)	Fast-Acting Insulin aspart	√	FlexPen & FlexTouch Pen	√	**Novopens:** NovoPen Echo NovoPen 6		**Give up to 2 minutes before or up to 20minutes after starting a meal.**
SHORT: ACTING: Soluble Insulin		Actrapid (Novo Nordisk)	Human Soluble Insulin	√	**X** Vial Only **DO NOT INCLUDE IN TTO / EIDD**	**X**	**X**	 **Onset**: 30 minutes **Peak:** 1-3 hours **Duration**: up to 8 hours	**Give 20-30 minutes before food.** Usually three times a day S/C, 30 minutes before food. **Corrective rate:** 4 hourly
		Humulin S (Lilly)	Human Soluble Insulin	√	**X**	√	**HumaPens**, HumaPen Savvio HumaPen Luxura HD		
PRE-MIXED: Analogue		NovoMix 30 (Novo Nordisk)	Biphasic insulin aspart	**X**	FlexPen	√	**NovoPens:** NovoPen 6	 **Onset:** 10-20 minutes **Peak:** Dual **Duration:** up to 24 hours	**Give just before/with/just after food.** Twice daily S/C. These insulins require re-suspending before use. (NOTE: The number after the name of the insulin refers to the percentage of rapid acting insulin).
		Humalog Mix 25 (Lilly)	Biphasic insulin lispro	√	Humalog Mix 25 KwikPen	√	**HumaPens,** HumaPen Savvio Autopen Classic		
		Humalog Mix 50 (Lilly)	Biphasic insulin lispro	**X**	Humalog Mix 50 KwikPen	√	**HumaPens,** Autopen Classic HumaPen Savvio		

PRE-MIXED: Insulin		Humulin M3 (Lilly)	Soluble and isophane insulin	√	Humulin M3 KwikPen	√	**HumaPens**, Autopen Classic HumaPen Savvio	 **Onset:** 30 minutes **Peak**: 2-8 hours **Duration**: up to 24 hours	**Normally given twice daily.** NOTE: Humulin M3 contains 30% short acting soluble insulin & 70% intermediate acting insulin). Requires re-suspending before use.
INTERMEDIATE Acting Insulin		Insulatard (Novo Nordisk)	Isophane Insulin	√	Innolet device	√	**NovoPens:** NovoPen 6	 **Onset**: 1.5 hours **Peak**: 4-12 hours **Duration**: up to 24 hours	**Normally given once or twice daily.** requires re-suspending before use
		Humulin I (Lilly)	Isophane Insulin	√	KwikPen	√	**HumaPens,** Autopen Classic HumaPen Savvio		
LONG ACTING: Insulin Analogues		Levemir (Novo Nordisk)	Insulin detemir	X	FlexPen /FlexTouch Pen/ Innolet device	√	**NovoPens:** NovoPen 6	 **Onset:** 24-48 hours **Peak:** extended activity **Duration**: up to 24 hours	**Give once or twice daily.** Must be given at the same time each day.
		Lantus (Sanofi)	Insulin glargine 100 units/ml	√	SoloStar pen	√	**Aventis Pens:** ClickSTAR		
		Abasaglar (Lilly)	Insulin Glargine 100 units /ml	X	KwikPen	√	**HumaPens:** HumaPen Savvio		
		Toujeo (Sanofi)	Insulin glargine **300 units/ml**	X	SoloStar pen	√	**X**	 **Onset:** 24-48 hours **Peak:** extended activity **Duration:** up to 72 hours	**Give once daily**. Tresiba® allows for flexibility in the timing of insulin administration when administration at the same time of day is not possible.
		Tresiba (Novo Nordisk)	Insulin degludec 100units/ml (200 units/ml available BUT not supplied by OUH).	X	FlexTouch pen available in 100units & 200units/ml	√	**NovoPens:** NovoPen 6		

Appendix 2: Insulin Therapeutic Substitutions

Rapid Acting INSULIN Analogue	Switch to this insulin	
Humalog  KwikPen Apidra  SoloStar Pen		NovoRapid  FlexPen & NovoRapid FlexTouch pen	 **Onset:** 10-20 minutes **Peak**: 1-2 hours **Duration**: up to 5 hours **Give just before/with/just after food.** Usually three times a day subcutaneously (s/c) give 10- 20 minutes before food **Corrective rate:** 4 hourly
Short Acting Soluble Insulin	**Switch to this insulin**	
Humulin S 		Actrapid 	 **Onset**: 30 minutes **Peak:** 1-3 hours **Duration**: up to 6-8 hours **Give 20-30 minutes before food.** Usually three times a day S/C, 30 minutes before food. **Corrective rate:** 4 hourly
Intermediate Acting INSULIN	**Switch to this insulin**	

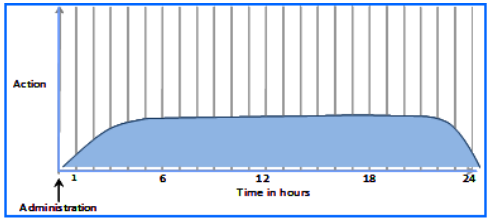
Insulatard  NovoPen 5 / Innolet device Insuman Basal Solostar 		Humulin I  KwikPen
Long-Acting INSULIN Analogues	**Switch to this insulin**	
Abasaglar  KwikPen		Lantus  SoloStar pen



Onset: 1.5 hours **Peak**: 4-12 hours

Duration: up to 24 hours

Normally given once or twice daily. Requires re-suspending before use



Onset: 24-48 hours **Peak:** extended activity

Duration: up to 24 hours

Give once or twice daily. Must be given at the same time each day.