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Injection
Technique
Malaysia

FIT-MY

Recommendations
for Best Practice in
Injection Technique

2026



MINISTRY OF HEALTH MALAYSIA



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FIT-MY Injection Technique Guideline

Diabetes mellitus remains a major public health concern in Malaysia and continues to pose significant challenges to the healthcare system. The increasing prevalence of diabetes, together with the rising utilisation of injectable therapies, underscores the importance of ensuring safe, effective, and standardised approaches to diabetes management across all levels of care. Proper injection technique is a critical component of treatment optimisation, patient safety, and the prevention of avoidable complications.

Since the release of the first edition of Forum for Injection Technique Malaysia (FIT-MY), Recommendations for Best Practice in Injection Technique for Diabetes Educators and Healthcare Professionals, there have been notable advances in diabetes therapeutics, delivery devices, and evidence-based clinical practices. These developments necessitate regular review and updating of clinical guidance to ensure continued relevance, consistency, and alignment with current standards of care. The encouraging uptake and application of the first edition of FIT-MY clearly demonstrated its value as a practical reference in supporting healthcare professionals involved in diabetes education and management.

The second edition of the FIT-MY Recommendations for Best Practice in Injection Technique 2026 provides an updated, comprehensive, and locally contextualised reference that incorporates current evidence, technological advances, and best practices in injectable therapy. The guideline is intended to support healthcare professionals in delivering accurate, safe, and effective injection education, thereby strengthening the quality of care, improving treatment outcomes, and promoting patient empowerment. This initiative is consistent with the Ministry of Health Malaysia's ongoing efforts to enhance the quality and safety of healthcare services, particularly in the management of non-communicable diseases.

I would like to commend the Forum for Injection Technique Malaysia for their initiative and sustained commitment in the development of this updated guideline, in collaboration with the Ministry of Health Malaysia. I also wish to acknowledge the valuable contributions of the multidisciplinary working committee and external reviewers, whose expertise and diligence have been instrumental to the successful completion of this document.

It is my hope that this revised guideline will continue to serve as an important reference for healthcare professionals throughout Malaysia, supporting standardised practices in injection technique and contributing to improved clinical outcomes and quality of life for people living with diabetes.



YBhg Datuk Dr Mahathar bin Abd Wahab
Director General of Health
Ministry of Health Malaysia

The landscape of diabetes management is constantly evolving, with new therapies and technologies emerging to improve the lives of people living with this chronic condition. While we've seen significant strides since the first edition of the Forum for Injection Technique Malaysia (FIT-MY), one thing remains constant: the critical role of proper injection technique in ensuring effective treatment and preventing complications.

In Malaysia, the prevalence of diabetes continues to be a major health concern, making resources like this guideline more vital than ever. The first edition served as a foundational tool, helping to standardise educational practices and empower healthcare professionals to teach safe and accurate injectable therapy administration. It's clear from its widespread adoption that it fulfilled a significant need.

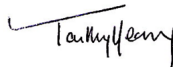
This second edition represents a comprehensive update, reflecting the latest evidence and best practices in diabetes care. We've incorporated new insights on injectable therapies, addressed emerging issues, and expanded on key topics to ensure this guideline remains a definitive resource for diabetes educators and healthcare professionals. Our goal is to continue to enhance clinical outcomes and empower people with diabetes to manage their health with confidence and precision.

On behalf of the Malaysian Diabetes Educators Society, I would like to extend my deepest appreciation to the Ministry of Health Malaysia and the dedicated working committee. Your continued commitment and immense contributions have been invaluable in bringing this new edition to fruition. We also thank the external reviewers for their critical feedback and support.

I trust that this revised guideline will serve as an indispensable resource, continuing our shared mission to improve the quality of life for all people with diabetes in Malaysia.



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Forum for Injection Technique- Malaysia
2nd Edition Committee



Dr Tan Ming Yeong, RN CDE
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2nd Edition Committee

OBJECTIVE

To develop evidence-based recommendations for best practice in injection technique for healthcare professionals involved in the care of people with diabetes in Malaysia.

TARGET POPULATION

This guideline provides evidence-based recommendations on injection technique for people with diabetes who use injectable therapy in their daily management.

TARGET GROUP

This guideline may be used by healthcare professionals involved in diabetes care, particularly those providing education or management related to injection therapy, including diabetes educators, nurses, assistant medical officers, dietitians, pharmacists, and medical practitioners.

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INTRODUCTION

In Malaysia, diabetes is a major public health issue. The recent National Health and Morbidity Survey (NHMS) 2023 reported the prevalence of known diabetes as 9.7% which estimates that 2.2 million adult Malaysians having an established diagnosis of diabetes and expectedly receiving treatment.¹ It is expected that up to 99% of these individuals have Type 2 diabetes. The burden of Type 1 diabetes in Malaysia is reported to affect approximately 7000 individuals in 2022.²

Not surprisingly, with the rising prevalence of diabetes in Malaysia, there has been a rapid increase in insulin therapy over the past two decades. The NHMS 2006 report noted a low rate of insulin use of 7% among adults with known diabetes as compared to the most recent NHMS 2023 which reported a threefold higher rate of insulin use of 21.8%, representing one in five of those diagnosed with diabetes or approximately half a million adult Malaysians requiring administration of insulin injections daily for the long term treatment of their disease.^{1,3} The rate of insulin use in public primary care clinics has been closely monitored annually, reported to be 28.8% in 2022.⁴ Higher rates of insulin treatment, above 50% in 2022, were reported among people with Type 2 diabetes attending outpatient diabetes care in public hospitals.⁵

In the recent decade there has been rapid development in newer non-insulin injectable therapies for glucose lowering such as glucagon-like peptide-1 receptor agonist (GLP-1 RA), now mostly available as weekly injections replacing the prior daily injection formulations. In the near future, more non-insulin injectable formulations of dual and potentially triple agonists of pancreatic and gut hormones will be made available for treating people with Type 2 diabetes, potentially reducing the need for insulin injections.

There have been continuous advances in needle and pen device technology which has greatly improved insulin injection experience for people with diabetes. Finer needles are more comfortable and less painful, allow smooth insertion, less skin trauma and better insulin flow. Newer pen devices may offer smart technology such as insulin dose tracking, integration with glucose meters and apps via bluetooth connectivity which improves patient safety and adherence.

Optimising injection technique in diabetes care is crucial to ensuring treatment efficacy, minimizing complications, and improving patient outcomes.⁶ Improper injection technique can result in erratic glucose control, lipohypertrophy and suboptimal adherence. Educating healthcare professionals, people with diabetes and their caregivers on the correct injection techniques and related developments in the field needs to be prioritised as an essential element to ensuring best patient outcomes with regards to quality of life, glycaemic control and preventing acute and chronic diabetes related complications.

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INJECTABLE THERAPY IN DIABETES

Key Messages:

1. Injectable therapies are central to diabetes management and generally classified as insulin or non-insulin injectables.
2. All people with Type 1 diabetes require insulin therapy, delivered through basal-bolus regimens or pump systems to replicate physiological patterns.
3. In people with Type 2 diabetes, either insulin or incretin based therapies, may be initiated when lifestyle changes and oral glucose lowering drugs are inadequate.
4. Understanding the various insulin types, formulations and regimens enables individualised treatment, optimal glycaemic control and reduced risk of complications, particularly hypoglycaemia.

Injectable therapies form an important pillar of diabetes management, helping to achieve and maintain optimal blood glucose control. While people with Type 1 diabetes rely on insulin therapy for daily survival, people with Type 2 diabetes may progress to injectables when oral treatments are no longer sufficient.

2.1 Insulin Preparations

Insulin formulations have evolved from early animal-derived sources (porcine and bovine) to human insulin produced via recombinant DNA technology, and subsequently to insulin analogues—structurally modified forms of human insulin designed to enhance efficacy, reduce hypoglycaemia risk, and provide more predictable pharmacokinetic profiles.

More recently, biosimilar insulins have been introduced and have a close resemblance to their originator insulins. Biosimilar insulins, including both human and analogue forms, are more affordable, enable better access and have expanded insulin use worldwide.

There are several types of insulin based on pharmacokinetic and clinical use as shown in Table 2.1 and Table 2.2.

Bolus insulin. These are short-, rapid- or ultra-rapid acting insulins, administered pre-meals or for correction of acute hyperglycaemia. It is used to control the post-meal glucose excursion and can be used with an insulin pump

Basal insulin. These are intermediate-, long- or ultra-long acting insulins which are administered once or occasionally twice daily. It covers basal insulin requirements between meals and overnight to address endogenous hepatic

glucose production. Newer once-weekly basal insulin formulations have been developed and have demonstrated safety and efficacy in clinical trials, with some already approved for use in certain countries.

Premixed insulin. These are biphasic insulin incorporating a combination of short or rapid- acting insulin with its intermediate-acting counterpart into a single formulation. It covers both post-prandial glucose excursions as well as basal insulin requirements simultaneously.

Co-formulations. A combination of two types of insulin or an insulin with a glucagon- like peptide-1 receptor agonist (GLP1-RA).

Table 2.1: Insulin Type and Formulations¹

Insulin Type	Conventional	Analogue Brand (Generic)
Bolus	Short-acting regular human insulin <ul style="list-style-type: none"> Actrapid ® Insugen R ®* 	Rapid-acting <ul style="list-style-type: none"> NovoRapid ®, *Kirsty ® (insulin aspart) Humalog ® (insulin lispro) Apidra ® (insulin glulisine) Ultra-rapid-acting insulin <ul style="list-style-type: none"> FiAsp ® (insulin aspart)
Basal	Intermediate-acting or NPH insulin <ul style="list-style-type: none"> Insulatard ® Insugen N ®* Diabulyl N ®* Wosulin N ®* 	Long-acting insulin <ul style="list-style-type: none"> Lantus ®/ Lantus ® SoloStar ® (U 100 insulin glargine) Toujeo ® SoloStar ® (U-300 insulin glargine) Levemir ® (insulin detemir) Basalog ® / Basalog One ® (rDNA insulin glargine) Glaritus ®* (rDNA insulin glargine) Ultra-long-acting insulin <ul style="list-style-type: none"> Tresiba ® (insulin degludec)

Insulin Type	Conventional	Analogue Brand (Generic)
Premixed	Combination of short & intermediate-acting insulin: 30% regular insulin + 70% NPH <ul style="list-style-type: none"> Mixtard 30 ®• Insugen 30/70 ®* 	Combination of rapid-acting analogue & protaminated insulin <ul style="list-style-type: none"> NovoMix 30 ® (30% aspart + 70% aspart protamine) Humalog ® Mix25™ (25% insulin lispro + 75% insulin lispro protamine) Humalog ® Mix50™ (50% insulin lispro + 50% insulin lispro protamine)
Co-formulation		Combination of rapid-acting & long-acting insulin <ul style="list-style-type: none"> Ryzodeg ® (30% insulin aspart + 70% Insulin degludec; iDegAsp) Combination of a long-acting insulin and a GLP1-RA <ul style="list-style-type: none"> Soliqua ® (insulin glargine + lixisenatide)

*Biosimilar insulin. GLP1-RA, glucagon-like peptide 1 receptor agonist; NPH, neutral protaminated Hagedorn; rDNA, recombinant DNA.

Table 2.2: Pharmacokinetic Profiles of Various Types of Insulin¹

Brand (Generic) Name	Onset	Peak (H)	Duration (H)	Timing of Insulin
Short-acting regular <ul style="list-style-type: none"> Actrapid® Insugen R®* 	30 min 30 min	1.5-3.5 2-4	8 6-8	30 min before Meals
Rapid-acting analogue <ul style="list-style-type: none"> NovoRapid® (insulin aspart) Humalog® (insulin lispro) Apidra® (insulin glulisine) 	10-20 min 0-15 min 5-15 min	1-3 1 1-2	3.5 3.5-4.5 3.5	5 -15 min before or immediately after meals

Brand (Generic) Name	Onset	Peak (H)	Duration (H)	Timing of Insulin
Ultra-rapid-acting <ul style="list-style-type: none"> • FiAsp® (insulin aspart) 	5 min	0.5	3-4	At the start of the meal or within 20 min of meal
Intermediate-acting or NPH <ul style="list-style-type: none"> • Insulatard® • Insugen N®* 	1.5 H 1 H	4-12 4-10	18-23 16-18	Pre-breakfast / Pre-bed
Long-acting analogue <ul style="list-style-type: none"> • Lantus®/Lantus® SoloStar® (U-100 insulin glargine) • Basalog One®* (rDNA insulin glargine) • Toujeo® SoloStar® (U-300 insulin glargine) • Levemir® (insulin detemir) 	2-4 H 2-4 H 1 H 1-2 H	Peakless for all	20-24 30 17-23 16-24	Same time every day at any time of the day
Ultra-long-acting analogue <ul style="list-style-type: none"> • Tresiba® (insulin degludec) 	30-90 min	Peakless	42	Same time every day at any time of the day
Premixed human (30% regular insulin + 70% NPH) <ul style="list-style-type: none"> • Mixtard® 30 • Insugen® 30/70* 	30 min 30 min	Dual Dual	18-23 16-18	30 min before meals
Premixed analogue <ul style="list-style-type: none"> • NovoMix® 30 (30% aspart + 70% aspart protamine) • Humalog® Mix25™ (25% insulin lispro + 75% insulin lispro protamine) 	10-20 min 0-15 min	Dual Dual	18-23 16-18	5-15 min before meals

Brand (Generic) Name	Onset	Peak (H)	Duration (H)	Timing of Insulin
<ul style="list-style-type: none"> Humalog® Mix⁵⁰™ (50% insulin lispro + 50% insulin lispro protamine) 	0-15 min	Dual	16-18	5-15 min before meals
Co-formulation <ul style="list-style-type: none"> Ryzodeg® (30% insulin aspart + 70% insulin degludec; iDegAsp) Soliqua™ (insulin glargine + lixisenatide) 	9-14 min 2 H	0.5-1.5 3.5	>24 20-24	5-15 min before the main meal/s Within 1 H before meal

H, hours; min, minutes; NPH, neutral protaminated Hagedorn; rDNA, recombinant DNA.

Note:

- The time course of action of any insulin may vary depending on the individual or at different times or injection sites in the same individual.
- Due to such variations, the time periods described above should only be used as general guidelines
- Although short- and intermediate-acting insulins can be self-mixed as an alternative to the human premixed insulin, this is not encouraged due to the significant reduction in the reproducibility of insulin action.

2.1.1 Insulin Regimens

Insulin regimens vary according to the frequency of injections as shown in Table 2.3. This is usually determined by the type of diabetes. People, with Type 1 diabetes will usually require intensive insulin therapy with multiple dose injection regimens such as basal bolus insulin regimen incorporating bolus and basal insulins.

Table 2.3: Insulin Regimens¹

No. of Injections Per Day	Insulin Regimen	Type of Insulin and Timing
One	Basal	Intermediate-acting (NPH) insulin: Pre-bed
	Basal	Long-acting or ultra-long-acting analogue: Once daily (same timing at any time of the day)
	Premixed OD	Premixed/premixed analogue: Pre-dinner

No. of Injections Per Day	Insulin Regimen	Type of Insulin and Timing
One	Co-formulation	iDegAsp: Once daily at the main meal Insulin glargine/lixisenatide: Once daily within 1 hour before meal
Two	Basal	Intermediate acting (NPH): Pre-breakfast and pre-dinner
	Premixed BD	Premixed insulin: Pre-breakfast and pre-dinner
	Premixed-plus (1)	Premixed (pre-dinner) + 1 Bolus insulin
	Basal-plus (1)	Basal insulin (pre-bed) + 1 Bolus insulin
	Co-formulation	iDegAsp: Twice daily at two main meals
Three	Basal - plus (2)	Basal insulin: Once daily Bolus insulin: Twice daily
	Bolus	Bolus insulin: 1 pre-breakfast + 1 pre-lunch + 1 pre-dinner
	Premixed TDS	Premixed analogue: 1 pre-breakfast + 1 pre-lunch + 1 pre-dinner
	Premixed – plus	Premixed insulin: 1 pre-breakfast + 1 pre-dinner Bolus insulin: 1 pre-lunch OR Premixed insulin: 1 pre-dinner Bolus insulin: 1 pre-breakfast + 1 pre-lunch
	Co-formulation plus (2)	iDegAsp: Once daily at the main meal Bolus insulin: At two other meals OR Insulin glargine/lixisenatide: Once daily within 1 hour before meal Bolus insulin: At two other meals

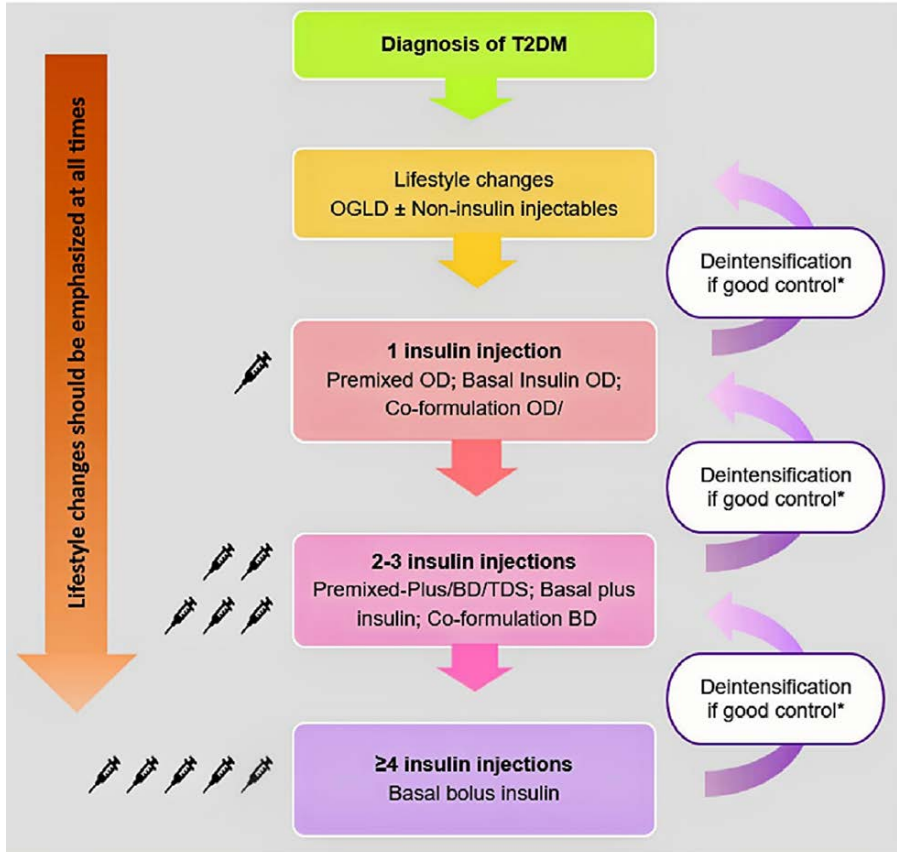
No. of Injections Per Day	Insulin Regimen	Type of Insulin and Timing
Four	Basal – bolus	Basal insulin: Once daily Bolus insulin: 1 pre-breakfast + 1 pre-lunch + 1 pre-dinner
Five*	Basal – bolus	Intermediate acting (NPH) insulin: 1 pre-breakfast + 1 pre-dinner Bolus insulin: 1 pre-breakfast + 1 pre-lunch + 1 pre-dinner

*Only for selected cases.

BD, twice daily; iDegAsp, insulin degludec aspart; NPH, neutral protaminated Hagedorn; OD, once daily; TDS, three times daily.

In people with Type 2 diabetes, simpler insulin regimens are preferred, usually combined with oral glucose lowering drugs. The choice of insulin regimen should be individualised based on the patient's glycaemic profile, dietary pattern, personal lifestyle and desired flexibility.¹ Intensification of regimens² are necessary if glycaemic control is not achieved and deintensification of regimens should also be considered in specific circumstances³ as shown in Figure 2.1.

Figure 2.1: Overall Treatment Algorithm for People with Type 2 Diabetes Requiring Insulin Treatment



Consider deintensification if good glycaemic control, i.e., at individualised targets. BD, twice daily; OD, daily dose; OGLD, oral glucose lowering drugs; TDS, three-times daily.

Note:

1. Metformin should be continued while on insulin therapy unless contraindicated or intolerant.
2. Sulphonylureas (SUs)/meglitinides should be discontinued once bolus insulin is used regularly with meals.
3. Insulin dose should be optimised prior to switching/intensifying regimens.
4. Steps to intensify/deintensify is as the algorithm above. However, multi-step changes (i.e. skipping step/s) may be considered on discretion.
5. Self-monitoring of blood glucose (SMBG) is required for all patients initiating insulin.

(Adapted with modification from Practical Guide to Insulin Therapy in Type 2 Diabetes Mellitus 2024)

2.2 Non-Insulin Injectables

Non-insulin injectable medications for diabetes have been available since the mid-2000s. These are formulations containing agonists or analogues of single or multiple pancreatic and gut hormones that may enhance endogenous insulin secretion as well as additional mechanisms such as slowing gastric emptying and affecting appetite and satiety control to reduce food intake. The most commonly prescribed are GLP1-receptor agonists. Dual agonists of GLP-1 and Gastric Inhibitory Polypeptide (GIP) are now available in some countries. Earlier formulations require daily injections but have been largely replaced by once weekly injections and are available in pre-filled pen devices.

These non-insulin injectables are recommended and preferred as first-line injectable therapies in people with Type 2 diabetes with obesity, cardiovascular disease, chronic kidney disease and metabolic dysfunction-associated steatotic liver disease (MASLD). However, availability and accessibility are limited mainly due to high cost. Refer to Table 2.3 for the currently available injectable GLP1 Receptor Agonists.

Table 2.4: Currently Available Injectable GLP1 Receptor Agonists

Generic Name	Brand Name	Dosing Frequency	FDA Approval	Dose Range
Liraglutide	Victoza®	Once daily	2010	0.6 - 1.8 mg
Liraglutide	Saxenda®	Once daily	2014	0.6 - 3.0 mg
Dulaglutide	Trulicity®	Once weekly	2014	0.75, 1.5 mg
Semaglutide	Ozempic®	Once weekly	2017	0.5 - 1.0mg
Semaglutide	Wegovy®	Once weekly	2021	0.5 - 2.4 mg
Tirzepatide	Mounjaro®	Once weekly	2022	2.5 - 15mg
Tirzepatide	Zepbound®	Once weekly	2023	2.5 - 15 mg

Note: Zepbound is indicated for weight loss in those without diabetes.

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THERAPEUTIC EDUCATION

Key Messages:

1. Address psychological and functional barriers proactively to improve injectable therapy adherence.
2. Shared decision-making and thorough initial education are fundamental for successful injectable therapy initiation and adherence.
3. Continuous assessment, reinforcement, and problem-solving are vital for long-term injectable therapy adherence and optimal outcomes.

Many individuals with diabetes fear starting insulin or injectable therapy due to misconceptions, psychological barriers, fear of side effects, and lack of self-efficacy. To reduce this fear, healthcare professionals (HCPs) should explain the role of insulin early in the course of diabetes management beginning at diagnosis and reinforce this understanding regularly.

Globally, 25% - 79% of insulin-naïve individuals with Type 2 diabetes refuse or reject insulin.^{1,2} One study showed that people with Type 2 diabetes may delay insulin therapy by about 790 days after it's recommended.³

Shared decision-making between HCPs, individuals with diabetes, and caregivers is crucial for starting injectable therapy. The 'Ottawa Personal Decision Guide' can aid this process ⁴ [Ottawa Personal Decision Guide \(ohri.ca\)](https://ohri.ca/ottawapersonaldecisionguide/).

3.1 Initial Education

3.1.1 Assessment

Assessments for initiating insulin/injectables should include:

- **Psychological:** Address anxieties and barriers to injectable therapy. Discuss fear of pain and management strategies (e.g., pen devices, smaller needles). Distraction, play therapy, or Cognitive Behavioural Therapy may help younger children.
- **Functionality:** Evaluate physical and cognitive ability (e.g., dexterity, vision, literacy) for self-administration or need for caregiver assistance.
- **Clinical:** Assess diabetes type, management skills, and presence of complications or hypoglycaemia.
- **Psychosocial:** Check insulin storage conditions. Assess living conditions for those needing caregiver assistance (e.g., disability, young, older adults) and work environment for those needing multiple daily injections.

3.1.2 Goal Setting

Initiate and adhere to prescribed insulin treatment.

3.1.3 Planning

Develop a shared action plan. Identify suitable regimens based on lifestyle and resources for supplies, considering the individual's location.

3.1.4 Implementation

Before insulin initiation:

- Educate on diabetes, insulin's role, disease progression, and the importance of a healthy lifestyle.
- Delivery Device Choices - Involve individuals/caregivers in decisions about devices, addressing preferences, concerns, and barriers.

At Insulin initiation:

- Explain insulin is the treatment for people with Type 1 diabetes. For people with Type 2 diabetes, explain the need for insulin/injectables as a natural progression, not a personal failure, and that oral therapy may become inadequate.

Explain the prescribed treatment regimen:

- Demonstrate and teach correct injection techniques and site rotation.
- Educate on early warning signs of faulty technique/devices (e.g., lipohypertrophy, leakage, bruising, pain).
- Guide on monitoring devices and glycaemic management, including reporting abnormalities and target ranges.
- Use simulated tools or videos, and provide verbal/written instructions tailored to literacy, numeracy, and culture.
- Assess understanding using the teach-back method.⁵

3.1.5 Special Topics:

- Hypoglycaemia: Review signs and symptoms, causes, prevention, and treatment with Rule of 15. Discuss when to seek help including hypoglycaemia management.
- Driving Safely
- Travel
- Ramadan
- Sick day management

3.2 Follow-up Visits:

- Assess adherence, address barriers, and problem-solve collaboratively (Refer Table 3.1).
- Examine injection sites, review techniques, and check for issues like lipohypertrophy.
- Evaluate hypoglycaemia and self-care.
- Review glucose records.
- Reinforce education and document discussions.

Table 3.1: Barriers to Insulin Therapy and Suggested Solutions.⁶

Barriers	Suggested Solutions
Poor understanding of diabetes and its complications as well as role of insulin	<ul style="list-style-type: none"> • Provide comprehensive education. • Explain reduction of risk for complications with better glycaemic control. • Explain the role of insulin in glucose regulation.
Seeing insulin therapy as treatment failure	<ul style="list-style-type: none"> • Explain that most people with Type 2 diabetes and pancreatogenic diabetes, their insulin production decreases with disease progression. For gestational diabetes, insulin resistance increases with progression of gestation. Hence people with Type 2 diabetes, pancreatogenic diabetes and gestational diabetes will eventually need insulin to keep their blood glucose controlled.
Fear of needles or injections	<ul style="list-style-type: none"> • Provide reassurance that today's needles are finer and are coated with silicon, allowing smoother insertion. • Most people find injections almost painless and even less uncomfortable than a finger prick for blood glucose monitoring. • Use trial injection.
Fear of side-effects of insulin (hypoglycaemia and weight gain)	<ul style="list-style-type: none"> • Provide education on how to prevent, recognize and treat hypoglycaemia. • Refer to pharmacists or diabetes educators before starting insulin.

Barriers	Suggested Solutions
Lifelong medications /change in lifestyle	<ul style="list-style-type: none"> Reassure people with diabetes that achieving good glucose control after starting insulin often leads to improved energy levels and an overall better sense of well-being.

(Malaysian Diabetes Education Manual 2024)

3.2.1 Long-term Follow-up:

- Monitor injection technique.
- Optimise treatment and glycaemic targets.
- Address questions and concerns.

3.3 Evaluation

- At initial education, ask the person with diabetes to perform a return demonstration of the insulin injection technique (Refer Section 4).
- On follow-up, periodic return demonstration of insulin injection technique using the person with diabetes own devices to identify issues.
- Adherence to treatment should be assessed on every follow-up visit. An example of insulin adherence tool is Malaysian Medication Adherence Tool (myMAAT questionnaire).⁷

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INJECTION TECHNIQUE

Key Messages:

1. Read the label to ensure withdrawing the correct formulation prescribed. Check for the expiry date and inspect insulin discoloration or the formation of clumps before injection.
2. Safety pen needles with dual automatic protective shields in both ends of needles are recommended in hospital/clinical setting by healthcare professionals to minimise risk of accidental needle stick injury.

For people with diabetes, injection therapy can be insulin or non-insulin injectables such as GLP-1 receptor agonists. Proper injection technique is vital to avoid intradermal or intramuscular injections and ensure appropriate delivery to the subcutaneous tissue.

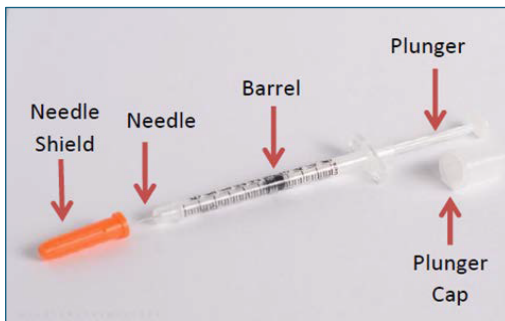
4.1 Insulin Injection

There are various ways to administer insulin, including syringes, insulin pens, insulin pumps, needle-free insulin injection systems and inhaled insulin. Insulin pens are the primary injecting device used by the majority of people with diabetes in Malaysia. However, syringes are still commonly used in healthcare facilities, particularly for inpatient administration.

4.1.1 Insulin Syringe and Vial


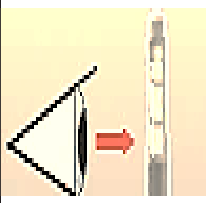
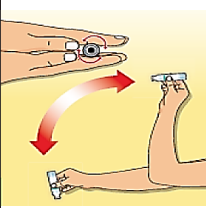
- Insulin syringes (Figure 4.1) are mostly used by healthcare professionals in Malaysia. Before injecting, choose the right size of insulin syringe (volume U-100 is widely used in our local healthcare setting) and the length of the needle. A 6 mm and 8 mm needle length of insulin syringe are recommended over a 12.7 mm syringe due to a lower risk of intramuscular injection.






Figure 4.1: Component of an Insulin Syringe

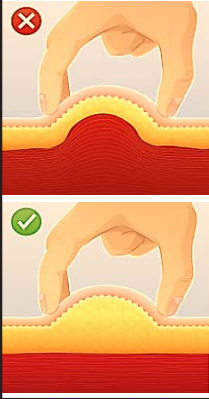
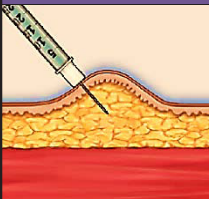



- A 6 mm syringe needle is generally considered anatomically suitable for most adults and adolescents with diabetes. For individuals with a BMI between 19 and 25 kg/m², a 90-degree injection angle combined with a skin-fold technique is necessary to reduce the risk of intramuscular injection. However, these syringe needles are not recommended for individuals with minimal subcutaneous fat (BMI <19 kg/m²) or children under 6 years old, as the risk of intramuscular injection remains high even when proper technique is applied.
- Before injecting insulin, an insulin vial should be taken out of the refrigerator 30 minutes prior to injection to ensure insulin is at room temperature. Table 4.1 shows the steps of injecting insulin using vial and insulin syringe.

Table 4.1: Steps of Injecting Insulin Using Vial and Insulin Syringe

<p>Step 1</p> 	<ul style="list-style-type: none"> • Wash hands before handling insulin syringe and vial.
<p>Step 2</p> 	<ul style="list-style-type: none"> • Read the label to ensure withdrawing of the correct insulin (formulation) prescribed. Check for the expiry date and inspect insulin discoloration or the formation of clumps.
<p>Step 3</p> 	<ul style="list-style-type: none"> • Roll insulin vial between hands if the insulin has just been removed from the refrigerator. Skip this step if insulin is already at room temperature. • For cloudy insulin (e.g. NPH and premixed insulin), gently roll the vial 10 times and invert it 10 times until it becomes evenly milky white. • Do not shake the vial vigorously, it may cause bubble formation and reduce the dose accuracy.^{1,2}

<p>Step 4</p> 	<ul style="list-style-type: none">• Wipe the top of the insulin bottle/vial with an alcohol swab.
<p>Step 5</p> 	<ul style="list-style-type: none">• Remove the cap of the plunger and the needle.• Pull the plunger backward to draw enough air that equals the prescribed dose of insulin into the insulin syringe.
<p>Step 6</p> 	<ul style="list-style-type: none">• Insert a needle at 90 degrees into the rubber stopper of the insulin vial.• Press down the plunger to inject the air into the vial.
<p>Step 7</p> 	<ul style="list-style-type: none">• Overturn the vial upside down.• Pull the plunger backward to fill the insulin syringe to the required dose with an additional 1 unit.
<p>Step 8</p> 	<ul style="list-style-type: none">• Remove the needle from the vial in a straight/vertical motion.• With the needle pointing upward, tap the barrel to release any bubbles, then gently push the plunger to expel them. Ensure the insulin dose is correct and that no air bubbles remain.

<p>Step 9</p> 	<ul style="list-style-type: none"> • Clean the site of injection with an alcohol swab, wait until the alcohol completely dry before injection.^{3,4,5,6} • Gently pinch up the skin between thumb and index finger.
<p>Step 10</p> 	<ul style="list-style-type: none"> • Inject needle at 45 degrees if needle length is $\geq 8\text{mm}$.⁷ • Inject needle at 90 degrees if needle length is $< 8\text{mm}$. • Push plunger forward until the insulin is completely injected. • Remove the insulin syringe followed by releasing the pinch. • For people with diabetes on anticoagulants, apply pressure after withdrawing the needle from skin.
<p>Step 11</p> 	<ul style="list-style-type: none"> • Dispose the insulin syringe into a sharp disposal container (hospital setting) or puncture-proof container (home based user). Refer to Section 7 for needle disposal. • Insulin syringes should be used only once.^{8,9}

4.1.2 Insulin Pen and Needles

- Insulin pen devices or injectors are the common ways to administer insulin. The pens can be disposable (pre-filled pen) or reusable (refill pen). Both pens consist of three components (Figure 4.2):
 - a) Built-in-dial (dosage knob) is for the user to dial the required insulin dose.
 - b) The cartridge holder is for holding the insulin cartridge.
 - c) Pen needle is to be attached at the end of the cartridge holder.

- For disposable (pre-filled) pens, the built-in-dial and the cartridge holder are fused, whereas for reusable (refill pens) these parts need to be assembled separately.
- Safety pen needles (Figure 4.3) with dual automatic protective shields in both ends of needles are available in Malaysia and mostly used in hospital/clinical setting by healthcare professionals.

Figure 4.2: Components of Insulin Pen Devices

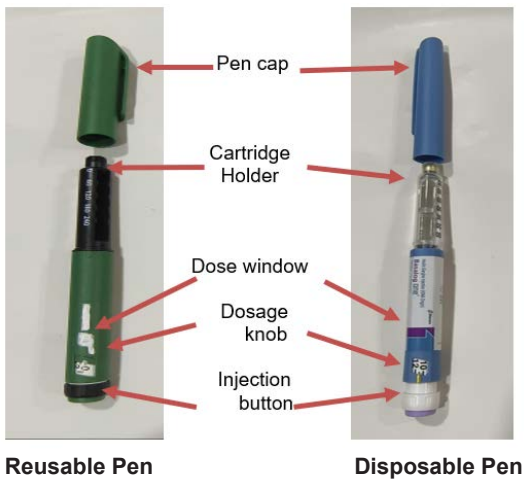
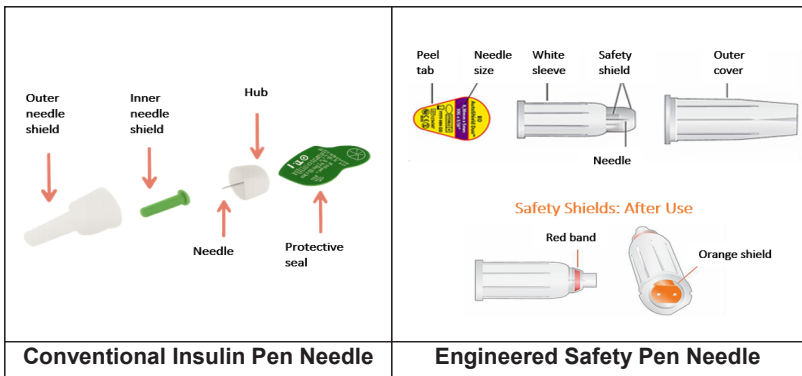







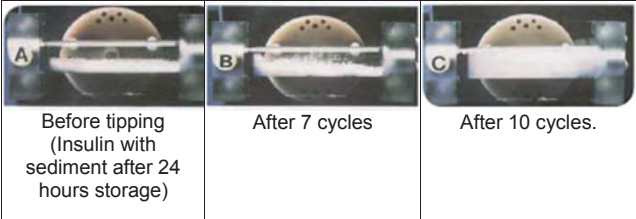


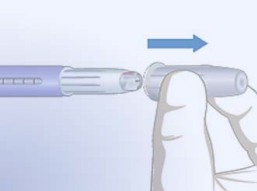
Figure 4.3: Components of Insulin Pen Needle


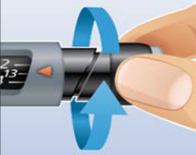
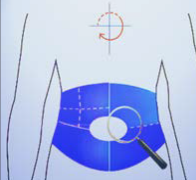








- Administration using pen devices is preferred compared to insulin syringes because of the benefits of accuracy, convenience and improved confidence level of the users. Table 4.2 shows the steps of the injection procedure using an insulin pen device.

Table 4.2: Steps of Injecting Insulin Using Insulin Pen Devices

<p>Step 1</p> 	<ul style="list-style-type: none"> Wash hands before handling insulin pen devices.
<p>Step 2</p> 	<ul style="list-style-type: none"> Read the label to ensure injecting the correct insulin (formulation) prescribed. Check for the expiry date and inspect insulin discoloration or formation of clumps.
<p>Step 3</p> 	<ul style="list-style-type: none"> Roll the insulin pen between palms if the pen is newly removed from the refrigerator. Skip this step if the insulin is at the room temperature.
<p>Step 4</p> 	<ul style="list-style-type: none"> Re-suspend cloudy insulin (e.g. NPH or premixed) by gently tipping the pen up and down about 10 times or until the insulin appears uniformly milky. Avoid vigorous shaking, because it causes bubbles formation and reduces the dose accuracy.

<p>Step 5</p> 	<ul style="list-style-type: none"> • Always double check the consistency, as inadequate re-suspension can lead to dose variation and unpredictable clinical responses. • Cloudy insulin (e.g. NPH and premixed insulin) must be re-suspended prior to each injection to ensure the suspension has a consistently milky white appearance (Figure 4.4).^{1,2,10.} • For clear insulin, skip Step 4 and 5. <p>Figure 4.4: Suspension of NPH Insulin Before and After Electronic Tipping to 180° (one cycle).</p> 	
<p>Step 6</p> 	<ul style="list-style-type: none"> • Attach a needle to an insulin pen device. • It is recommended to use a new needle for each injection to reduce the risk of needle breakage, needle clog, needle contamination causing abscess formation and lipohypertrophy formation resulting in poor insulin absorption.^{8,11.} 	
<p>Step 7</p>	<p>Step 7A</p>  <p>For conventional pen needle:</p> <ul style="list-style-type: none"> • Remove outer and inner needle shield. Discard inner needle shield and keep the outer needle shield. 	<p>Step 7B</p>  <p>For safety pen needle:</p> <ul style="list-style-type: none"> • Pull ONLY the outer cover straight off.

<p>Step 8</p> 	<ul style="list-style-type: none"> • Prime insulin pen device with the needle pointing upwards. • Watch for at least a drop of insulin to appear at the tip of the needle. 	
<p>Step 9</p> 	<ul style="list-style-type: none"> • Dial the required dose. • Listen to the “click” sound for people with poor vision. 	
<p>Step 10</p> 	<ul style="list-style-type: none"> • Identify an injection site: abdomen, thighs, buttocks or back of arms • Avoid these areas: stretch marks, scars, tattoos, skin lesions as their impact on altering insulin absorption is unknown. • Avoid skin areas that show signs of oedema, infection, inflammation or ulcerations. 	
<p>Step 11</p>	<p>Step 11A</p>  <p>For conventional pen needle:</p> <ul style="list-style-type: none"> • Insert needle into the skin at 90-degree, push the dose button completely. 	<p>Step 11B</p>  <p>For safety pen needle:</p> <ul style="list-style-type: none"> • Apply a firm constant pressure to keep the needle shield tip touching the skin until the injection is completed. Light pressure will release the needle shield and lock the needle.

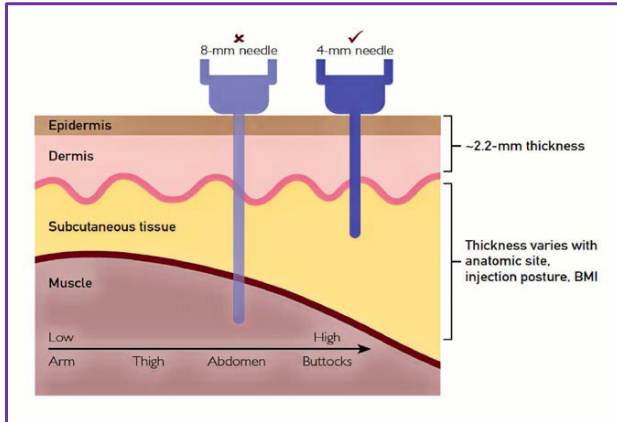
<p>Step 12</p> 	<ul style="list-style-type: none"> • Count to 10 secs before withdrawing the needle from the skin. Counting more than 10 secs may be necessary for higher volume of insulin doses.¹² This is to ensure full dose is delivered and prevent insulin leakage. • Avoid rubbing the injection site. • For people with diabetes on anticoagulants, apply pressure after withdrawing the needle from skin.
<p>Step 13</p> 	<ul style="list-style-type: none"> • To discard pen needle: <ul style="list-style-type: none"> - Option 1: use a needle clipping device.  <ul style="list-style-type: none"> - Option 2: Cover the exposed needle using scooping technique (Figure 4.5), unscrew or dislodge it, then dispose into a sharp bin (hospital setting) or puncture-proof container (home based user). <p>Figure 4.5: Scooping technique</p>  <ul style="list-style-type: none"> • For Safety Pen Needle: <ul style="list-style-type: none"> - the inner shield will automatically deploy and lock in place. Unscrew the needle from the pen and discard it into a sharp disposal container. • Always remove the needle after each use. Leaving the needle attached can cause insulin leakage and allow air or contaminants to enter the cartridge, potentially affecting dose accuracy.¹³

4.2 Non-insulin Injectable Therapy

- Non-insulin injectable therapies (e.g. GLP-1 RA or Co-formulations of GLP-1 RA and insulin) are available with different designs of pen devices, which may be disposable or reusable depending on the product. Single dose/single use prefilled pens that come with a pre-attached needle differ from multi-doses/reusable prefilled pens. Both pen devices are administered subcutaneously, just like insulin administration.
- Non-insulin injectable therapy should adhere to the same guidelines as insulin injections in terms of pen needle length, injection site selection, and site rotation practices. Although the risk of lipohypertrophy is lower with non-insulin injectables than with insulin, subcutaneous nodules have been reported, particularly with once-weekly GLP-1 RA such as exenatide and semaglutide.¹⁴
- The recommended needle length is the same as that required to deliver a subcutaneous injection of insulin, except for single dose/single use prefilled pen, which has its own specific needle devices.
- Recommended sites for injection are the abdomen, thigh and arms, however, the same principles apply for reducing the risk of intramuscular injection as they do for insulin injections. GLP-1 agents may be injected at any of the usual injection sites as the pharmacokinetics do not appear to be site-specific.
- The injection technique for multi-dose prefilled pen devices is similar to insulin pen devices. The main practical difference of the injection technique is the priming part as priming is only required once before the first injection of each new pen as per specific product manufacturer's recommendations. No priming is required for single dose/single use prefilled pen devices.

4.3 Needle Length, Gauge and Injection Angle

- The choice of needle length should be appropriate for adults, adolescents and children to ensure that the insulin and non-insulin injectables (e.g. GLP-1 RA) are administered into the subcutaneous layer and preventing the intradermal and intramuscular injections.¹
- A 4 mm pen needle is effective for insulin delivery across a range of BMIs and is generally suitable for both adults and children with diabetes. When inserted at a 90-degree angle to the skin surface, a 4 mm needle is long enough to penetrate the skin and enter the subcutaneous tissue while minimizing the risk of intramuscular injection (Figure 4.6).^{13,14}
- If 4 mm pen needles are unavailable, 5 mm needles can serve as a suitable alternative. In adults, injections with these shorter needles should be done at a 90 degree to the skin surface. Longer pen needle lengths of 6 to 8 mm should be discouraged for individuals with minimal subcutaneous fat (BMI <19 kg/m²) or children under 6 years old due to the increased risk of intramuscular injection.¹⁴

Figure 4.6: Skin Layer ¹⁴

- Ultrasound and other research technologies have shown that the subcutaneous fat layer may vary within a particular anatomical area, e.g. the abdomen.¹⁰ The use of a 4 mm needle minimizes the potential for intramuscular injection and allows individuals to use a larger area for injection, i.e. a postcard-size area as opposed to a postage stamp-sized area.²
- The pen needle lengths available in Malaysia are 3.5 mm, 4 mm, 5 mm, 6 mm and 8 mm with different gauge (G) as shown in Table 4.3.

Table 4.3: Pen Needle Lengths available in Malaysia

3.5 mm	4 mm	5 mm	6 mm	8 mm
34G	32G 32.5G 33G 34G*	31G 32G	31G 32G 32.5G	31G 32.5G

*Not available in Malaysia yet

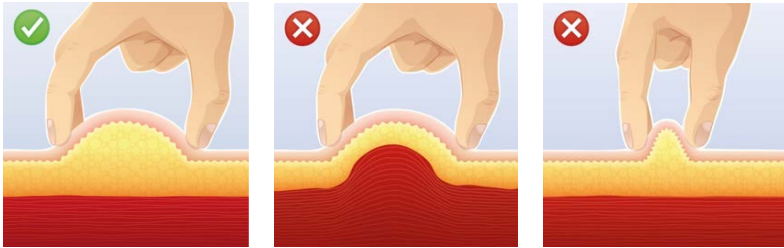
- Shorter pen needles (4, 5, 6 mm) provide equal efficacy and safety as compared to longer ones (8 mm), even in obese individual, without an increase of leakage.⁸

- It is well established that the subcutaneous adipose tissue layer varies with BMI, making individuals with lower body fat, such as those with low BMI, older adults, or pregnant women, more susceptible to intramuscular injection. In such cases, the skinfold or "pinch-up" technique at standard injection sites may be necessary to ensure adequate subcutaneous delivery.¹⁴
- Some countries are beginning to introduce 3.5 mm pen needles as an alternative, with early research suggesting they are non-inferior to 4 mm needles. However, current 3.5 mm options typically have a high gauge (34G; see Table 4.3), which has been associated with reports of requiring greater manual force during injection.
- Shorter and finer-gauge needles reduce pain. Compared with the traditional 3-bevel syringe and needle tip, the 5-bevel needle tip has less penetration force in a skin hence provides more comfort and easier to insert.^{3,4,5}
- While higher-gauge needles are less painful and may cause less fear of injection, they can be more prone to bending or breaking. Current evidence suggests that 32G reduces pain without being too fragile.¹⁴

4.4 Lifted Skin folds

- The lifted skin fold should not be squeezed so tightly that it causes skin blanching or pain.
- The optimal sequence should be:
 - Make a lifted skin fold. Only the thumb, index finger and middle finger should be used.
 - Insert needle into skin at 90°.
 - Administer therapy.
 - Leave the needle in the skin for at least 10 seconds after the dose button is fully depressed.
 - Withdraw the needle from the skin.
 - Release lifted skin fold.⁶
 - Dispose of used needles safely.
- A proper skin-fold technique should take up skin and subcutaneous tissue only, leaving muscle behind (Figure 4.7).

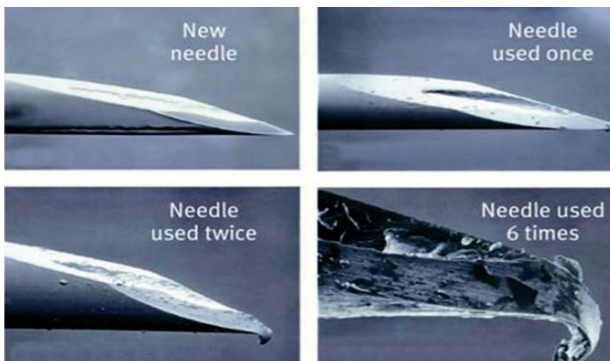
Figure 4.7: Correct and Incorrect Technique of Performing Skin Fold



4.5 Needle Reuse

- Pen needles and syringes should be used only once. Figure 4.8 shows reused needle damages the tip of the needle.^{2,7,9}
- Reused needles and syringes may cause pain, bleeding or bruising on injection sites and also may cause the insulin in the barrel to crystallize and block the flow during the next injection.
- There is a probable association between needle reuse and the presence of lipohypertrophy, although a direct causal relationship has not been proven.
- Reusing pen needles and syringes is not an optimal injection practice. People with diabetes should be discouraged from doing so. Single-use needles are highly recommended to reduce the risk of lipohypertrophy.
- Needles should be disposed of immediately after use. It should not leave attached to the pen. This allows the entry of air or other contaminants into the cartridge, or leakage of insulin from the cartridge, which can affect subsequent dose accuracy.¹⁵

Figure 4.8: Comparing the Tips of New and Reused Needles



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INJECTION SITES

Key Messages:

1. Insulin and other injectable agents should be administered into subcutaneous layer, with the abdomen and thighs preferred for self-injection due to accessibility and consistent absorption.
2. Systematic rotation of injection sites, with at least 1 cm spacing between injections, is essential to prevent lipohypertrophy and maintain stable absorption profiles.

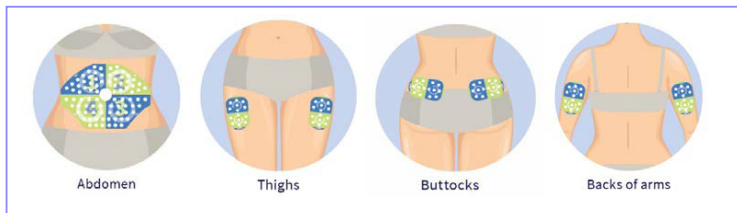
Besides proper injection technique, education should also cover inspection of injection sites and highlight the importance of site rotation for optimal glycaemic control. Correct technique, including regular needle changes and site rotation, is a cost-effective approach to improving HbA1c and reducing insulin requirements by preventing lipohypertrophy.¹ The subcutaneous tissue has a relatively poor blood supply, which slows the absorption of injected medicines and contributes to a more consistent absorption rate.²

As a result, insulin and non-insulin injectable therapies should be injected into the subcutaneous layer in the abdomen, buttocks, and thighs for self-administering or arms and buttocks if given by caregivers.

5.1 Injection Sites Selection

The Figure 5.1 below shows the current recommendation on insulin injection sites.

Figure 5.1: Insulin Injection Sites



For ease of self-injection, the **abdomen** and **thighs** are the two main recommended injection site for adults.²

- **Abdominal:** Abdominal sites are within the following boundaries:
 - 1cm above symphysis pubis.
 - 1cm below the lowest rib.

- 1 cm away from umbilicus and laterally at the flanks.²
- **Thighs** – use the upper 3rd anterior lateral aspect.
- The posterior lateral aspect of both upper buttocks and flanks, will need a caregiver to give the injection correctly.
- Arm – mid 3rd posterior aspect of upper arm. In view of the difficulty in accessing the correct zone, difficulty in injecting at 90 degree and lessened thickness of subcutaneous fat which are the potential risk factors that may cause intramuscular injection. It is not a preferable site for self-injection and requires the assistance of caregivers.

5.2 Rotation of Injection Sites

- Individuals with diabetes should be educated on the importance of injection site rotation shown in Figure 5.2 to prevent lipohypertrophy and ensure consistency of insulin and non-insulin absorption.^{2,3,4,5}
- The pattern of site rotation that has been shown to be effective involves dividing the injection site into quadrants (or halves when using thighs and buttocks).
- Injection sites rotation within any quadrant should be done systematically (e.g. use one quadrant per week) and rotate quadrant to quadrant in a consistent direction (e.g. clockwise).²
- Within the chosen quadrant, move to a new spot for each injection, spacing at least 1cm apart or one finger width away from the last injection in order to prevent repeat tissue trauma.³
- If a specific area becomes tender, bruised, or develops lipodystrophy, it is advised to avoid that area entirely for a few weeks to allow it to heal.

Figure 5.2: Systemic Rotation Within the Recommended Injection Site



5.3 Insulin Absorption

Optimal absorption of insulin depends on injection into subcutaneous tissue. The absorption rate can be affected by various factors such as type of insulin, volume

of insulin administered [NPH and short-acting (regular) human insulins]^{6,7}, insulin storage, skin temperature, site of injection and exercising.

5.3.1 Factors Affecting Absorption Rates

- **Type of insulin**

- Insulin type affects rate of absorption from the injection site. Rapid and short-acting insulin are absorbed faster than intermediate and long-acting insulin.

- **Site of Insulin Injection**

- Insulin absorption is fastest and most consistent when injected into the abdomen due to its larger overall blood circulation and higher body heat⁶, followed by a moderate absorption rate in the upper arm and lateral thigh. The slowest rate of absorption is at the posterior lateral aspects of the buttock area.² Rotation of injection sites within the selected area is crucial to ensure optimal and consistent insulin absorption. However, insulin absorption also differs based on the type of insulin, as shown in Table 5.1.
- Injecting through clothing is not commonly practiced by people with diabetes, especially in a hurry or public place. However, this practice is discouraged as the person cannot inspect the site, or properly use a lifted skin fold if required. Further, the advent of shorter needles means that the injection may not penetrate the skin sufficiently for the correct administration of medicine into the subcutaneous tissue.^{2,5}

Table 5.1: Type of Insulin, Injection Site and Absorption Rate

Prandial Insulin	Basal Insulin	Premixed Insulin
<p>Short Acting, Regular:</p> <ul style="list-style-type: none"> - Abdomen preferred due to fastest absorption rate.^{2,8} 	<p>Intermediate Acting, NPH:</p> <ul style="list-style-type: none"> - Thigh and buttocks preferred due to slowest absorption rate.² 	<p>Human or analogue</p> <p>Morning dose:</p> <ul style="list-style-type: none"> - Abdomen preferred to increase speed of absorption to cover post-breakfast glycaemic excursion.²

Prandial Insulin	Basal Insulin	Premixed Insulin
<p>Rapid Analogue:</p> <ul style="list-style-type: none"> May be given at any of the recommended sites of injection, absorption rates do not appear to be site specific.^{9,10} 	<p>Long-Acting Analogue:</p> <ul style="list-style-type: none"> May be given at any of the recommended sites of injection, absorption rates do not appear to be site specific.^{9,10} 	<p>Human or analogue</p> <p>Evening dose:</p> <ul style="list-style-type: none"> Preferred in the thigh or buttock to slower absorption and to lower the risk of nocturnal hypoglycaemia for high-risk individuals.²

5.3.2 Other Factors Affecting Absorption Rates

- **Insulin injection volume**

Variability in (human) insulin absorption is increased and net absorption is decreased as the volume of (human) insulin in a single injection increase.^{2,4,6,7,11} For individuals with significant insulin resistance who are using large doses of (human) insulin, smaller injections given multiple times per day may help decrease the variability in absorption. It may therefore be desirable to divide large doses into smaller doses once the (human) insulin dose reaches over 50 units (0.5ml).^{2,7} Using concentrated insulin products is another approach that can be used to decrease injection volume.^{2,6}

- **Insulin concentration**

Lower insulin concentrations are associated with faster absorption.⁴

- **Intramuscular (IM) injection**

IM injection may accelerate the absorption rate of insulin, which is more evident during exercise. Accidental IM injection may contribute to variability in insulin pharmacokinetics, particularly in lean individuals. Proper site selection and injection technique can help prevent this.⁴

- **Blood flow**

Practices that increase regional blood flow, such as exercise, local massage or friction, hot showers, or soaks and saunas, can accelerate insulin absorption and thus alter insulin action.⁶

- **Exercise**

Insulin absorption can be increased with exercise, with the location and depth of the injection being contributing factors.

Injecting insulin into an exercising limb can lead to faster absorption.

Glargine is not affected by exercise.⁴

- **Temperature**

Insulin absorption is increased by local or ambient heating due to the increased subcutaneous vasodilation and blood flow to the injection site, causing the insulin to be absorbed more rapidly in both pump and injection therapy.^{9,11}

Exposure to a cold environment has the opposite effect.¹¹

- **Lipohypertrophy**

Lipohypertrophy significantly delays insulin absorption^{4,11}, increases glycaemic variability and unexplained hypoglycaemic episodes.⁶

- **Obesity**

Increased subcutaneous fat delays insulin absorption due to a reduction in subcutaneous blood flow.^{4,12}

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MEDICATION STORAGE

Key Messages:

1. Insulin exposed to freezing, direct heat, or sunlight may lose potency. It should be discarded if is frozen or if signs of clumping, discoloration, precipitation, or poor re-suspension are observed.
2. Children and adolescents with diabetes need proper medication storage at school or child care centre, particularly in hot weather, in order to maintain insulin efficacy throughout the day.

Proper storage of insulin and non-insulin injectable therapies is important to ensure the potency and effectiveness of the medication. Educate users and caregivers on the importance of proper medication storage at initial treatment and reinforced periodically as needed.

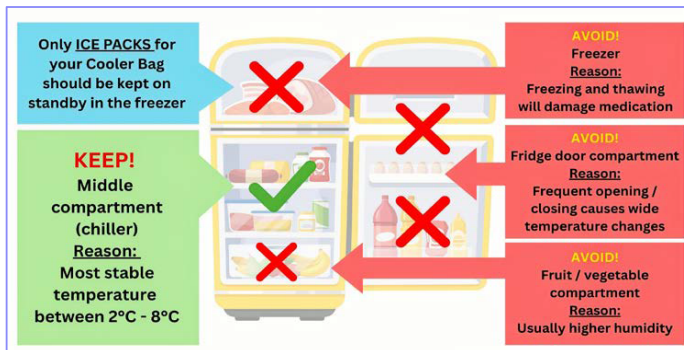
6.1 Injection Storage

6.1.1 Ideal Injection Storage

Unopened injectable medications (refer Figure 6.1)

- Should be stored at refrigeration temperature between 2°C-8°C (Check the storage instructions as per manufacturer may differ).
- Insulin or non-insulin injectable medications should never be frozen or exposed to extreme heat for prolonged periods; it will affect its potency and action.

Figure 6.1: Insulin Storage in the Refrigerator ¹



(Department of Pharmacy UMMC, 2025)

- In places where a refrigerator is not available, it is recommended to liaise with the nearest health facility for the storage of unopened insulin.²
- Avoid extremes of temperature such as: direct sunlight, kitchen, closed cars, top of a radiator or a television.

In-use injectable medication

- In-use injectable medication shall be stored at room temperature (<30°C) except Soliqua (<25°C) (refer to Table 6.1 for the manufacturer's recommendation).

6.1.2 Recommended Injection Storage

- Refer Table 6.1 for the manufacturer's recommendation.
- Write the date opened on the injectable medications to keep track of the date (Recommended practice for institution or hospital).

Table 6.1: Manufacturer Recommendation on Injectable Medication Stability

Product Name	Expiration		
	Upon Opening or Removing from Refrigerator (< 30C)*	Unopened (Cold Chain Maintained)	
Bolus Insulin			
Actrapid ®	42 days	Until expiration date stamp	
Humulin R ® (vial)	28 days		
Insugen-R ®	42 days		
Apidra ®	28 days		
Fiasp ®	28 days		
Humalog ®	28 days		
NovoRapid ®	28 days		
Basal Insulin			
Humulin N ® (vial)	28 days		
Insulatard ®	42 days		
Insugen-N ®	42 days		
Basalog ®	28 days		
Lantus ®	28 days		
Levemir ®	42 days		
Toujeo ®300	42 days		
*Tresiba ®	56 days		
<i>Once Tresiba is opened, it may be stored in the refrigerator or at room temperature below 30°C</i>			

Product Name	Expiration		
	Upon Opening or Removing from Refrigerator (< 30C)*	Unopened (Cold Chain Maintained)	
Premixed			
Humulin 30/70 ® (vial)	28 days	Until expiration date stamp	
Insugen-30/70 ®	42 days		
Mixtard 30/70 ®	42 days		
NovoMix 30 ®	28 days		
Humalog Mix 25 ®	28 days		
Humalog Mix 50®	28 days		
Co-formulation			
Ryzodeg ®	28 days		
Soliqua ®	28 days		
Kirsty ®	28 days		
Xultophy ®	21 days		
Non-insulin injectables			
Trulicity ®	14days		
Victoza ®	30 days		
Ozempic ®	56 days		

* For opened/in-used insulin/pens, always check the manufacturer's product insert, as some products allowed to refrigerate, while some do not.

6.1.3 Quality Considerations

- Insulin can degrade more rapidly when shaken or agitated, especially as the insulin volume decreases. This increased exposure to air and surface contact may compromise insulin stability.³
- Insulin should be discarded if it has been frozen or if there is any evidence of clumping, frosting, discoloration, precipitation or when uniform re-suspension cannot be achieved.^{1,3,4}

6.1.4 Student with Diabetes

- The majority of young people with diabetes spend many hours at school and/or in some type of child care programme. Trained and knowledgeable staff are essential to provide a safe school and child care environment for children with diabetes.⁵
- Young people and their caregivers should be aware of the importance of optimal storage to maintain potency of their insulin, in particular the avoidance of exposure to high temperatures (e.g., pumps left in the sun when disconnected, insulin stored in a car glove compartment).³

- In hot weather, insulin that needs to be administered before the school meal or snack (and glucagon, if available) should be stored in a refrigerator or a cooling bag kept in the child's school bag. The child should always carry a "hypo kit", containing a sugary drink, a snack to be taken after treating hypoglycaemia, and glucometer with test strips, especially if blood glucose levels are not routinely monitored before insulin administration. These arrangements should be outlined in a written, individualised care plan developed in collaboration with child's caregivers, healthcare team and school staff to ensure consistent and safe diabetes management during school hours.⁶

6.2 Injection Storage During Travel

6.2.1 Travel: On Land

- Insulin should be stored in a proper container.
- Insulin can be transported and stored wrapped in plastic, in a thermos flask, along with 3–4 cubes of ice, which are replaced when they melt.⁶
- There are several products (bags or cases) on the market for protecting insulin pens and vials from heat, although their performance has not been studied. When using ice packs insulin pens or vials should never be kept directly on ice to avoid freezing.³
- Insulin should never be kept in the glove compartment of a car, or left in a locked car.⁷

6.2.2 Travel: Air

- Insulin should be stored in a proper container in a personal bag or hand luggage.
- Insulin should not be stored in the check-in baggage hold of the plane due to the risk of exposure to extreme temperatures.⁷ Any insulin in this luggage may lose its potency.¹
- Carry extra insulin pen or vial with a prescription for any unforeseen circumstances that may occur.^{1,8}

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SAFETY INITIATIVE

Key Messages:

1. Ensure safe injection practices by using shorter pen needle or safety pen needle only once, and maintain proper hand hygiene and injection site cleanliness.
2. Cultivate a safety-first culture within institutions through ongoing education, proper reporting systems, and adherence to best practices in sharps handling.

Safe administration of insulin and other injectables requires proper use of pen needles or syringes by both healthcare professionals (HCPs) and people with diabetes. This section aims to promote the safe handling and disposal of sharps to reduce needle stick injuries (NSIs) and blood-borne infections, emphasising education, risk awareness, and best practices to build a strong safety culture in diabetes care.

7.1 Safe Injection Practices

Sharp devices pose a risk for the transmission of blood-borne pathogens such as Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Immunodeficiency virus (HIV) in the event of NSI or blood exposure. The following good practice is essential to minimize these risks and ensure the safety of all individuals involved.

- Enforce a strict one-patient/one-pen policy in all healthcare settings.¹
- Use pen needles or insulin syringes only once to avoid needle breakage, clogging, lipohypertrophy, abscess, and inaccurate dosing.²
- Practice strict hand hygiene and ensure clean injection sites to prevent or minimize cross infections.
- Disinfect injection sites using 60%-70% alcohol swabs, allowing them to dry completely prior to injections administered especially in a hospital or long-term care setting.
- Individuals with diabetes do not need to use alcohol swabs before insulin injection at home, but they should ensure the injection site is clean. If the skin is visibly dirty, it should be cleaned with soap and water.^{3,4}
- Cleaning the medication cartridge or vial with alcohol swabs before use.^{1,5,6}
- Educate all at risk individuals including HCPs, clinical /domestic waste handlers on safe handling and use of personal protective equipment (PPE).

7.2 Safe Sharps Disposal

All HCPs, individuals with diabetes, and caregivers should be aware of proper disposal of sharps and the consequences of inappropriate disposal (e.g. needle stick injuries). The following disposal guidelines are encouraged:

- Demonstrate safe disposal methods during initiation of injection therapy and reinforce at subsequent visits.
- Do not recap, bend or manipulate needles after use.¹
- To discard pen needles:
 - Option 1: Use a needle clipping device.¹
 - Option 2: Use the single-handed scoop technique to recap with the outer cap, then dispose into a sharp bin or puncture-proof container (Refer to section 4 on injection technique).
- For home users, use labelled, puncture-proof containers and place them out of reach of children or vulnerable individuals.
- Never dispose of sharps in a public trash bin or normal household waste.
- When traveling, always store used sharps in a closed, secure container when travelling in a vehicle.¹
- Used sharps containers should:¹
 - Be clearly labelled as “SHARP”.
 - Be sealed properly.
 - Be stored out of reach of children, confused individuals, or drug abusers.
 - Not for recycling.
- Empty pen devices (without needles) can be disposed of as normal household waste.

7.3 Needle Stick Injuries/Blood-borne Infection Risk

To reduce NSI risk during injection:

- Using shorter needles (e.g. 4- and 5-mm pen needles) without a skin fold lifting is recommended. (Refer to section 4 on injection technique).
- If using a lifted skin fold, ensure the finger and thumb are approximately 1 inch (25mm) apart and should make the injection in the centre of the fold to avoid through-skin fold NSI.
- HCPs and caregivers should wear personal protective equipment (PPE), such as gloves, when administering injections for individuals who are seropositive for HIV, HBV and HCV.
- Use of safety pen needle is recommended to minimize NSI risk.¹
- Refer to section 4 on injection technique.

7.4 Institution

The safety of individuals with diabetes and HCPs in medical institutions and long-term care facilities is a primary consideration regarding injection technique.

- Institutional administrators are responsible for establishing and maintaining a culture of safety through:
 - Clear safety procedures and documentation.
 - Accessible reporting systems with “no blame” policy.
 - Regular audits of NSIs to identify risks and implement corrective actions.¹
 - Proper disposal techniques must be demonstrated at initiation of injection therapy and reinforced consistently
- Education and training programmes should be provided to all at risk personnel, including healthcare staff and waste handlers.
- Immunization for at risk workers (e.g., for HBV) should be encouraged.
- Formal post-NSIs protocols must be in place, with clearly defined clinical contacts and steps for follow-up.

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SPECIAL CONSIDERATION IN INJECTABLE THERAPY

Key Messages:

1. Important to practise proper injection technique and rotate injection sites to prevent pain, bruising, bleeding, and lipodystrophy.
2. People with diabetes should be advised on how to manage hypoglycaemia, missed doses, and travel-related insulin adjustments to maintain stable glucose levels.
3. Improve long-term adherence by addressing patient barriers and involving caregivers in management.

Optimal insulin management requires recognizing hypoglycaemia, managing injection issues such as pain, bleeding, hypersensitivity as well as regularly checking for lipodystrophy. Proper site rotation and needle use help prevent absorption problems. Educating people with diabetes and caregivers on handling missed doses and insulin use during travel are important.

8.1 Hypoglycaemia

Hypoglycaemia is defined by either one of the following two conditions:¹

- Low plasma glucose level (<3.9 mmol/L).
- Presence of autonomic or neuroglycopenic symptoms (Refer Table 8.1).
- Reversed by simple carbohydrate intake.

Table 8.1 Symptoms of Hypoglycaemia*

Autonomic	Neuroglycopenic
<ul style="list-style-type: none"> • Trembling • Palpitation • Sweating • Anxiety • Hunger • Nausea • Tingling 	<ul style="list-style-type: none"> • Difficult concentrating • Confusion • Weakness/stroke like symptoms • Drowsiness • Vision Changes • Difficult speaking • Headache • Seizure/coma

*Glucose level at which an individual becomes symptomatic is highly variable.

There are three levels of classification for hypoglycaemia (Refer Table 8.2).

Table 8.2: Classification of Hypoglycaemia

Level	Glycaemic Criteria	Description
1	<3.9 mmol/L but ≥3.0 mmol/L	Threshold for neuroendocrine responses to falling glucose in people without diabetes
2	<3.0 mmol/L	Threshold at which neuroglycopenic symptoms begin to occur. Requires immediate action to resolve the hypoglycaemic event.
3	-	A severe event characterised by altered mental and/or physical functioning that requires assistance from another person for recovery.

(Adapted from Clinical Practice Guidelines for the Management of Diabetes Mellitus 2020 Ministry of Health Malaysia)

- Risk factors contributing to hypoglycaemia include:
 - Advancing age
 - Severe cognitive impairment
 - Low health literacy
 - Suboptimal glycaemia control
 - Long duration of insulin therapy
 - Hypoglycaemia unawareness
 - Renal and hepatic impairment
 - Peripheral and autonomic neuropathy
 - Alcohol intake
 - Intramuscular administration of insulin
- Prevention of hypoglycaemia requires identifying individuals at risk and providing education on recognition of hypoglycaemic symptoms.^{1,2}
- Exercises have an effect on increased insulin sensitivity, which lasts up to 48 hours after the exercise.³ The target range for blood glucose levels prior to exercise should ideally be between 5.5 mmol/l and 15 mmol/l.^{4,5}

8.2 Bleeding and Bruising

- Bleeding can indicate unintentional intramuscular injecting-directly affecting insulin absorption action.
- Local bruising, bleeding or pain can occasionally occur at injection sites. It does not appear to impede insulin absorption.^{2,6}
- If bleeding occurs, apply light pressure on the injection site to stop the bleeding.
- Do not rub the injection site as it may lead to bruising.
- People with diabetes on anticoagulants may experience bruises after injectable medications. They are advised to apply direct pressure to the injection site once the needle is removed.
- Advise people with diabetes (including those on anticoagulants) to avoid injecting insulin over bruised areas until the bruising has resolved.

8.3 Painful Injection

- Review injection technique, pain can be an indicator of intramuscular injection.
- Tips for making injections less painful
 - Keeping injectable solutions in use at room temperature.
 - Encourage a new needle at each time of injection, rotating sites.
 - Using needles of shorter length and smaller gauge/diameter.^{2,5}
 - Insert the needle in a quick smooth movement through the skin.
 - Inject slowly and ensure that the plunger (syringe) or thumb button (pen) has been fully depressed.
 - Remove at same angle and keep hand steady.^{6,7}

8.4 Hypersensitivity Reaction

- Localised skin reactions such as rash or itchiness around the injection area may indicate that the person with diabetes is allergic to certain excipients of insulin.
- Healthcare professionals (HCPs) e.g. doctors to fill up the adverse drug reaction (ADR) form. Pharmacists to investigate the probability of the allergic reaction.
- People with diabetes who develop hypersensitivity reactions may be admitted to the hospital and restarted on insulin at a lower dose and gradually increased (desensitisation).

8.5 Lipodystrophy

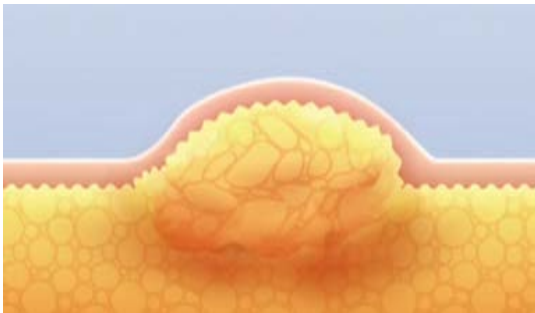
Insulin-induced lipodystrophy is a common, often underdiagnosed complication of subcutaneous insulin injections, resulting in localized fat abnormalities—either fatty lumps (lipohypertrophy) or dents (lipoatrophy). It causes erratic insulin absorption, leading to severe glycemic variability, unexpected hypoglycemia, and poor diabetes control.

- Lipohypertrophy (LH): The most common type of lipodystrophy (up to 49% in type 2 diabetes, 34% in type 1 diabetes), presenting as soft, rubbery, or firm lumps, often on the abdomen or thighs due to the anabolic effect of insulin.
- Lipoatrophy (LA): Less common, typically an immune-mediated loss of fat tissue appearing as sunken scars.
- Injection into sites of lipodystrophy may cause erratic insulin absorption, increase risk of hypoglycaemia, hyperglycaemia and glucose variability.⁹
- Subclinical lipodystrophy can negatively influence glycaemic outcomes.
- There is no conclusive research suggesting the length of time required for a lipohypertrophic area to heal. In severe cases, liposuction may be considered as a treatment.²

8.5.1 Detection of Lipohypertrophy

- Lipohypertrophy lesions vary in size. Some are visually apparent, while others require palpation for detection. In subclinical stages they can be difficult to detect by visual/palpation examination.
- Lipohypertrophy develops when insulin or other injections are repeatedly given in the same localised area. Each injection causes minor tissue damage, and insulin stimulates fat build-up during healing, creating lumps over time. This can be exacerbated if needles are reused (Refer Figure 8.1).

Figure 8.1: Lipohypertrophy

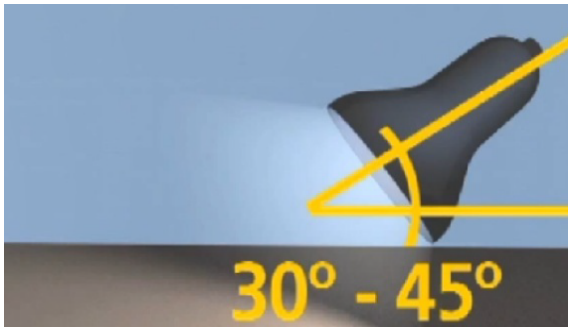


8.5.2 Assessment of Lipohypertrophy

Creating an optimal environment for lipohypertrophy detection.


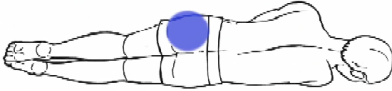
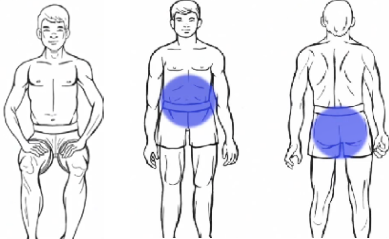
- The must be warm to prevent chilling, shivering and muscle tension.
- Use directional task lighting if at all possible. Light should be oblique 30° to 45° to the skin surface, preferably not overhead (Refer Figure 8.2).²

Figure 8.2: Direction of Lighting on Assessment of Lipohypertrophy



8.5.3 Preparing for Clinical Examination of Injection Site

Table 8.3: Steps of Clinical Examination of Lipohypertrophy

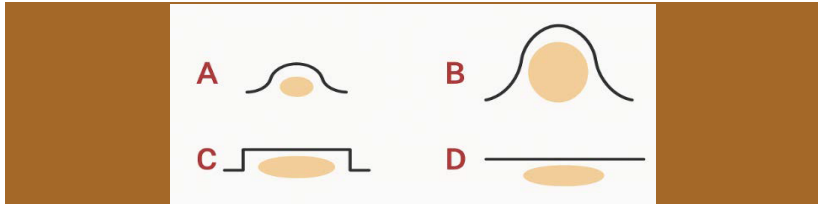
<ul style="list-style-type: none"> Position the individual laying down on their back with only their underclothes, then examine their abdomen, arms and thigh injection zones. 	
<ul style="list-style-type: none"> For abdomen and buttock, get the individual to lie on alternate sides and flex his/her knees towards the chest to examine the buttock area. 	
<ul style="list-style-type: none"> If without an examination bed, sitting upright in a chair with his/her hands resting on the lap and with his/her legs at right angles to the floor to examine the arms and thighs. For the abdomen, get the individual in standing position with his/her arms hand by their sides. 	

8.5.4 Visual Examination of Injection Site

Lipohypertrophy is usually manifested as a raised or mound-like convex area, sitting above the surrounding skin surface. (refer to Figure 8.3 with reference insertion here)⁸

- Occasionally, lipohypertrophy areas can be manifested as shiny or hyper-pigmented, especially in darker skins. You may also notice some hair loss.
- Mark the area if lipohypertrophy are detected.
- Bring clinical examination gel to near body temperature and apply into the area liberally, palpate with your fingertips with light massage motion, forward thrust and circular sweeps.
- Using a skin safe marker pen to draw a line around the lipohypertrophy area.
- Ultrasound method as one of the method detections of lipohypertrophy especially for flat skin area.²

Figure 8.3: Morphology Appearance and Identification Frequent Type of Lipohypertrophy



Type	Definition	Visibility	Palpable	Texture
A	Small nodule	Easily seen silhouette / better with tangential light	Easily	Harsh elastic
B	Large nodule	Clearly visible silhouette/ better with tangential light	Easily	Harsh elastic
C	Flat plastron	Hardly visible	Not easily palpable/ better by pinching	Usually, elastic
D	Flat nodule	Not visible	Difficult to identify, easier by deep palpation or pinching	Usually, elastic

8.5.5 After Examination

- Teach people with diabetes to conduct self-examination for lipohypertrophy at regular intervals. The use of hand or body lotion may help locate lipohypertrophy more easily.
- Lipohypertrophy area must not be injected.
- When injecting into a healthy area, close monitoring on blood glucose levels is required to reduce the dose of insulin accordingly.

8.5.6 Lipohypertrophy Prevention

- Teach people with diabetes to rotate injections sites (refer section 5.2) using the zone system and never reuse needles.^{2,8}

8.6 Travelling

8.6.1 General Advice to Insulin User Before Travelling

- Seek personalized advice from healthcare professionals prior to traveling.
- Make travel companions aware of diabetes diagnosis, signs and symptoms of hypoglycaemia and appropriate treatment measures.
- Plan for unexpected delays in travel.
- Continue insulin use but adjust during diarrheal or vomiting illnesses.
- Avoid alcohol during the flight and drink plenty of non-alcoholic fluids to maintain hydration.

Supplies and Devices

- Pack sufficient insulin supplies and suggest bringing a blood glucose meter (including batteries), test strips and lancet along.

Medicines

- Medicines, including insulin, non-insulin injectable therapies and blood glucose monitoring equipment should be carried on hand carry.
- Carry sources of carbohydrates like snacks, glucose tablets, or gels.
- Be aware of the difference between insulin strength (U-300, U-200, U-100, U-80, U-40) and blood glucose measurements (mmol/L vs. mg/dL) in case of needing to use local supplies.
- Once opened, store insulin vials/pen at ambient temperature (15°-30°C), away from sunlight. Unopened vials/pens can be stored in a refrigerator at 2-8°C.

Documentation

- Can assist with customs and security checks.
- Bring along a letter stating medical condition, medicines, supplies, and emergency contacts.
- Supplies should be in their original containers with official preprinted pharmacy or manufacturer labels.
- Smart insulin pens represent a promising tool to improve adherence and reduce errors in insulin therapy, but more evidence is needed to confirm their impact on long-term diabetes outcomes.¹⁰

8.6.2 Insulin Adjustment During Travel

Individualising insulin modification for travellers should favour simple adjustments over complex ones. The adjustments depend on factors such as the type of insulin (human vs. analogue) the regimen, the number of time zones crossed, direction of travel (eastward vs. westward) and the duration of travel (Refer to Table 8.4).

Eastward travel refers to flying to a country with a later time zone (day becomes shorter), while westward travel refers to flying to a country with an earlier time zone (day becomes longer).¹¹

- Eastward travel shortens the day and is associated with higher risk of hypoglycaemia.
- Westward travel prolongs the day and is associated with higher risk of hyperglycaemia.

Table 8.4: Insulin Adjustment

Basal insulin	Eastward travel-Consider reducing insulin dose
	Westward travel-Consider splitting the dose
Prandial/bolus insulin	Prefer rapid acting analogues for better flexibility and control
Premixed insulin	Continue on the same regimen unless your physician advises a change regime. Note that some studies have suggested this regimen is discouraged for air travel, with a switch to a basal-bolus regimen being preferred during travel. ¹¹

8.6.3 Storage During Travelling (Refer to Section 6)

8.7 Missing Insulin Injection

Insulin therapy is essential for managing diabetes. Despite its importance, adherence to insulin therapy remains a significant challenge. Refer to Section 3 for barriers and suggested solutions to insulin therapy. Table 8.5 discusses the impact of missing insulin injections on glycaemic control, long-term complication and quality of life of people with diabetes.^{2,12,13}

Table 8.5: Impact of Missing Insulin Injection

Glycaemic Control	Long-Term Complications	Quality of Life
<p>Hyperglycaemia: Increase risk of diabetic ketoacidosis.</p> <p>Glycaemic Variability: Irregular dosing leads to unstable blood glucose levels.</p>	<p>Increase risk of macrovascular and microvascular complication risks.</p>	<p>Poor glycaemic control causes fatigue, mood changes, and limits daily activities.</p>

8.7.1 Missing Injection Guide – Insulin & Non-insulin Injectable Therapy

For missing insulin and non-insulin injectable therapy, Table 8.6 and Table 8.7 provides guide to suggested therapy management.^{6,14}

Table 8.6: Missed Insulin Injectable Therapy

Regimen Type	Time Delay	Suggested Action
Once Daily Basal	≤ 6 hours	Give full usual dose
	6 – 12 hours	Give 50% of usual dose
	> 12 hours	Omit dose and monitor blood glucose
Twice Daily Regimen	≤ 2 hours	Reduce dose by ~10%
	2 – 4 hours	Reduce dose by ~25%
	4 – 6 hours	Reduce dose by ~50%
	> 6 hours	Omit dose and monitor blood glucose until next injection
	Overslept	Follow above advice according to delay duration
Basal Bolus Regimen – Bolus (Rapid-acting insulin)	≤ 30 minutes after meal	Give full usual dose
	30 minutes – 2 hours	Individual patient assessment required
	> 2 hours	Consider taking next rapid-acting dose early with food
Basal Bolus Regimen – Basal	≤ 6 hours	Give full usual dose
	6 – 12 hours	Give 50% of usual dose
	> 12 hours	Omit dose and monitor blood glucose

Table 8.7: Missed Doses of Non-insulin Injectable Therapy

Agent	Recommended Dosing Interval	Manufacturer Recommendations for Missed Doses
Short-acting agents		
Exenatide	Twice daily	Skip the missed dose and resume at the next scheduled dose.
Lixisenatide	Once daily	If a dose is missed, administer it within 1 hour prior to the next meal.
Long-acting agents		
Dulaglutide	Once weekly	Administer as soon as possible if there are ≥ 3 days (72 hours) until the next scheduled dose. If < 3 days before the next scheduled dose, skip the missed dose and administer on the next scheduled day.
Exenatide XR	Once weekly	Administer as soon as possible if there are ≥ 3 days (72 hours) until the next scheduled dose. If < 3 days before the next scheduled dose, skip the missed dose and administer on the next scheduled day.
Liraglutide	Once daily	If dose is missed, resume with the next scheduled dose.
Semaglutide (injectable)	Once weekly	Administer as soon as possible within 5 days after the missed dose. If > 5 days have passed, skip the dose and administer on the next scheduled day.
Tirzepatide	Once weekly	Administer as soon as possible within 4 days (96 hours) after the missed dose. If > 4 days have passed, skip the dose and administer on the next scheduled day.

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SPECIAL POPULATIONS

Key Messages:

1. A structured management plan is desirable and should be based on a comprehensive assessment of physical, cognitive and functional changes in older adults with diabetes mellitus.
2. Assessment of subcutaneous fat thickness in children is important to determine the choice of needle length and administration technique.
3. Involvement and education of parents, family members, or friends are encouraged to provide support and ensure safety for children and older adults with diabetes mellitus. All training on injection therapy should include follow-up demonstrations.

9.1 Pregnancy

Evidence on insulin injection technique during pregnancy is limited and largely based on expert consensus and foetal ultrasonographic assessments of subcutaneous fat patterns of women between 16 to 38 weeks during gestations.¹

9.1.1 Recommendations During Pregnancy

- Educate pregnant women with diabetes who require insulin. Topics should include psychological adjustment, changes in insulin requirements during pregnancy, injection sites, site rotation, and hypoglycaemia prevention.
- Address concerns about insulin's effect on the foetus to support adherence.
- Discuss other safety issues such as hypoglycaemia and the technical use of insulin pens and glucose monitoring devices.²
- The abdomen is a safe and preferred site for insulin administration during pregnancy.³
- The thigh can be used as an alternative injection site.⁴
- Reassure women that the injection site or technique does not need to change during the first trimester.
- During the second and third trimesters, injections should be given on the lateral abdomen when the central abdominal skin becomes taut. Ensure the skin fold is lifted properly before injection (Refer Figure 9.1).

Figure 9.1: Recommended Injection Sites During the Second and Third Trimester of Pregnancy



- Use shorter needles (4 mm, 5 mm) and skin fold techniques to reduce the risk of intramuscular injection as abdominal fat becomes thinner.⁵
- Avoid injections within 2–3 cm of the umbilicus or in areas with excessively taut skin.⁵

9.2 Older Adults

Older adults with diabetes face unique challenges in insulin or non-insulin injectable therapy due to both physical and psychological impairments. These may include reduced muscle mass and strength, fragile skin, and sensory changes such as impaired vision and hearing. Cognitive decline is also common, which may affect their ability to safely and accurately administer injections. Therefore, assessing cognitive and functional capacity is essential to ensure safe injection practices in this population.⁶

9.2.1 Recommendations for Older Adults

Individualised Assessment and Functional Considerations

- Conduct assessments using standardized tools to evaluate cognitive and functional abilities.^{7,8}
- The Clock Drawing Test is recommended to assess cognitive function.⁷
- Regular depression screening should be included as part of ongoing assessments.^{8,10}

Risk of Hypoglycaemia and Comprehensive Care Planning

- The older adults have impaired counter-regulatory hormone responses, which can reduce their ability to recognize hypoglycaemia.⁸
- This increases the risk of falls and fractures, requiring a more cautious and individualized treatment plan.

- Diabetes care in the older adults should be holistic, considering physical, psychological, social, and spiritual needs.⁹

Injection Devices and Techniques

- A written diabetes management and injection plan should be developed based on a thorough physical and psychological assessment.¹⁰
- Insulin pens are preferred over vials and syringes for ease of use and safety.
- Disposable prefilled pens and technology-assisted injection devices improve adherence and enhance safety.¹⁰
- The abdomen is the recommended injection site.
- Use of 4 mm pen needles is advised to minimize the need for skin lifting.

Family Support and Training

- Educate family members and caregivers to support daily insulin administration.¹¹
- Encourage their active involvement in the care of older adults with diabetes.
- Provide follow-up training and return demonstration of insulin injection technique using the person with diabetes devices to identify issues and to reinforce proper injection techniques.

9.3 Paediatrics (Children and Adolescents)

Many children and adolescents are emaciated at the time of diagnosis. Furthermore, children aged 2 to 6 years, lean and slim especially teenage boys have minimal subcutaneous fat tissues. These factors make it challenging to ensure proper insulin injection technique and accurate dose administration. Needle anxiety is common in children and adolescents and their parents. Younger children may express higher levels of fear and pain. The emotional responses of parents play a significant role in shaping their child's acceptance and cooperation with insulin therapy. Proper education and injection training are essential to ensure effective insulin delivery, reduce anxiety, and achieve optimal blood glucose control.

9.3.1 Recommendations for Children and Adolescents

Individualised Assessment and Technique

- Healthcare professionals should perform an individualised assessment of subcutaneous fat thickness at each injection site to guide the selection of needle length and injection angle.¹²
- Insulin pens are preferred as they accommodate shorter needles (4 mm, 5 mm, 6 mm), which are safer and easier to use.
- A 4 mm needle can be used at 90° without a skin fold in most children aged 6 years and older.

- In children aged 2 to 6 years, or in lean individuals, a skin fold is usually needed with a 4 mm needle to prevent intramuscular injection.^{13,14}
- For 5- or 6-mm needles, a 45° injection angle with a skin fold is recommended for lean children.^{13,14}

Injection Site Rotation

- Educate children, adolescents, and their caregivers on the importance of injection site rotation.
- Rotation should be done both between different sites (inter-site) and within the same site (intra-site).
- Within-site rotation should move approximately 1 cm (about a finger-width) from the previous injection point in a planned pattern to prevent lipohypertrophy.
- For children who self-inject, supervision may be necessary to ensure correct and consistent site rotation.

Addressing Needle Fear and Emotional Support

- Healthcare professionals should proactively ask about fear and pain associated with injections, as many children may not disclose these concerns unless specifically asked.
- At diagnosis, parents should be informed that their emotional response and attitude toward insulin injections can influence their child's willingness to participate in therapy.¹⁵
- Encourage parents to remain calm and supportive, and consider using demonstration techniques such as saline practice injections to build confidence and reduce fear.
- Needle anxiety in younger children may be reduced by distraction therapy or play therapy. For older children and adolescents, it may be helped by cognitive behavioural therapy such as relaxation training, guided imagery, graded exposure or active behavioural rehearsal.¹²

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PSYCHOSOCIAL CHALLENGES OF INJECTION

Key Messages:

1. Psychological Insulin Resistance (PIR) causes more than 25% of individuals with diabetes to delay in initiating insulin and non-insulin injectable therapy.
2. Different age groups of diabetes demonstrated different concerns about injectable therapy. In general fear and anxieties occur at all ages, use individualised approaches in addressing the challenges.
3. Some healthcare professionals may have reservations about initiating injectable therapy often due to personal negative perceptions or concerns regarding insulin use and safety.

Injection and Insulin therapy are associated with numerous negative perceptions and complications, such as diabetic ketoacidosis and hypoglycaemia.¹ More than one-fourth of individuals with diabetes may refuse insulin therapy after prescription or delay the initiation of insulin treatment and titration due to psychological factors.²

This phenomenon is called psychological insulin resistance (PIR).

10.1 Psychosocial Challenges Among Children

The age at which children can self-inject is related to development maturity rather than chronological age. Most children over the age of ten can give their own injections. There are several concerns regarding injections among the children.

- Needle fear is common in both children with diabetes and their parents. Younger children report more fear and pain.³
- Children have lower threshold of pain and often do not express it spontaneously.
- Intentional under dosing or overdosing of insulin is common in children (and adolescent) and can lead to severe diabetic ketoacidosis or hypoglycaemia.⁴

Practical Tips for Parents and Children

For Parents of Guardians

- Parents who are well- prepared in advance will transmit less anxiety to a child.
- Projects a calm and composed attitude towards the injections.
- Inform parents that their displayed distress and negative attitudes can influence their child's co-operation.⁵
- Let parents experience an injection with pen tip needle attached to an empty insulin pen device.⁵

- Encourage parents to be involved in insulin administration if insulin dose manipulation is suspected or confirmed such as omission or over-dosing.⁶

For Children

- Shows concern to the child by asking about the pain and use positive words.⁶
- Use diversion techniques or play therapy such as reading, watching a movie, listening to music or playing video games.⁴
- Have the child learn or practice the steps of the needle procedure, and coach parents about ways to support their child. Some examples are: ⁴
 - inject into a soft toy animal
 - watch favourite show
 - look for hidden objects in picture books
 - blow bubbles
- If self-injecting, young children should share this responsibility with their parents and do so under supervision.⁷
- For children with suspected or confirmed insulin dose manipulation e.g. omission or over-dosing, encourage parents to supervise their insulin administration.⁷
- Supervision of injections by parents or caregivers should include checking the dose prior to injection and ensuring the injection has penetrated the skin.⁷

10.2 Psychosocial Challenges Among Adolescents

Adolescents are defined as onset of puberty to 18 years of age. During this stage of life, insulin resistance is more common, and higher doses of insulin are often required to achieve near-normal glucose control. They may exhibit sub-optimal adherence to insulin injection schedule or skip insulin due to: ⁸

- Peer pressure
- Depression
- Diabetes burnout
- Diabetes distress
- Forgetfulness
- Lack of seriousness
- Rebellion
- Pain & frustration
- Fear of weight gain (especially girls)
- Social stigma

Practical Tips for Adolescents

- Encourage them to discuss their feelings about injection, particularly their frustration and struggles.⁹
- Reassured them that no-one manages diabetes perfectly all the time and that slip-ups do occur. As long as these do not become routine, they are not signs of failure.⁹
- Explain the benefits of injectable therapy.
 - Improve blood glucose control.
 - Reduce long term complications.
- Apply Cognitive Behavioural Therapy
 - Relaxation training
 - Guided imagery.
 - Graded exposure.
 - Active behavioural rehearsal.
 - Modelling and reinforcement.
- Give them a sense of control e.g. flexible injection schedule for weekends and holidays.^{9,10}
- Encourage joining a support group or diabetes camp.⁷
- Refer to Paediatric Clinical Psychologist / Psychiatrist.⁷

10.3 Psychosocial Challenges Among Adults

Managing diabetes in adults may be challenging in certain cases because PIR could be due to several factors. Please refer to Section 3, for more detail.

- Very few adults have true needle phobia, but many have anxiety about injecting, especially at the beginning of therapy.¹¹
- Loss of quality of life: less flexibility in performing activities, difficult injecting at the right amount and right time every day.¹¹
- Social stigma: embarrassment to inject in public.
- Social economic status: cost of medicine and injection equipment.¹¹
- Misconceptions of insulin therapy:¹¹
 - Insulin initiation means a sign of worsening illness or being the 'last resort' of treatment options.
 - Insulin causes serious health problems.
- Feeling a sense of personal failure or self- blame.¹¹
- Fear of side effects: hypoglycaemia or diabetic ketoacidosis, weight gain.

Practical Tips for Adults

- Assess an individual's attitudes towards insulin and his or her expectations about insulin therapy.
- Prepare all individuals with Type 2 diabetes early after diagnosis that they will likely require injectable therapy in the future to treat their diabetes.
- Explain the progressive nature of diabetes and making clear that injectable therapy treatment is not a sign of patient failure.
- Discuss the advantages and disadvantages of injectable therapy versus other therapy.
- Provide information on insulin and the various formulations.
- Discuss both short- and long-term advantages of achieving target glucose level. It is important to explain that finding the right combination of therapies, which may include the use of injectable therapy to achieve individualised glycaemic targets is the treatment goal.
- Involve the individual in decision making (e.g. selecting needle sizes, injection frequency).

10.4 Psychosocial Challenges Among Older Adults

The older population are challenged by both physical and psychological issues. Please refer to Section 9, for more detail.

10.5 Psychosocial Challenges Among the Caregivers

- Forty-six percent of the caregivers were reported giving injections to their loved ones, but only 14% received training.¹²
- Family caregivers were found to commonly worry about whether they would cause pain or harm to their loved one.¹²

Practical Tips for Caregivers

- Assess family caregiver knowledge. Identify who will be administering the injection. Schedule teaching time.¹²
- Receiving injection training from a diabetes nurse (educator) is associated with significantly lower HbA1c levels and less frequent unexpected hypoglycaemia and glucose variability.¹⁰
- Identify the goals of therapy; that is, the rationale for the medication, how it works, and how long it needs to be used. Discuss how to know if the treatment is effective.¹²
- Allow the caregiver to perform a return demonstration to identify learning gaps and confirm understanding.¹²

- Encourage caregivers perform a monitored injection on the care recipient prior to doing so at home unsupervised.¹²
- Discuss common adverse effects of the injection as well as how the caregiver should address if they occur.¹²
- Provide tips on reducing pain e.g. allow a refrigerated insulin to restore to room temperature for about 30 minutes, use new shorter-length needle, insert the needle quickly into the skin and inject slowly.¹²
- Pain is associated with needle reuse and tends to increase as the number of times the needle is reused.
- Provide written materials that caregivers can refer to at home.¹²

10.6 Psychosocial Challenges Among the Healthcare Professionals (HCPs)

Despite ample evidence showing that relatively few people with Type 2 diabetes achieve glycaemic control with oral therapy alone, physicians are still reluctant to initiate insulin injection. The reluctance to add insulin injection may be due to¹³.

- Having negative perceptions about injectable therapy.
- Lack of motivation and confidence.
- Concern about lack of continuity of care for the patients.
- Lack of manpower and resources.
- Prefer choice in the use of complementary medicines by people with diabetes.

Practical Tips for HCPs

- Reflect on your own perceptions of injectable therapy. Avoid using any terms which imply that such therapy is a sign of failure, a form of punishment.¹⁴
- Ask people with diabetes about their use of complementary therapies when initiating insulin.
- Initiate insulin with a lower starting dose.
- Customise a follow-up plan for people with diabetes to facilitate initiation and optimise the use of insulin.¹³
- Address misconceptions by counselling people with diabetes about the natural progression of diabetes at an early stage of the illness.
- Policy maker design and implement training curriculum for healthcare professionals.¹³

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No	Abbreviation	Terminology
1	ADR	Adverse drug reaction
2	BD	Twice daily
3	G	Gauge
4	GLP-1 RA	Glucagon-like peptide-1 receptor agonist
5	GIP	Gastric inhibitory polypeptide
6	HCP	Healthcare professional
7	HBV	Hepatitis B virus
8	HCV	Hepatitis C virus
9	HIV	Human Immunodeficiency virus
10	IM	Intramuscular
11	iDegAsp	Insulin degludec aspart
12	LH	Lipohypertrophy
13	LA	Lipoatrophy
13	MASLD	Metabolic dysfunction–associated steatotic liver disease
14	NPH	Neutral protaminated Hagedorn
15	NHMS	National Health and Morbidity Survey
16	NSIs	Needle stick injuries
17	OD	Once daily
18	OGLD	Oral glucose lowering drugs
19	PPE	Personal protective equipment
20	PIR	Psychological insulin resistance
21	rDNA	Recombinant DNA
22	SU	Sulphonylureas
23	SMBG	Self-monitoring of blood glucose
24	TDS	Three times daily

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