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## Insulins

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*—A chart of insulin products and administration devices is located on pages three through ten—  
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Insulins are categorized in the tables below according to their onset and duration of action: rapid-, short-, intermediate-, long-acting, and premixtures of rapid or short-acting insulin combined with intermediate-acting insulin.

**Availability.** The new insulin analogs and U-500 insulin are available by prescription only. Other insulins are available OTC, but a prescription may be required for insurance company reimbursement.

**Type.** The only forms of insulin available in the U.S. are human, human analog, and pork insulins. Beef insulins are no longer made or FDA-approved for use in the U.S. There is a theoretical concern for transmission of bovine spongiform encephalopathy (mad cow disease) from beef insulin. For information on obtaining it from other countries for patients who cannot take other types of insulin, go to <http://www.fda.gov/cder/drug/beefinsulin/default.htm#Q-1>.

**Onset, peak, duration.** The tables below compare the onset, peak, and duration of action of insulin formulations after subcutaneous injection. These values are approximate since many factors can affect the pharmacokinetics of insulin. Human insulins have a shorter onset and duration of action than pork insulin.<sup>1</sup> Variability of absorption is less with lispro than regular insulin.<sup>2</sup> Insulin lispro protamine and NPH insulin have similar pharmacokinetic profiles.<sup>3</sup>

**Administration.** Insulin suspensions should be gently (not vigorously) shaken or rotated before each injection. Pens and cartridges of insulin suspensions should be rolled and tipped back and forth 10 to 20 times before each injection to re-suspend the insulin.<sup>4,5</sup> Regular insulin is the only formulation that can be given IV (unlabeled use).<sup>4</sup>

**Meal timing.** The most recent position statement from the American Diabetes Association (ADA) recommends that rapid-acting insulin analogs be injected within 15 minutes before or immediately after a meal.<sup>1</sup> Administration after a meal may be helpful in young children who are unreliable eaters.<sup>6</sup> Meal-timing for premixed formulations is not addressed in product labeling, but should be based on whether the mixture contains lispro or regular insulin.

In one algorithm, the interval between injecting insulin and starting a meal depends on blood glucose monitoring. For regular insulin, the interval is 20 to 30 minutes for a blood glucose of 65 to 150 mg/dL, 30 to 45 minutes for >150 to 250 mg/dL, and 50 to 60 minutes for >250 mg/dL. Insulin lispro can be injected immediately before meals when blood glucose is 65 to 150 mg/dL. The interval between injecting and eating is 10 to 20 minutes for >150 to 250 mg/dL, and 20 to 30 minutes for >250 mg/dL.<sup>6</sup> A more detailed algorithm is outlined in the ADA's book, *Intensive Diabetes Management*.<sup>7</sup>

**Formulations.** All insulins are available in 10 mL vials (U-100; 100 units/mL). The only exception is U-500 (500 units/mL) regular insulin (20 mL vial), which is available from Eli Lilly by prescription only for patients who require more than 200 units/day.<sup>3</sup> Some formulations are available in prefilled disposable pens or reusable pens with disposable insulin cartridges. These products, reviewed in a table below, are for subcutaneous injection. Although they are more expensive, they can make insulin administration simpler, more convenient, and less error-prone than withdrawing insulin from a vial and injecting with a syringe. Injections with an insulin pen may also be less painful; the needles are small and are not dulled by the withdrawal of insulin from a vial to syringe. Jet injectors (*Medi-Jector*, *Tender Touch*, *Preci-Jet 50*, and *Vitajet*) allow the administration of insulin without injection by a needle. These devices are even more expensive than pens (\$500-\$900) and require frequent sterilization.<sup>19,20</sup>

**Appearance.** Patients or clinicians should check the appearance of an insulin before using it. Rapid- and short-acting insulins and insulin glargine should appear clear; the others should be cloudy.<sup>1,3</sup>

**Compatibility.** Although human and pork insulins can probably be mixed, there is no reason to do so.<sup>4</sup> There is no information on the compatibility between *Novolin* and *Humulin* insulins; incompatibility could result from differences in buffering agents between the two product lines. When mixed with another insulin, a rapid- or short-acting insulin should be drawn up in the syringe first in order to maintain its clear appearance. Insulin mixtures should never be administered IV.<sup>3</sup> Although some insulin mixtures are chemically stable under refrigeration for up to three months, the possibility of microbial contamination must be considered.<sup>2</sup>

Insulin diluents are available upon request from Eli Lilly free of charge. There are three diluents: regular (for both human and pork), NPH (for *Humalog*, *Humalog 75/25*, human and pork NPH, *Humulin 70/30* and *50/50*) and lente (for human and pork lente and human ultralente). Opened and unopened vials of diluent should be stored at room temperature. Opened vials of diluent and diluted insulin are both stable for one month at room temperature.<sup>4</sup> Product labeling states that diluted *Humalog* is stable at room temperature for 14 days.<sup>8</sup>

**Stability.** Unopened insulin products should be stored in the refrigerator (36 to 46° F; 2 to 8° C). Once the stopper or seal has been punctured with a needle, the product is considered to be “open” or “in-use.” In-use insulin vials are usually kept at room temperature (59 to 86° F; 15 to 30° C) to make injections less painful. At room temperature, opened vials are stable for up to 28 days. The duration of stability at room temperature varies for other insulin products. In-use insulin pens and cartridges should be stored at room temperature. Eli Lilly recommends that pre-measured syringes containing a single insulin or mixtures of insulins should be stored in the refrigerator and used within 21 days. The needle tip should be pointed upward and mixtures should be gently re-suspended before injection.<sup>4</sup>

**Rapid-acting (Onset less than 1/2 hour)**

	<b>Insulin Lispro Suspension</b>	<b>Aspart Insulin Solution</b>
Brand name	<i>Humalog</i> <sup>8</sup>	<i>NovoLog</i> <sup>9</sup>
Manufacturer	Eli Lilly	Novo Nordisk
Availability	Prescription required <sup>1</sup>	
Description	Human insulin analog (rDNA)	Human insulin analog (rDNA)
Onset <sup>2</sup>	15 to 30 minutes	10 to 20 minutes
Peak <sup>2</sup>	30 minutes to 2.5 hours	1 to 3 hours
Duration <sup>2</sup>	3 to 6.5 hours	3 to 5 hours
Administration	SC injection. Although not FDA-labeled, American Diabetes Association considers appropriate for SC infusion. <sup>10</sup>	FDA-labeled for SC injection and SC infusion in <i>Disetronic H-Tron plus V100 &amp; MiniMed 505, 506, 507</i> . <sup>11</sup>
Meal timing	Give SC injection within 15 minutes before or immediately after meals. <sup>1</sup> Give pump bolus immediately before meal. <sup>6</sup>	Give 5 to 10 minutes before meals.
Formulations	100 units/mL. 10 mL vials, 1.5 mL cartridges, 3 mL disposable pens.	100 units/mL. 10 mL vials, 3 mL cartridges (latex-free) <sup>12</sup> , 3 mL disposable pens.
Appearance	Clear <sup>1</sup>	
Compatibility	<ul style="list-style-type: none"> <li>• Can mix with NPH or ultralente (draw lispro into syringe first and inject within 5 minutes of mixing).<sup>3</sup></li> <li>• Mixture with NPH stable for 28 days at room temperature and refrigeration.<sup>4</sup></li> <li>• Can mix with sterile diluent for <i>Humalog</i>; <i>Humulin-N, 50/50</i>, or <i>70/30</i>; or <i>NPH Iletin</i> to dilutions of 1:2 (U-50) or 1:10 (U-10) for use by children. Diluted solutions stable for 28 days at 5° C (41° F) and 14 days at 30° C (86° F).</li> <li>• Do not mix with glargine.</li> <li>• Do not dilute or mix with other insulins when used in external pump.</li> <li>• Discard pump insulin if exposed to &gt;37° C.</li> </ul>	<ul style="list-style-type: none"> <li>• Can mix with NPH (draw aspart into syringe first and inject immediately after mixing).<sup>2</sup></li> <li>• No data on mixing with regular, lente, or ultralente.<sup>12</sup></li> <li>• Do not dilute or mix with other insulins when used in external pump.</li> <li>• Can use <i>Disetronic 3.15</i> plastic cartridges &amp; <i>Classic/Tender</i> infusion sets with <i>Disetronic H-Tron plus V100</i> pump. Use <i>MiniMed 3 mL</i> syringes &amp; <i>Polyfin/Sofset</i> infusion sets with <i>MiniMed</i> pump. No data on use with quick-release infusion sets and cartridge adapters.</li> <li>• Discard pump insulin if exposed to &gt;37° C.</li> <li>• Do not mix with glargine.</li> </ul>
Stability of in-use products at room temperature	Vial, cartridge, pen: 28 days. External pump: Up to 48 hours ( <i>MiniMed 504, Disetronic H-Tron</i> )	Vial, cartridge, pen: 28 days. External pump: Up to 48 hours. <sup>12</sup>
AWP	\$54.10/10 mL vial \$54.43/5 of 1.5 mL cartridge \$108.86/3 of 3 mL cartridge \$108.86/5 of 3 mL pen	\$66.95/10 mL vial \$124.44/5 of 3 mL cartridge \$129.34/5 of 3 mL pen

**Short-acting (Onset 1/2 to 2 hours)**

	<b>Regular</b>	<b>Regular</b>	<b>Buffered regular</b>	<b>Regular</b>
Brand name	<i>Humulin-R</i>	<i>Novolin-R</i>	<i>Velosulin BR</i> <sup>13</sup>	<i>Iletin II Regular</i> <sup>13</sup>
Manufacturer	Eli Lilly	Novo Nordisk	Novo Nordisk	Eli Lilly
Species	Human (rDNA)	Human (rDNA)	Human (rDNA)	Pork
Availability	Non-prescription (except 500 units/mL <i>Humulin-R</i> )			
Onset <sup>2</sup>	30 to 60 minutes; onset more rapid with human than pork.			
Peak <sup>2</sup>	1 to 5 hours (1 to 3 hours for <i>Velosulin BR</i> ); peak may be more rapid with human than pork.			
Duration <sup>2</sup>	6 to 10 hours; longer with pork than human. May be longer with U-500.		Approx. 8 hours	4 to 12 hours
Administration	SC, IM, IV (unlabeled). 500 units/mL SC only.	SC, IM, IV (unlabeled).	SC, IM, IV (unlabeled); FDA-approved for use in SC pump.	SC, IV (unlabeled), but not IM.
Meal timing	SC injection: 30 minutes before meals. <sup>1</sup> Pump bolus: 20 to 30 minutes before a meal. <sup>6,14</sup>			
Formulations	100 units/mL: 10 mL vial. 500 units/mL: 20 mL vial.	100 units/mL. 10 mL vial, 1.5 & 3 mL cartridge, 1.5 mL disposable pen, 3 mL <i>Innolet</i> .	100 units/mL. 10 mL vial.	100 units/mL. 10 mL vial.
Appearance	Clear and colorless. <sup>1</sup> U-500 may be straw-colored. <sup>2</sup>			
Compatibility	<ul style="list-style-type: none"> <li>• Can mix with NPH; use immediately or store for future use.<sup>1</sup></li> <li>• Mixture stable at room temp for 1 month, refrigerator for 3 months.<sup>2</sup></li> <li>• Mixing with lente/ultralente can delay onset of regular; may not reach binding equilibrium for 24 hours. Per ADA, mix with lente only if patient already stabilized on regimen. Standardize interval between mixing &amp; injecting (either immediately or ≥24 hours after mixing).<sup>1,3,4</sup></li> <li>• Do not mix with glargine.</li> <li>• Can mix with water for injection/0.9% sodium chloride for injection for use in SC infusion pump. Use within 24 hours.<sup>2</sup></li> <li>• Stable at room temp for 1 month in Lilly regular insulin diluent.<sup>4</sup></li> </ul>		<ul style="list-style-type: none"> <li>• Do not mix with other insulins.<sup>13</sup></li> <li>• Phosphate buffer prevents deposition of insulin crystals on pump tubing.</li> <li>• Can use <i>Polyfin/Sofset</i> infusion sets without quick release with <i>MiniMed</i> pump.</li> </ul>	<ul style="list-style-type: none"> <li>• Can mix with Iletin II Lente if administered immediately.<sup>4</sup></li> <li>• Can mix with NPH.<sup>3</sup></li> <li>• Can mix with ultralente.<sup>3</sup></li> <li>• Do not mix with glargine.</li> <li>• Stable for 1 month at room temperature after dilution with Lilly regular insulin diluent.<sup>4</sup></li> </ul>
Stability of in-use products at room temperature	Vial: 30 days	Vial, pen, 1.5 mL cartridge: 1 month 3 mL cartridge & <i>Innolet</i> : 28 days	Vial: 28 days External pump: up to 48 hours in <i>MiniMed</i> 504S, 505, 506, 507 <sup>2, 13</sup>	Vial: 1 month
AWP	\$26.56/10 mL vial (U-100) \$191.09/20 mL vial (U-500)	\$26.56/10 mL vial \$44.99/5 of 1.5 mL cartridge \$81.70/5 of 3 mL cartridge \$42.96/5 of 1.5 mL pen \$53.10/5 of 3 mL <i>Innolet</i>	\$39.00/10 mL vial	\$47.98/10 mL vial

**Intermediate-acting (Onset 2 to 6 hours)**

	<b>Lente</b> (Insulin zinc suspension; contains zinc and acetate buffers) <sup>3</sup>			<b>NPH</b> (Isophane insulin suspension; contains zinc and protamine) <sup>3</sup>		
Brand name	<i>Novolin-L</i>	<i>Humulin-L</i>	<i>Iletin II Lente</i> <sup>13</sup>	<i>Novolin N</i>	<i>Humulin N</i> <sup>13</sup>	<i>Iletin II NPH</i> <sup>13</sup>
Manufacturer	Novo Nordisk	Eli Lilly	Eli Lilly	Novo Nordisk	Eli Lilly	Eli Lilly
Species	Human	Human	Pork	Human	Human	Pork
Onset <sup>2</sup>	1 to 3 hours; onset more rapid with human than pork.			1 to 2 hours; onset more rapid with human than pork.		
Peak <sup>2</sup>	6 to 14 hours			6 to 14 hours		
Duration <sup>2</sup>	16 to 24 hours; duration of human < pork.		Slightly >24 hours	16 to 24+ hours; duration of human < pork.		
Administration	SC only <sup>2</sup> Re-suspend before injection. <sup>4</sup>			SC only. <sup>2</sup> Re-suspend before injection. <sup>4</sup>		
Meal timing	<ul style="list-style-type: none"> <li>Inject within 15 minutes before meals when mixed with rapid-acting insulin.<sup>1</sup></li> <li>Usually injected 30 minutes before meals when mixed with regular.<sup>1</sup></li> <li>Individualize based on blood glucose.<sup>6</sup></li> </ul>			<ul style="list-style-type: none"> <li>Inject within 15 minutes before meals when mixed with rapid-acting insulin.<sup>1</sup></li> <li>Usually injected 30 minutes before meals when mixed with regular.<sup>1</sup></li> <li>Individualize based on blood glucose.<sup>6</sup></li> </ul>		
Formulations	100 units/mL. 10 mL vial.	100 units/mL. 10 mL vial.	100 units/mL. 10 mL vial.	100 units/mL. 10 mL vial, 1.5 & 3 mL cartridge, 1.5 mL disposable pen, 3 mL <i>Innolet</i>	100 units/mL. 10 mL vial, 3 mL disposable pen.	100 units/mL. 10 mL vial.
Appearance	Cloudy <sup>1</sup>					
Compatibility	<ul style="list-style-type: none"> <li>Do not mix with regular insulin unless patient already stabilized on regimen (delays onset of short-acting insulin). Standardize interval between mixing and injecting (either immediately or at least 24 hours after mixing).<sup>1,3</sup> Mix with <i>Iletin II</i> regular immediately before injection.<sup>4</sup></li> <li>Can mix with ultralente.<sup>3</sup></li> <li>Stable for 1 month at room temperature after dilution with Lilly lente insulin diluent.<sup>4</sup></li> <li>Do not mix with NPH or glargine.<sup>1</sup></li> </ul>			<ul style="list-style-type: none"> <li>Can mix with aspart or lispro.<sup>3</sup> Draw up the rapid-acting insulin first and inject immediately.<sup>12</sup></li> <li>Can mix with regular. Draw up the regular insulin first; can be used immediately or stored for future use.<sup>1</sup> Mixture stable at room temp for 1 month and in refrigerator for 3 months.<sup>3</sup></li> <li>Stable for 1 month at room temperature after dilution with Lilly NPH insulin diluent.<sup>4</sup></li> <li>Do not mix with lente, ultralente, or glargine.<sup>1,3</sup></li> </ul>		
Stability of in-use products at room temperature	Vial: 1 month	Vial: 1 month	Vial: 1 month	Vial: 30 days 3 mL cartridge & <i>Innolet</i> : 14 days Pen, 1.5 mL cart: 7 days	Vial: 1 month 3 mL pen: 14 days	Vial: 1 month
AWP	\$26.56/10 mL vial	\$26.56/10 mL vial	\$47.98/10 mL vial	\$26.56/10 mL vial \$44.99/5 of 1.5 mL cart \$81.70/5 of 3 mL cart \$47.26/5 of 1.5 mL pen \$53.10/5 of 3 mL <i>Innolet</i>	\$26.56/10 mL vial \$78.54/5 of 3 mL pen	\$47.98/10 mL vial

**Long-acting (Onset 2 to 10 hours)**

	<b>Insulin glargine solution</b>	<b>Ultralente</b> (Extended insulin zinc suspension)
Brand name	<i>Lantus</i> <sup>15</sup>	<i>Humulin-U</i>
Manufacturer	Aventis	Eli Lilly
Availability	Prescription only	Non-prescription
Species	Human insulin analog (rDNA)	Human (rDNA)
Onset <sup>2</sup>	1.1 hours	4 to 6 hours
Peak <sup>2</sup>	No significant peak	8 to 20 hours
Duration <sup>2</sup>	24 hours	24 to 28 hours with 0.5 units/kg; somewhat dose-dependent. <sup>4</sup>
Administration	<ul style="list-style-type: none"> <li>• SC at bedtime. Not for IV administration.</li> <li>• Reduce daily <i>Lantus</i> dose by 20% when switching from twice daily NPH. No adjustment when switching from daily NPH/ultralente human insulin.</li> <li>• Not necessary to shake before administration.</li> <li>• Low pH of solution may cause burning at the injection site.</li> </ul>	<ul style="list-style-type: none"> <li>• Re-suspend before injection.<sup>4</sup></li> <li>• SC injection only.</li> </ul>
Meal timing	Not applicable.	<ul style="list-style-type: none"> <li>• Inject within 15 minutes before meals when mixed with rapid-acting insulin.<sup>1</sup></li> <li>• Usually injected 30 minutes before meals when mixed with regular.<sup>1</sup></li> <li>• Individualize based on blood glucose.<sup>6</sup></li> </ul>
Formulations	100 units/mL. 10 mL vial.	100 units/mL. 10 mL vial.
Appearance	Clear <sup>1</sup>	Cloudy <sup>1</sup>
Compatibility	<ul style="list-style-type: none"> <li>• Do not mix with other insulins; diluent has low pH (4).<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Can mix with insulin lispro (inject within 5 minutes of mixing), regular (standardize time from mixing to injecting), and lente.<sup>3,4</sup></li> <li>• Mixture with lente stable at room temp for 1 month and in refrigerator for 3 months.<sup>16</sup></li> <li>• Stable for 1 month at room temperature after dilution with Lilly lente insulin diluent.<sup>4</sup></li> <li>• Do not mix with NPH.<sup>1</sup></li> </ul>
Stability of in-use products at room temperature	10 mL vial: 28 days	10 mL vial: 1 month. <sup>3</sup>
AWP	\$46.99/10 mL vial	\$26.56/10 mL vial

**Premixed combinations (biphasic absorption)**

	<b>30% insulin aspart, 70% insulin aspart protamine</b>	<b>25% insulin lispro, 75% insulin lispro protamine</b>	<b>70% NPH, 30% regular</b>		<b>50% NPH, 50% regular</b>
Brand name	<i>Novolog Mix 70/30</i> <sup>18</sup>	<i>Humalog Mix75/25</i> <sup>17</sup>	<i>Humulin 70/30</i> <sup>13</sup>	<i>Novolin 70/30</i> <sup>13</sup>	<i>Humulin 50/50</i>
Manufacturer	Novo Nordisk	Eli Lilly	Eli Lilly	Novo Nordisk	Eli Lilly
Availability	Prescription only	Prescription only	Non-prescription	Non-prescription	Non-prescription
Species	Human insulin analog (rDNA)	Human insulin analog (rDNA)	Human (rDNA)	Human (rDNA)	Human (rDNA)
Onset	Faster than <i>Novolin 70/30</i>	Faster than <i>Humulin 70/30</i>	30 to 60 minutes <sup>7</sup>	30 to 60 minutes <sup>7</sup>	30 to 60 minutes <sup>7</sup>
Peak	Mean 2.4 hours Range 1 to 4 hours	Mean 2.6 hours Range 1 to 6.5 hours	Mean 4.4 hours Range 1.5 to 16 hours	2 to 12 hours	Mean 3.3 hours Range 2 to 5.5 hours
Duration	Effective: 15 to 18 hours Max: Up to 24 hours	Up to 24 hours (similar to <i>Humulin 70/30</i> ).	Effective: 10 to 16 hours <sup>7</sup> Max: Up to 18 to 24 hours. <sup>7</sup>	Effective: 10 to 16 hours <sup>7</sup> Max: Up to 18 to 24 hours <sup>7</sup>	Effective: 10 to 16 hours <sup>7</sup> Max: Up to 18 to 24 hours <sup>7</sup>
Administration	SC only. Re-suspend before injection. <sup>4</sup>				
Meal timing	• Give 10 to 20 minutes before meals. <sup>1</sup> Individualize based on blood glucose. <sup>6</sup>	• Give approx. 15 minutes before meals. <sup>1</sup> Individualize based on blood glucose. <sup>6</sup>	• Give approx. 30 minutes before meals. <sup>1</sup> Individualize based on blood glucose. <sup>6</sup>	• Give approx. 30 minutes before meals. <sup>1</sup> Individualize based on blood glucose. <sup>6</sup>	• Give approx. 30 minutes before meals. <sup>1</sup> Individualize based on blood glucose. <sup>6</sup>
Formulations	100 units/mL. 10 mL vial, 3 mL cartridge, 3 mL disposable pen ( <i>NovoLog Mix 70/30 FlexPen</i> )	100 units/mL. 10 mL vial, 3 mL disposable pen	100 units/mL. 10 mL vial, 3 mL disposable pen	100 units/mL. 10 mL vial, 1.5 & 3 mL cartridge, 1.5 mL disposable pen, 3 mL <i>Innolet</i>	100 units/mL. 10 mL vial
Appearance	Cloudy				
Compatibility	• Do not mix with other insulins. • <i>Humalog Mix 75/25, Humulin 70/30, and Humulin 50/50</i> stable for 1 month at room temperature after dilution with Lilly NPH insulin diluent. <sup>4</sup>				
Stability of in-use products at room temp	Pen: 14 days 3 mL cartridge: 14 days Vial: 28 days	Vial: 28 days Pen: 10 days	Vial: 28 days 3 mL pen: 10 days	Vial: 30 days 1.5 mL cart, pen: 7 days 3 mL cart, <i>Innolet</i> : 10 days	Vial: 28 days
AWP	\$124.44/5 of 3 mL cartridge \$129.34/5 of 3 mL pen \$66.95/10 mL vial	\$54.10/10 mL vial \$108.86/5 of 3 mL pen	\$26.56/10 mL vial \$78.54/5 of 3 mL pen	\$26.56/10 mL vial \$44.99/5 of 1.5 mL cart \$81.70/5 of 3 mL cart \$47.26/5 of 1.5 mL pen \$53.10/5 of 3 mL <i>Innolet</i>	\$26.56/10 mL vial

Administration Devices						
Device name Manufacturer	Description	Dosage range and precision	Insulin Used	Storage & stability of in-use pens	Cost*	Comments
<i>Autopen</i> Owen Mumford 800-421-6936 www.owenmumford.com	Reusable pen	1-16 units in 1-unit increments or 2-32 units in 2-unit increments	1.5 mL cartridges (fits Novo Nordisk cartridges)	According to insulin cartridge specifications	\$34-45	Has automatic side injection button. Comes with <i>Unifine Pentip</i> needles (1/2" or 5/16", both 29 gauge), but can use other needles. Cannot easily correct "over-dialed" dose without loss of insulin.
	Reusable pen	1-21 in 1-unit increments or 2-42 units in 2-unit increments	3 mL cartridges (ie, <i>Humalog</i> ; does not fit Novo Nordisk cartridges)	According to insulin cartridge specifications	\$34-45	Has automatic side injection button. Dosing dial has audible click. Comes with <i>Unifine Pentip</i> needles (1/2" or 5/16", both 29 gauge), but can use other needles. Cannot easily correct "over-dialed" dose without loss of insulin.
<i>BD Pen</i> Becton Dickinson 888-232-2737 www.bd.com	Reusable pen	1-30 units in 1-unit increments	1.5 mL cartridges	According to insulin cartridge specifications	\$35-40	Uses <i>BD Ultra-fine Original</i> (29 gauge, 1/2") & <i>Ultra-fine III Short</i> (31 gauge, 5/16") needles. Magnifier available.
<i>BD Pen Mini</i> Becton Dickinson	Reusable pen	1/2-15 units in 1/2-unit increments	1.5 mL cartridges	According to insulin cartridge specifications	\$35-40	Uses <i>BD Ultra-fine Original</i> (29 gauge, 1/2") & <i>Ultra-fine III Short</i> (31 gauge, 5/16") needles. Colorful design on pen. Available by mail (888-400-7367).
<i>Disetronic pen</i> Disetronic Medical Systems 800-280-7801 www.disetronic-usa.com	Reusable pen has cartridges that can be filled with vial insulin	1-80 units in 1-unit increments	Disposable 3.15 mL cartridges to be filled with any type, brand, or mixture of insulin. Also fits <i>Humalog</i> cartridges.	Varies according to insulin type and manufacturer	\$116 for kit  \$98 for 25 empty cartridges	Kit contains supplies for filling cartridges. Plastic or glass cartridges available. LED display. Compatible with syringe needles up to 30 gauge (not <i>BD</i> or <i>Novofine</i> pen needles). Prescription required.



Device name Manufacturer	Description	Dosage range and precision	Insulin Used	Storage & stability of in-use pens	Cost*	Comments
<i>InDuo</i> Novo Nordisk 800-727-6500 www.insulindevice.com	Blood glucose meter with reusable insulin doser	1-70 units in 1 unit increments	3 mL Novo Nordisk <i>PenFill</i> cartridges	Room temperature; duration according to specific cartridge	\$88-99	Uses <i>OneTouch Ultra</i> test strips. Memory function on doser displays time and amount of last dose. Must remove needle before recapping pen.
<i>Innovo</i> Novo Nordisk	Same reusable insulin doser as <i>InDuo</i>	1-70 units in 1 unit increments	3 mL Novo Nordisk <i>PenFill</i> cartridges (Does not fit <i>Humalog</i> cartridges)	Room temperature; duration according to specific cartridge	\$59	Memory function on doser displays time and amount of last dose. Must remove needle before recapping pen.
<i>Innolet</i> Novo Nordisk	Prefilled disposable device	1-50 units in 1-unit increments	3 mL Novo Nordisk <i>PenFill</i> cartridges prefilled with: <i>Novolin N</i> <i>Novolin 70/30</i> <i>Novolin R</i>	Room temperature for:  14 days 10 days 28 days	Not available	Has large dosage dial and numbers.
Lilly pens Eli Lilly 800-545-5979 www.lillydiabetes.com	Prefilled disposable pen	60 units in 1-unit increments	3 mL cartridges prefilled with: <i>Humalog 75/25</i> <i>Humalog</i> <i>Humulin N</i> <i>Humulin 70/30</i>	Room temperature for: 10 days 28 days 10 days 14 days	\$75-96 Higher price is for <i>Humalog</i> product.	Can use with 28 gauge <i>BD</i> pen needles or equivalent. Has magnifying dose window. Also additional magnifier that snaps on the pen. <i>Humalog</i> products are prescription only.
<i>NovoLog FlexPen</i> Novo Nordisk	Prefilled disposable pen	60 units in 1-unit increments	3 mL with <i>NovoLog</i>	28 days at room temperature	\$129.34 for 5 pens	Uses <i>NovoFine</i> needles.

Device name Manufacturer	Description	Dosage range and precision	Insulin Used	Storage & stability of in-use pens	Cost*	Comments
<i>NovoLog Mix 70/30</i> <i>FlexPen</i> Novo Nordisk	Prefilled disposable pen	60 units in 1- unit increments	3 mL with <i>Novolog Mix</i> <i>70/30</i>	14 days at room temperature	\$129.34 for 5 pens	
<i>Novolin</i> Novo Nordisk	Prefilled disposable pen	58 units in 2- unit increments	1.5 mL with:  <i>Novolin R</i> <i>Novolin N</i> <i>Novolin 70/30</i>	Room temperature for: 30 days 7 days 7 days	\$45-47 for 5 pens	Uses <i>NovoFine</i> or <i>BD</i> pen needles.
<i>NovoPen 3</i> Novo Nordisk	Reusable pen	2-70 units in 1- unit increments	3 mL Novo Nordisk <i>PenFill</i> cartridges ( <i>Novolin N, R,</i> <i>70/30</i> )	Room temperature; duration according to specific cartridge	\$32	Uses <i>NovoFine</i> or <i>BD</i> pen needles.
<i>NovoPen 1.5</i> Novo Nordisk	Reusable pen	1-40 units in 1- unit increments	1.5 mL Novo Nordisk <i>PenFill</i> cartridges ( <i>Novolin R, N,</i> <i>70/30, 50/50</i> )	Room temperature; duration according to specific cartridge	Not available	Discontinued in 2002. Constructed of aluminum and plastic. Uses <i>NovoFine</i> or <i>BD</i> pen needles.
<i>NovoPen Junior</i> Novo Nordisk	Reusable pen	1-35 units in ½ unit increments	3 mL Novo Nordisk <i>PenFill</i> cartridges ( <i>Novolin N, R,</i> <i>70/30</i> )	Room temperature; duration according to specific cartridge	Not available	Marketing expected by late 2002. Differentiated from <i>NovoPen 3</i> by raised circle on the push button. Can use with <i>PenMate</i> , an accessory that helps to insert needle. For use with <i>NovoFine</i> or <i>BD</i> needles.

\*From [www.drugstore.com](http://www.drugstore.com), reference 19, and 2002 Red Book.

**Chart is based on U.S. product labeling.**

Further information on insulin pens available online at: [http://www.lifeclinic.com/focus/diabetes/supply\\_syringes.asp](http://www.lifeclinic.com/focus/diabetes/supply_syringes.asp); [http://www.childrenwithdiabetes.com/d\\_06\\_360.htm](http://www.childrenwithdiabetes.com/d_06_360.htm);  
[http://www.childrenwithdiabetes.com/d\\_06\\_361.htm](http://www.childrenwithdiabetes.com/d_06_361.htm); [http://www.realitycheck.org.au/insulin-pen\\_test.htm](http://www.realitycheck.org.au/insulin-pen_test.htm); [www.nfb.org/vod/vsum9909.htm](http://www.nfb.org/vod/vsum9909.htm).

*Users of this document are cautioned to use their own professional judgment and consult any other necessary or appropriate sources prior to making clinical judgments based on the content of this document. Our editors have researched the information with input from experts, government agencies, and national organizations. Information and Internet links in this article were current as of the date of publication.*

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