



THE UNIVERSITY OF NORTH DAKOTA



The University of North Dakota

School of Medicine
& Health Sciences



Courtesy Univ Texas San Antonio

Diabetes Medications: Insulin Therapy

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Diabetes and Insulin

- Type 1 Diabetes
 - Autoimmune destruction of beta cells in pancreas (usually rapid)
 - Absolute insulin deficiency
 - Require insulin at time of diagnosis
- Type 2 Diabetes
 - Core defect is insulin resistance
 - Beta cells will fail more slowly over time (usually years)
- Modern insulin therapy safer, more predictable, easier with better delivery technology

Goals of Glucose Management

Targets for glycemic (blood sugar) control

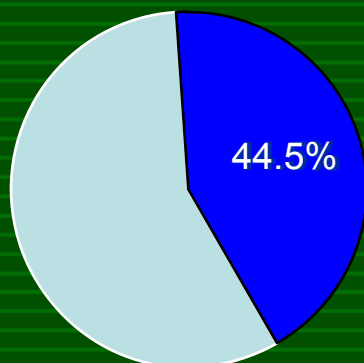
	ADA	AACE
A1c (%)	<7*	≤6.5
Fasting (preprandial) plasma glucose	70-130 mg/dL	<110 mg/dL
Postprandial (after meal) plasma glucose	<180 mg/dL	<140 mg/dL

*<6 for certain individuals

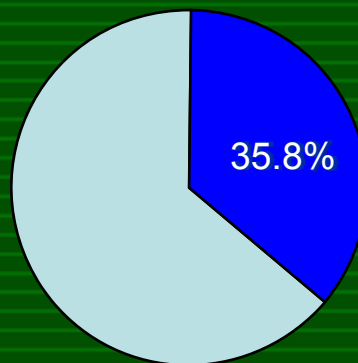
- American Diabetes Association. *Diabetes Care*. 2009;32(suppl 1)
- Implementation Conference for ACE Outpatient Diabetes Mellitus Consensus Conference Recommendations: Position Statement at <http://www.aace.com/pub/pdf/guidelines/OutpatientImplementationPositionStatement.pdf>. Accessed January 6, 2006.
- AACE Diabetes Guidelines – 2002 Update. *Endocr Pract*. 2002;8(suppl 1):40-82.

~Two-thirds of Patients are not Achieving Glycemic Control

NHANES¹



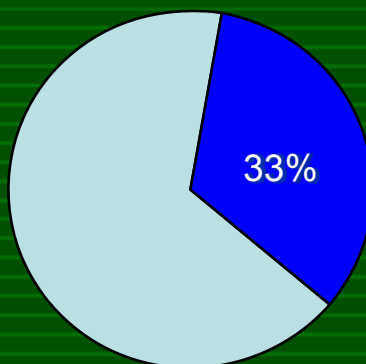
1988-1994
N = 1215



1999-2000
N = 372

■ A1c < 7%

AACE survey²
39 U.S. states included



■ A1c ≤ 6.5%

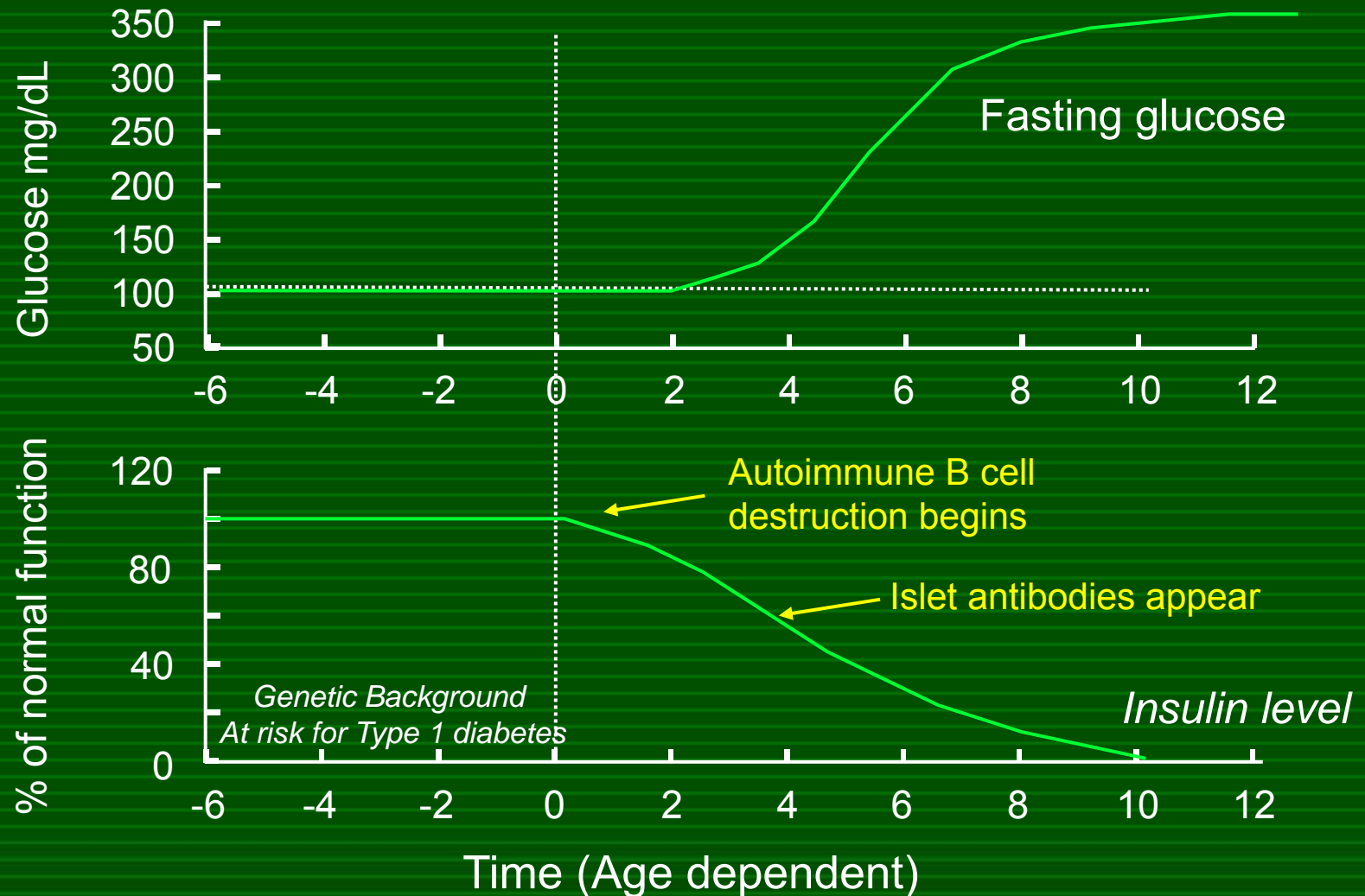
N = 157,000 type 2 patients

NHANES = National Health and Nutrition Examination Survey.

¹Koro et al. *Diabetes Care*. 2004;27:17-20

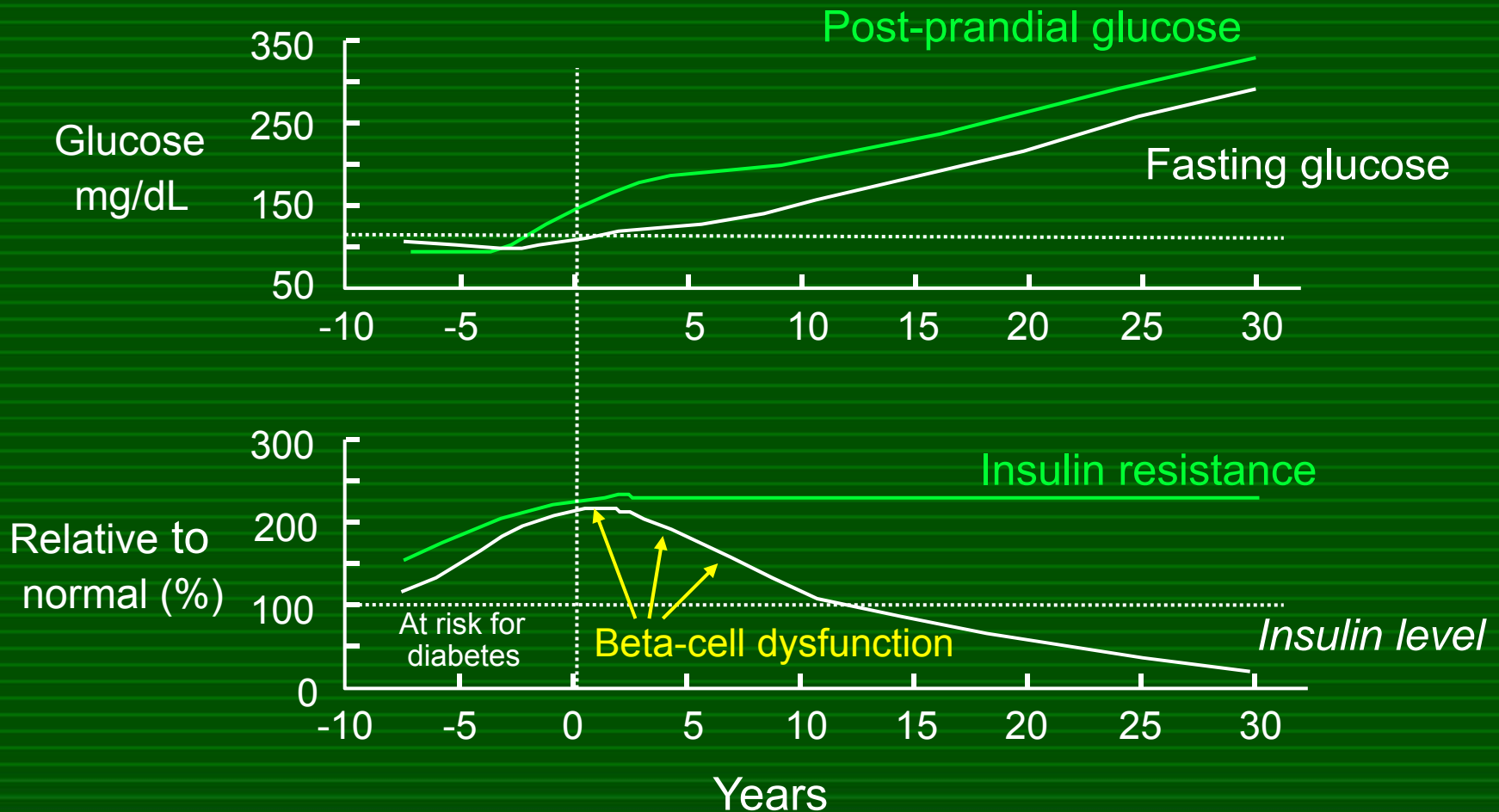
²*State of Diabetes in America*, American Association of Clinical Endocrinologists, 2003-2004. Available at: <http://www.aace.com/public/awareness/stateofdiabetes/DiabetesAmericaReport.pdf>. Accessed January 6, 2006.

Natural History of Type 1 Diabetes



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Natural History of Type 2 Diabetes



R. Bergenstal and D. Kendall, International Diabetes Center

Insulin Therapy

- Required at diagnosis for type 1 diabetes
- Many patients with type 2 diabetes will eventually need insulin
 - Pancreas makes less insulin over time
 - Oral agents will not be as effective over time

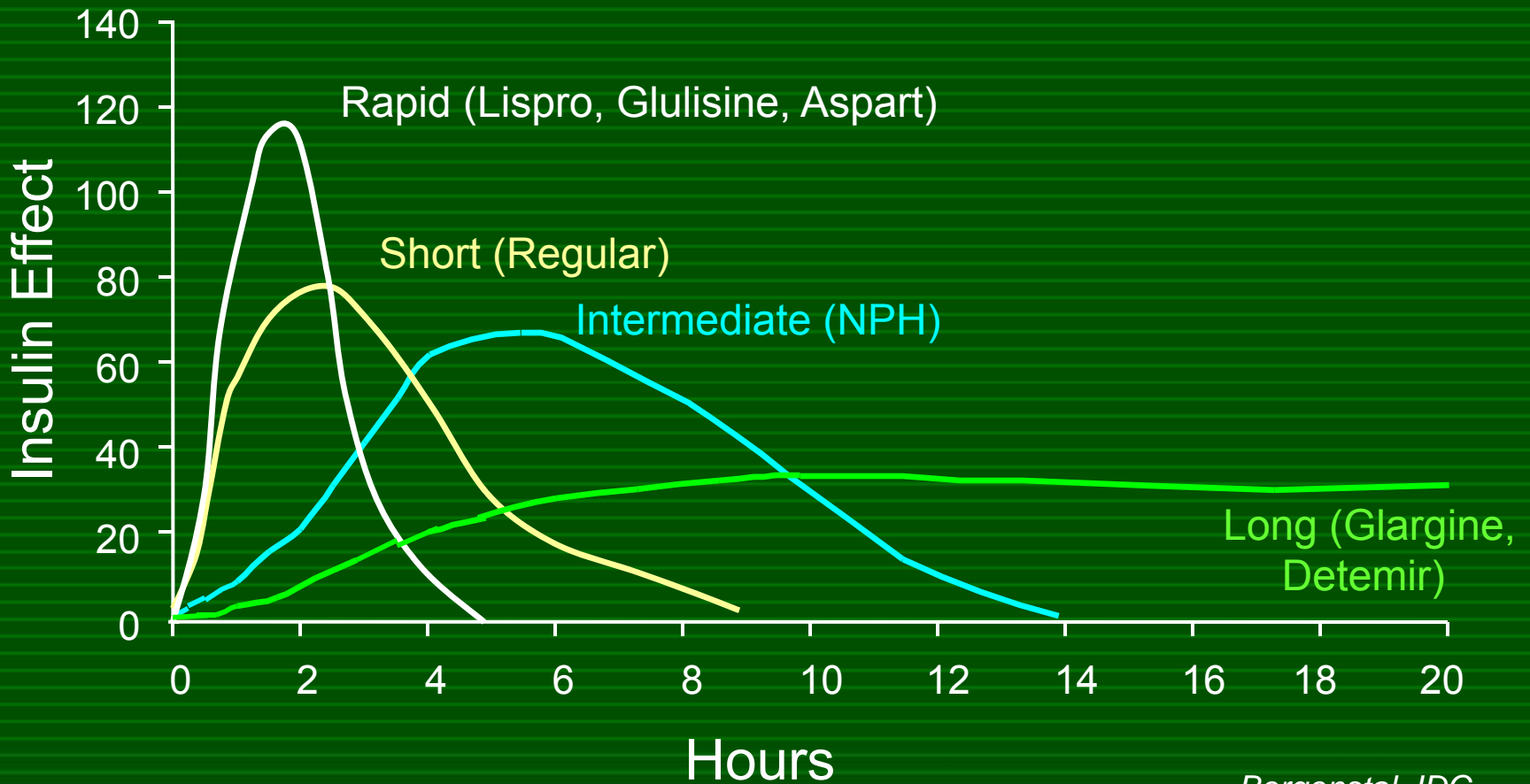
Insulin Therapy

- Modern insulins safe and predictable
- Most insulin types come in pen injectors
- Pen injectors easy to use, less cumbersome than vials/syringes

Types of Insulin

- Long-acting (basal) Insulin
 - Used once or twice daily in type 1 or type 2
 - “Background” insulin
- Short (Rapid) acting (bolus) Insulin
 - Taken with meals and snacks in type 1 or type 2
 - “Covers” food
- Combination of long-acting and-short acting common in type 1 and type 2 diabetes patients

Insulin Time Action Curves



Bergenstal, IDC

Types of Insulin

- Rapid acting
 - Insulin aspart (Novolog), Insulin lispro (Humalog), glulisine (Apidra)
 - Human Regular (R)

Types of Insulin

- Long acting (Basal) insulin
 - Insulin glargine (Lantus), Insulin detemir (Levemir)
 - Human NPH (N)

Case Study

- 54 y/o white male
- Diagnosed with type 2 diabetes after 2 fasting blood sugars of 154 and 142
- Also has high blood pressure and cholesterol disease (common in type 2)
- Physician has made treatment plan

Case Study

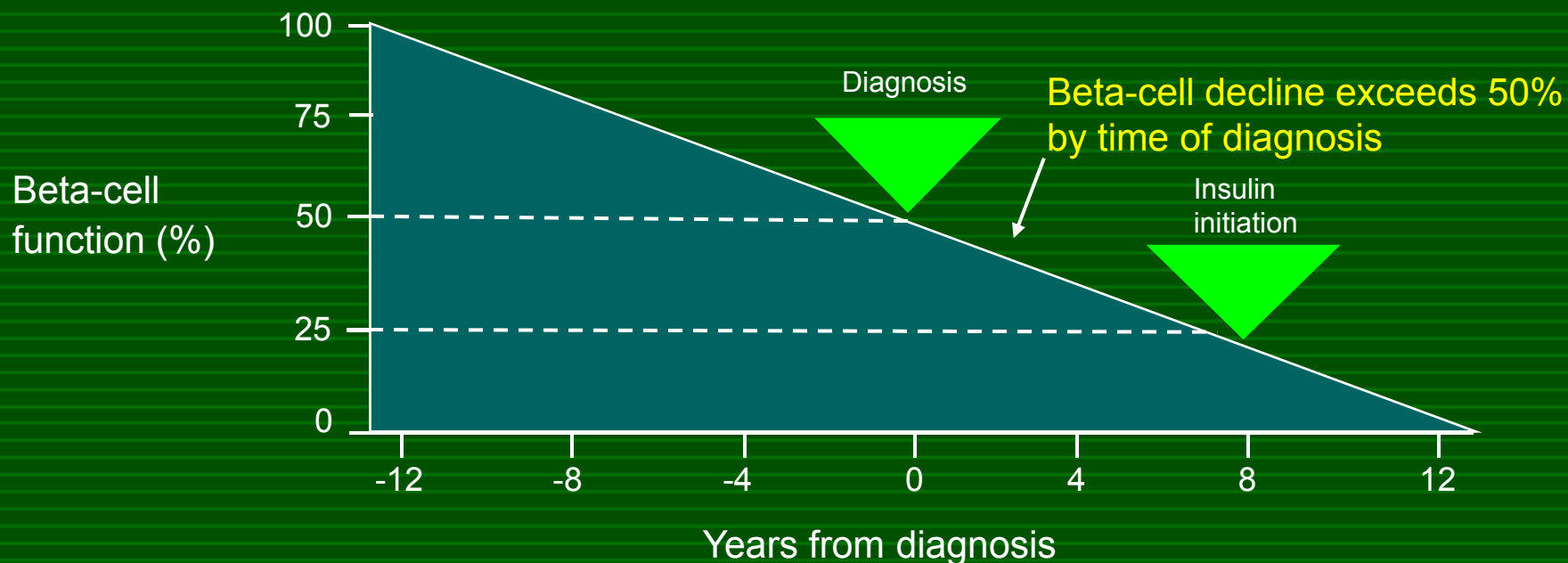
- Metformin 500 mg prescribed twice daily
- Referred to Diabetes Educator and Dietician for meal planning
- Recommend developing graduated exercise plan
- Six months after diagnosis, A1C = 6.8%
(target <7%)

Case Study

- Three years later, patients A1C has risen to 8.4% (target <7%)
- Blood pressure and cholesterol effectively treated
- Now what?

Beta-cell function declines as diabetes progresses

Beta-cell function decline over time



Lebovitz H. Diabetes Rev 1999;7:139-153.

Case Study

- Choices include
 - Adding a basal insulin once daily
 - Adding any other oral agent
 - Adding exenatide twice daily
- Any of these are good choices
- Choice may be made on individual factors

Case Study

- Basal insulin
 - *Advantages:* Once-daily, comes in pen, easy, likely good results, durable over time
 - *Disadvantages:* potential hypoglycemia (not difficult to manage/avoid), weight gain, likely will need combo with another insulin later (not a difficult transition)
- Additional oral agent
 - *Advantages:* Easy
 - *Disadvantages:* eventually lose effectiveness, weight gain (sulfonylureas, TZD's)

Case Study

- Other injectable (in this case, exenatide)
 - *Advantages:* Comes in pen, easy, may have weight loss
 - *Disadvantages:* eventually lose effectiveness, nausea, vomiting

Case Study

- Patient chose additional oral agent
- A1C:
 - 6 months later = 7.4% (target <7%)
 - 3 years later = 8.1% (target <7%)
- Basal insulin eventually started once daily
- Recall that pancreas produces less of its own insulin over time-will eventually need to be “replaced”

Summary

- Treatment of diabetes has evolved significantly in the last 10-15 years
- Can individualize treatment
- All type 1 patients need insulin at diagnosis
- Most type 2 patients will eventually need insulin in their treatment program