“Deprescribing” Insulin in Type 2 Diabetes

Caroline Trapp, DNP
Premier Internists
Southfield, MI
Physicians Committee
Washington, DC

Used with permission of Dan Piraro
Disclosure to Participants

Conflicts of interest and financial relationships:
None
Nada
Zip
Zero
Not a bit
Not any
Not an iota
Nil
Zilch
Naught

(Thank you, David Katz, MD)
Food is Medicine
Lyle from Rabbit Brush, NM

[Insert Video Clip]
Objectives

1. Discuss the utility of exogenous insulin to achieve patient-centered outcomes.
2. Explore methods to safely de-prescribe insulin.
3. Describe resources for clinical practice.
The Miracle of Insulin

Leonard Thompson
(1908 – 1935)

Dying from diabetes, he was the first human to get the extract in January 1922

Survived until the age of 27.

Type 1 vs. Type 2 Diabetes

Insulin-Dependent

Insulin-Required
A nurse in 1938 checks the amount of insulin in a needle. For many decades, the only insulin available to people with diabetes came from the pancreases of cattle or pigs. Insulin from animals is still available outside the U.S. — and cheaper than a recombinant DNA version.

Bettmann/Corbis
Oral medication only 58%

No medication 16%

Insulin only 12%

Insulin and oral medication 14%

# A1C reduction with glucose – lowering medications

<table>
<thead>
<tr>
<th>Oral agents</th>
<th>↓A1C (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfonylureas</td>
<td>1.5</td>
</tr>
<tr>
<td>Biguanides (metformin)</td>
<td>1.5</td>
</tr>
<tr>
<td>Glinides</td>
<td>1.0–1.5</td>
</tr>
<tr>
<td>Thiazolidinediones</td>
<td>0.8–1.0</td>
</tr>
<tr>
<td>DPP-IV inhibitors</td>
<td>0.5–0.9</td>
</tr>
<tr>
<td>α-Glucosidase inhibitors</td>
<td>0.5–0.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parenteral/inhaled agents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin</td>
<td>≥2.5</td>
</tr>
<tr>
<td>Inhaled insulin</td>
<td>1.5</td>
</tr>
<tr>
<td>GLP analogues</td>
<td>0.6</td>
</tr>
<tr>
<td>Amylin analogues</td>
<td>0.6</td>
</tr>
</tbody>
</table>

*Monotherapy
DPP = dipeptidyl peptidase; GLP = glucagon-like peptide
The Big Picture

Mortality Rates: How the U.S. Compares

Diabetes mellitus
Source: World Health Organization

- Japan
- United Kingdom
- Finland
- Norway
- France
- Switzerland
- Sweden
- Spain
- Australia
- Netherlands
- Germany
- Denmark
- Italy
- Canada
- United States
- Austria
- Portugal

Deaths per 100,000 in 2008 (age-adjusted)

Case Study – Mr. G

- 47 y.o., 10-year hx T2DM.
- HTN, elevated creatinine, obesity, depression
- 80 units basal insulin at bedtime
- 40 units bolus insulin at each meal
- A1c 10.2%; BMI 46
THE TOP TEN LIST

Reasons to Rethink Insulin
Reason # 10: Cost

$$$

Mr. G's co-pay on 1400 units of insulin a week = $400/month
Mean Expenditure per Patient (Private Insurance)

Insulin: 197% price increase in 11 years

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4886177/
Reason # 9: Higher Costs Ahead

No generic coming anytime soon.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4
Worldwide insulin market by value and market share by volume in 2011

Reason # 8:
“Evergreening”
Reason # 7: Adherence

“A substantial proportion of people with type 2 diabetes do not take medication as prescribed…. approximately (only) 60% of insulin doses.”


Mr. G. denied skipping doses; but others might, due to high cost, or side effects, such as weight gain and hypoglycemia.
Reasons # 6 & 7: Safety and Efficacy

• “Insulin is a treatment, not a cure.”
  Beran, Ewen & Laing, 2015
  Health Action International

It appears to be neither for Mr. G., on 200 units a day, in poor control.
Would more insulin improve his quality of life?
### Glycemic Recommendations for Nonpregnant Adults with Diabetes (1)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1C</strong></td>
<td>&lt;7.0%*</td>
</tr>
<tr>
<td>Preprandial capillary plasma glucose</td>
<td>80–130 mg/dL*</td>
</tr>
<tr>
<td></td>
<td>(4.4–7.2 mmol/L)</td>
</tr>
<tr>
<td>Peak postprandial capillary plasma glucose†</td>
<td>&lt;180 mg/dL*</td>
</tr>
<tr>
<td></td>
<td>(&lt;10.0 mmol/L)</td>
</tr>
</tbody>
</table>

*Goals should be individualized.
†Postprandial glucose measurements should be made 1–2 h after the beginning of the meal, generally peak levels in patients with diabetes.
Approach to the Management of Hyperglycemia

**Patient/Disease Features**

- **Risks associated with hypoglycemia & other drug adverse effects**
- **Disease Duration**
- **Life expectancy**
- **Important comorbidities**
- **Established vascular complications**
- **Patient attitude & expected treatment efforts**
- **Resources & support system**

**A1C 7%**

- more stringent
- less stringent

- low
- high
- newly diagnosed
- long-standing
- long
- short
- absent
- Few/mild
- severe
- absent
- Few/mild
- severe
- highly motivated, adherent, excellent self-care capabilities
- less motivated, nonadherent, poor self-care capabilities
- readily available
- limited

**American Diabetes Association Standards of Medical Care in Diabetes.**

Diabetes: Conventional HbA1c are being relaxed in various guidelines

<table>
<thead>
<tr>
<th>Major Comorbidity or Physiologic Age</th>
<th>Microvascular Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Absent or Mild</td>
</tr>
<tr>
<td>&gt;10 years of life expectancy</td>
<td>&lt;7%</td>
</tr>
<tr>
<td>Present</td>
<td>&lt;8%</td>
</tr>
<tr>
<td>5 to 10 years of life expectancy</td>
<td>&lt;8%</td>
</tr>
<tr>
<td>Marked</td>
<td>8-9%</td>
</tr>
<tr>
<td>&lt;5 years of life expectancy</td>
<td></td>
</tr>
</tbody>
</table>

(Veterans Affairs/Department of Defense 2010)
Intensive glycemic control reveals neutral effect on nonfatal CV events.

Feb. 1, 2016

“However, there was an increased risk for CV-related death, according to the researchers.”

## Tight Glycemic Control for Type 2 Diabetes (Over Five Years)

1 in 6 for hospitalization (hypoglycemia)

### Benefits in NNT

- None were helped (prevented death)
- None were helped (prevented stroke)
- None were helped (prevented heart attack)
- None were helped (prevented kidney failure)
- 1 in 250 were helped (prevented limb amputation)

### Harms in NNT

- 1 in 6* were harmed (severe hypoglycemia requiring hospitalization)

*This is a linear extrapolation to 5 years from 12 months, 3.5% per 12 months; at 10 years the rate would be 35% (NNH 3)

### Details for this Review


**Efficacy Endpoints:** Mortality, Heart attack, Stroke, Kidney Failure, Limb Amputation

Outcomes and Healthcare Resource Utilization Associated with Medically Attended Hypoglycemia in Older Patients with Type 2 Diabetes Initiating Basal Insulin in a US Managed Care Setting

Results: Of 31,000 patients (mean age 72 years [SD 9.2]), 3100 (10%) experienced [severe] hypoglycemia during the first year of basal insulin initiation.

After adjustment for demographic, comorbidity and medication history, hypoglycemia was associated with risk of hospitalization (HR 1.59; 95%CI:1.53-1.65) and death (HR 1.50; 95% CI:1.40-1.60).

Javier Escalada, Laura Liao, Chunshen Pan, Hongwei Wang & Mohan Bala (2016): Outcomes and Healthcare Resource Utilization Associated with Medically Attended Hypoglycaemia in Older Patients with Type 2 Diabetes Initiating Basal Insulin in a US Managed Care Setting, Current Medical Research and Opinion, DOI: 10.1080/03007995.2016.1189893
Outcomes that matter?

• Good numbers
• Quality and quantity of life

Mr. G’s Priorities:
1. Increase energy
2. Avoid kidney failure
3. Reduce medication expenses
Insulin treatment is neither durable in maintaining glycemic control nor is unique in preserving beta cells.

“Better clinical outcomes than those that occur with other antihyperglycemic regimens have not been shown.”

Reason # 4: Pharma marketing practices

Mr. G. does not want a clinician who is a shill for the pharmaceutical industry.
If all you have is a hammer, everything looks like a nail.
Expenditure by Type of Pharmaceutical Marketing (2011)

- Detailing (face-to-face sales and promotional activities)
- Samples (free medication provided to physicians)
- Educational and promotional meetings
- Promotional mailings
- Advertisements: medical journals and web
- Direct-to-consumer advertising

It is reasonable to reconsider prescribing patterns

To be approved, diabetes medications must lower blood glucose. The FDA does not require that they prevent complications or extend lives.

Ask your doctor if playing into the hands of the pharmaceutical industry is right for you.
Biopharmaceutical Research Companies Are Developing 180 Medicines to Treat Diabetes and Related Conditions

Nearly 25 million Americans are affected by diabetes—including 7 million people who are unaware they have the disease. One of the top 10 causes of death in the United States, diabetes has far-reaching implications for patients and their families and our health care system.

While healthy eating and exercise can help prevent and manage type 2 diabetes, medicines play a key role in helping reduce the risk of and treat the disease. For example, one medicine was found in studies to lower the risk by 31 percent. And in recent years, eight new classes of type 2 diabetes medicines have been approved by the Food and Drug Administration (FDA), giving patients and health care providers powerful new options to treat this chronic and devastating condition.

To build on progress to date and help further meet the challenges posed by diabetes, America’s biopharmaceutical research companies are developing 180 new medicines for type 1 and type 2 diabetes and diabetes-related conditions, such as chronic kidney failure due to diabetes and painful diabetic neuropathy.

Additionally, there are 200 active diabetes clinical trials in the United States, including 140 that have not yet started recruiting patients or are just now seeking volunteers to participate and another 60 that are active but not recruiting new patients. In addition to the critical role these trials play in the development and testing of new treatments, they represent potentially valuable therapeutic options for patients battling diabetes and diabetes-related conditions.

According to the Centers for Disease Control and Prevention (CDC), death rates for people with diabetes fell substantially—up to 40 percent—between 1997 and 2005. CDC links this decrease to improved cardiovascular medical treatment, better management of diabetes, and some healthy lifestyle changes.

Unfortunately, while the death rates due to diabetes are declining, the rate of new cases has been rising. The number of Americans diagnosed with diabetes has more than tripled since 1980, according to the CDC. Lifestyle choices can affect this increase. The CDC-led National Diabetes Prevention Program found that...

Contents
Recent Diabetes Medicine Approvals
Diabetes Medicines in the Pipeline
Early Diabetes Breakthroughs
Diabetes Medications
Improving Adherence
Treatment Intensification/
Clinical inertia
Facts About Diabetes in the United States
Medicines in Development
Glossary
Drug Development/
Approval Process
Independent Information about Drugs

Utilize non-commercial research to inform your prescribing preferences.

- **Prescrire**
  english.prescrire.org

- **Medical Letter**
  secure.medicalletter.org

- **Prescriber’s Letter**
  prescribersletter.therapeuticresearch.com

- **Pharmacist’s Letter**
  pharmacistsletter.therapeuticresearch.com

- **Up-to-Date**
  www.uptodate.com

- **Australian Prescriber**
  www.australianprescriber.com

- **Therapeutics Letter**
  http://www.ti.ubc.ca/therapeutics-letter/

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**Consumer Reports**

Did you know you have the right to question your doctor?

**PharmedOUT.ORG**

Top 5 questions to ask before any medical test or procedure at your next appointment.
Reasons # 3-1

Safer, less expensive, highly effective alternatives to insulin exist for people with type 2 diabetes.
Absolute number of events prevented by different interventions per 1000 patient years of treatment (data taken from Cholesterol Treatment Trialists’ Collaboration and Blood Pressure Lowering Treatment Trialists’ Collaboration).

- Per 4 mm Hg lower systolic blood pressure
- Per 1 mmol/L lower low density lipoprotein-cholesterol
- Per 0.9% lower glycated haemoglobin

Preiss D, Ray K K BMJ 2011;343:bmj.d4243
AACE 2016 Recommendations

LIFESTYLE THERAPY
RISK STRATIFICATION FOR DIABETES COMPLICATIONS

- **Nutrition**
  - Maintain optimal weight
  - Avoid trans fatty acids; limit saturated fatty acids

- **Physical Activity**
  - 150 min/week moderate exertion (e.g., walking, stair climbing)
  - Strength training
  - Increase as tolerated

- **Sleep**
  - About 7 hours per night

- **Behavioral Support**
  - Community engagement
  - Screen for mood disorders

- **Smoking Cessation**
  - No tobacco products

**Intensity Stratified by Burden of Obesity and Related Complications**

- Structured counseling
- Meal replacement
- Structured program
- Medical evaluation/dearance
- Medical supervision
- Screen for obstructive sleep apnea
- Refer to mental healthcare professional
- Behavioral therapy
- Structured programs

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Plant-Based Diets: A Physician’s Guide

Julieanna Hever, MS, RD, CPT

ABSTRACT

Because of the ever-increasing body of evidence in support of the health advantages of plant-based nutrition, there is a need for guidance on implementing its practice. This article provides physicians and other health care practitioners an overview of the myriad benefits of a plant-based diet as well as details on how best to achieve a well-balanced, nutrient-dense meal plan. It also defines notable nutrient sources, describes how to get started, and offers suggestions on how health care practitioners can encourage their patients to achieve goals, adhere to the plan, and experience success.

SUMMARY OF HEALTH BENEFITS

Plant-based nutrition has exploded in popularity, and many advantages have been well documented over the past several decades.¹ Not only is there a broad expansion of the research database supporting the myriad benefits of plant-based diets, but also health care practitioners are seeing awe-inspiring results with their patients across multiple unique subspecialties. Plant-based diets have recommendations¹⁵ for a heart-healthy diet to include no more than 5% to 6% of total calories from saturated fat, which is just the amount found naturally in a vegan diet (one consisting of no animal products).

- Dietary cholesterol: Human bodies produce enough cholesterol for adequate functioning. Although evidence suggests that dietary cholesterol may only be a minor player in elevated serum cholesterol levels and high blood pressure,¹⁶ growth factor-1, more is generated endogenously.¹¹ Fostering growth as a full-grown adult can promote cancer proliferation.
- Heme iron: Although heme iron, found in animal products, is absorbed at a higher rate than nonheme iron, found in plant-based and fortified foods, absorption of nonheme iron can be increased by pairing plant-based protein sources with foods high in vitamin C.²² Additionally, research suggests that excess iron is pro-oxidative²³ and may increase colorectal cancer risk²⁴ and promote atherosclerosis²⁵ and reduced insulin sensitivity.²⁶
- Chemical contaminants formed from high temperature cooking of cooked animal products: When flesh is cooked, compounds called polycyclic aromatic hydrocarbons (PAHs) are formed.²⁷
Case Study – Mr. G

- 47 y.o., 10-year Hx T2DM.
- HTN, obesity, depression, CRI
- 80 units basal insulin at bedtime
- 40 units bolus insulin at each meal
- A1c 10.2%; BMI 38

Diet history:
Had success with a whole food plant-based diet 8 years earlier, when he was on 3 oral agents and first told he needed insulin. Lost 60 pounds and was able to eliminate all medications.
Meet Mr. G – 10+ years of diabetes; 200 units of insulin/day

Now: no insulin or other medications.
Natural History of Type 2 Diabetes

Glucose (mg/dL)

Postprandial glucose
Fasting glucose

Insulin resistance
Insulin level

At risk for diabetes
β-cell dysfunction

Years

Relative to Normal

Conclusions – Deprescribing Insulin: Part 1

1. Insulin for type 2 diabetes will very effectively reduce blood glucose levels. However, not every patient will benefit, and some will suffer a range of harms. These range from moderate inconvenience to life-threatening emergencies.

2. Lifestyle intervention is the safest way to lower A1c.

3. Patients should be fully informed.
Part 2 - Deprescribing
Approach To Starting and Adjusting Insulin in Type 2 Diabetes

**Basal insulin**
(usually with metformin + other non-insulin agent)

- **Start:** 10 U/day or 0.1–0.2 U/kg/day
- **Adjust:** 10–15% or 2–4 U once-twice weekly to reach FBG target.
- **For hypo:** Determine and address cause; 
  - dose by 4 U or 10–20%.

If not controlled after FBG target is reached (or if dose >0.6 U/kg/day), treat PPG excursions with mealtime insulin. (Consider initial GLP-1-RA trial.)

**Add 1 rapid insulin injection before largest meal**
- **Start:** 4 U, 0.1 U/kg; or 10% basal dose. If A1C <8%, consider basal by same amount.
- **Adjust:** 
  - dose by 1–2 U or 10–15% once-twice weekly until SMBG target reached.
  - For hypo: Determine and address cause; corresponding dose by 2–4 U or 10–20%.

If not controlled, consider basal bolus.

**Add ≥2 rapid insulin injections before meals ("basal–bolus")**
- **Start:** 4 U, 0.1 U/kg; or 10% basal dose/meal. If A1C <6%, consider basal by same amount.
- **Adjust:** 
  - dose by 1–2 U or 10–15% once-twice weekly until SMBG target reached.
  - For hypo: Determine and address cause; corresponding dose by 2–4 U or 10–20%.

If not controlled, consider basal bolus.

**Change to premixed insulin twice daily**
- **Start:** Divide current basal dose into 2/3 AM, 1/3 PM or 1/2 AM, 1/2 PM.
- **Adjust:** 
  - dose by 1–2 U or 10–15% once-twice weekly until SMBG target reached.
  - For hypo: Determine and address cause; corresponding dose by 2–4 U or 10–20%.

If not controlled, consider basal bolus.

---

**Flexibility**
- more flexible
- less flexible

**Complexity**
- low
- mod.
- high
Deprescribing

- reducing inappropriate polypharmacy the process of deprescribing
- deprescribing
- deprescribing medication
- deprescribing medication elderly
- review deprescribing
- elderly deprescribing
- polypharmacy deprescribing
- deprescribing trials
- deprescribing elderly
- polypharmacy the elderly and deprescribing
- deprescribing jama
- medication review deprescribing
- deprescribing review
- frailty polypharmacy and deprescribing
- scott deprescribing
- deprescribing for older patients
- deprescribing palliative
- describing deprescribing
- statin deprescribing
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The potential for deprescribing in care home residents with Type 2 diabetes.

Andresen LM¹, Kiome RI², Solvik UØ², Houghton J³, Desborough JA⁴.

Abstract

Background Type 2 diabetes is a common diagnosis in care home residents that is associated with potentially inappropriate prescribing and thus risk of additional suffering. Previous studies found that diabetes medicines can be safely withdrawn in care home residents, encouraging further investigation of the potential for deprescribing amongst these patients. Objectives Describe comorbidities and medicine use in care home residents with Type 2 diabetes; identify number of potentially inappropriate medicines prescribed for these residents using a medicines optimisation tool; assess clinical applicability of the tool. Setting Thirty care homes for older people, East Anglia, UK. Method Data on diagnoses and medicines were extracted from medical records of 826 residents. Potentially inappropriate medicines were identified using the tool ‘Optimising Safe and Appropriate Medicines Use’. Twenty percent of results were validated by a care home physician. Main outcome measure Number of potentially inappropriate medicines. Results The 106 residents with Type 2 diabetes had more comorbidities and prescriptions than those without. Over 90% of residents with Type 2 diabetes had at least one potentially inappropriate medication. The most common was absence of valid indication. The physician unreservedly endorsed 39% of the suggested deprescribing, and would consider discontinuing all but one of the remaining medicines following access to additional information. Conclusion UK care home residents with Type 2 diabetes had an increased burden of comorbidities and prescriptions. The majority of these patients were prescribed potentially inappropriate medicines. Validation by a care home physician supported the clinical applicability of the medicines optimisation tool.

KEYWORDS: Care homes; Deprescribing; Medicines optimisation tool; Pharmacists; Potentially inappropriate medicines; Type 2 diabetes mellitus

PMID: 27241345    PMCID: PMC4929175    DOI: 10.1007/s11096-016-0323-4
Algorithm to Deprescribe Insulin

• Review of the literature: None Found

Recommended reading:
Dr. Mark Sklar

- BG <65 mg/dL x1 without clear explanation, or 66-99 mg/dL on 2 consecutive tests, decrease insulin by 20%.

Dana Armstrong, RD, CDE

Reduces medication in consultation with MD

How do I deprescribe (as an NP in an Internal Medicine practice)?

• E & M Codes (99212-99215) for Time Spent Counseling & Education
• Patient is committed to and prepared to begin a whole food, plant-based diet.
• Individualized approach with regards to what to reduce or discontinue first, and how fast.
• Know the medications:
  – Risk of hypo
  – Cost
  – Efficacy
  – Other side effects/contraindications
  – Patient preference
• Don’t oversell – some will still need medication to reach targets.
The Power Plate

- Whole grains
- Vegetables
- Legumes (beans)
- Fruits

- Small amounts of nuts and seeds
- Vitamin B12
Confirm that the patient knows how to recognize and treat hypoglycemia.
How do I deprescribe (as NP in internal medicine practice)?

• Establish target blood sugar ranges (@100-180?)
  • A1c of 7.0 is equal to an average blood sugar of 154
• Establish a BG number at which to reduce # of units
• Establish a # of units to reduce insulin daily/weekly (this rarely works for me – “Art, not Science”)
• Provide phone number to call with questions 😊
DIY Insulin Reduction

(Not recommended; I offer this as evidence that people with type 2 diabetes can sometimes eliminate the need for insulin, even after years of DM)
7 diabetics in this photo, 107 years of battling diabetes, 1 bought with pancreatic cancer, 1 double bypass, 2 amputations, 2 individuals going blind, 2 heart attacks, 4 organ transplants, 12 years of dialysis.
Precautions for Significant Diet Shift

• Watch for hypoglycemia.
  – Review/instruct on signs and symptoms
  – Patients should be prepared to treat

• Watch for hypotension – may need less med.

• Supplement with Vitamin B12 500 mcg/d.

• Encourage follow-up with health care professional.
HEALTH AND FITNESS

One more reason...

Common diabetes medication among drugs found in Lake Michigan
#PlantBasedRx

NAME: ___________________________ DATE: __________

R
✓ Build meals around vegetables, fruits, whole grains, and legumes.
✓ Take a vitamin B12 supplement.

NOTES:

Physicians Committee
for Responsible Medicine

Repeat daily to get healthy and stay healthy.

SIGNED BY: ___________________________

ADDITIONAL RESOURCES:
Download plant-based meal plans and recipes from 21DayKickstart.org.
Learn more about the link between diet and health at NutritionFacts.org.
FOOD FOR LIFE
Diabetes Initiative

NUTRITION AND COOKING

• nutrition information
• cooking demos
• delicious recipes
• supportive group setting
• food sampling

44507 Manitou Drive
Clinton Twp., MI 48038

7:00-9:00 PM

Friday, Jan. 8
Introduction to How Foods Fight Diabetes

Friday, Jan. 15
The Power of Your Plate and Grocery Cart

Friday, Jan. 22
Understanding Type 2 Diabetes

Friday, Jan. 29
Designing a Diet for Max Weight Control

$120 for this 4-class series

Join Food for Life
Instructors
Kim & Marc Ramirez

Chickpea and Bean

Physicians Committee
for Responsible Medicine

The Food for Life program is a direct service nutrition education program of the Physicians Committee for Responsible Medicine. PCRM is a 501(c)3 nonprofit that promotes preventive medicine, conducts clinical research, and encourages higher standards for ethics and accountability in medicine. www.fflclasses.org

To register email us at chickpeaandbean1@gmail.com

586-215-2145
First of Every Month!

21-DAY VEGAN KICKSTART

21DayKickStart.org
Conclusions

1. T2DM is largely related to food.
2. Insulin for type 2 diabetes will very effectively reduce blood glucose levels. However, not every patient will benefit, and some will suffer a range of harms. These range from moderate inconvenience to life-threatening emergencies.
3. Food can prevent and reverse type 2 diabetes, without any risk of harm, and with benefits that go beyond blood glucose control.
4. Patients should be fully informed.
Paradigm Shift
Additional References

# Oral Diabetes Medications

<table>
<thead>
<tr>
<th>Class/Main Action</th>
<th>Name(s)</th>
<th>Daily Dose Range</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biguanides</td>
<td>metformin (Glucophage)</td>
<td>500 – 2500 mg (usually BID w/meal)</td>
<td>Side effects: nausea, bloating, diarrhea. Use XR to minimize. Lactic acidosis precaution: avoid in pts with creat &gt; 1.4 women, 1.5 men, during illness or surgery. Benefits: decreased cholesterol, no wt gain or hypoglycemia. Lowers A1c 1.0% – 2.0%.</td>
</tr>
<tr>
<td></td>
<td>Extended Release-XR (Glucophage XR) (Glumetza) (Fortamet)</td>
<td>(1x daily w/dinner) 500 – 2000 mg 500 – 2000 mg 500 – 2500 mg</td>
<td></td>
</tr>
<tr>
<td>Sulfonylureas</td>
<td>glyburide: (Micronase, Diabeta) (Glynase)</td>
<td>1.25 – 20 mg 0.75 – 12 mg</td>
<td>Can take once or twice daily before meals. Side effects include hypoglycemia and weight gain. Eliminated via kidney. Caution: Glyburide most likely to cause hypoglycemia. Lowers A1c 1.0% – 2.0%.</td>
</tr>
<tr>
<td></td>
<td>glipizide: (Glucotrol) (Glucotrol XL)</td>
<td>2.5 – 40 mg 2.5 – 20 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>glimepiride (Amaryl)</td>
<td>1.0 – 8 mg</td>
<td></td>
</tr>
<tr>
<td>DPP – 4 Inhibitors</td>
<td>sitagliptin (Januvia)</td>
<td>100 mg daily (eliminated via kidney*)</td>
<td>*If creatinine elevated, see pkg insert for dosing info. No wt gain or hypoglycemia. Side effects include nasopharyngitis, headache and upper-respiratory tract infection. Report signs of pancreatitis (abdominal pain, nausea, vomiting). Lowers A1c 0.6% – 0.8%.</td>
</tr>
<tr>
<td></td>
<td>saxagliptin (Onglyza)</td>
<td>Up to 5 mg daily (eliminated via kidney*, feces)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>linagliptin (Tradjenta)</td>
<td>5 mg daily (eliminated via feces)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>alogliptin (Nesina)</td>
<td>25 mg once daily (eliminated via kidney)</td>
<td></td>
</tr>
</tbody>
</table>

More medications on back. Note: These meds are for people with Type 2 diabetes and should not be used during pregnancy. Content is for educational purposes only: please consult prescribing information for details.

REV 01/2015 ©2016
<table>
<thead>
<tr>
<th>Class/Main Action</th>
<th>Name(s)</th>
<th>Daily Dose Range</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SGLT2 Inhibitors</strong></td>
<td>Canagliflozin (Invokana)</td>
<td>100 – 300 mg 1x daily</td>
<td>For all, monitor B/P, K+ and renal function. If GFR&lt;45, stop Invokana. If GFR&lt;60, stop Farxiga. Do not start pts w/ GFR&lt;45 on Jardiance. Side effects: hypotension, UTIs, increased urination, genital infections. Avoid Farxiga in pts w/ bladder cancer. Lowers A1c 0.7% – 1.5%, lowers wt 1 – 3 lbs.</td>
</tr>
<tr>
<td></td>
<td>Dapagliflozin (Farxiga)</td>
<td>5 – 10 mg 1x daily</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Empagliflozin (Jardiance)</td>
<td>10 – 25 mg 1x daily</td>
<td></td>
</tr>
<tr>
<td><strong>Thiazolidinediones “TZDs”</strong></td>
<td>pioglitazone (Actos)</td>
<td>15 – 45 mg daily</td>
<td><strong>Black Box Warning:</strong> TZDs may cause or worsen CHF. Monitor for edema and weight gain. Increased peripheral fracture risk. <em>Actos may increase risk of bladder cancer.</em> Lowers A1c 0.5% – 1.0%.</td>
</tr>
<tr>
<td></td>
<td>rosiglitazone (Avandia)</td>
<td>4 – 8 mg daily</td>
<td></td>
</tr>
<tr>
<td><strong>Glucosidase Inhibitors</strong></td>
<td>acarbose (Precose)</td>
<td>25 – 100 mg w/meals; 300 mg max daily dose</td>
<td>Start low dose, increase at 4-8 wk intervals to decrease GI effects. Caution with liver or kidney problems. In case of hypo, treat w/ glucose tabs. Lowers A1c 0.5– 1.0%.</td>
</tr>
<tr>
<td></td>
<td>miglitol (Glyset)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dopamine Receptor Agonists</strong></td>
<td>bromocriptine mesylate— Quick Release “QR” (Cycloset)</td>
<td>1.6 to 4.8 mg a day (each tab 0.8 mg)</td>
<td>Take within 2 hrs of waking. Side effects: nausea, headache, fatigue, hypotension, syncope, somnolence. Lowers A1c 0.6% – 0.9%.</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td><strong>Meglitinides</strong></td>
<td>repaglinide (Prandin)</td>
<td>0.5 – 4 mg w/meals (metabolized in liver)</td>
<td>Take before meals. Side effects may include hypoglycemia and weight gain. Lowers A1c 1.0% – 2.0%.</td>
</tr>
<tr>
<td></td>
<td>nateglinide (Starlix)</td>
<td>60 – 120 mg w/meals (eliminated via kidney)</td>
<td></td>
</tr>
</tbody>
</table>

Diabetes Education Services
(530) 893-8635
Beverly Dyck Thomassian
RN, MPH, BC-ADM, CDE

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DiabetesEd.Net
# Insulin Pocket Card

<table>
<thead>
<tr>
<th>Action</th>
<th>Insulin Name</th>
<th>Onset</th>
<th>Peak</th>
<th>Effective Duration</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolus</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rapid Acting Analogs</td>
<td>Aspart (Novolog)</td>
<td>5 - 15 min</td>
<td>30 - 90 min</td>
<td>&lt; 5 hrs</td>
<td><strong>Bolus</strong> insulin lowers after-meal glucose. Post meal BG reflects efficacy.</td>
</tr>
<tr>
<td></td>
<td>Lispro (Humalog)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glulisine (Apidra)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Acting</td>
<td>Regular*</td>
<td>30 - 60 min</td>
<td>2 - 3 hrs</td>
<td>5 - 8 hrs</td>
<td></td>
</tr>
<tr>
<td><strong>Basal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>NPH</td>
<td>2 - 4 hrs</td>
<td>4 - 10 hrs</td>
<td>10 - 16 hrs</td>
<td><strong>Basal</strong> insulin controls BG between meals and nighttime. Fasting BG reflects efficacy.</td>
</tr>
<tr>
<td>Long Acting</td>
<td>Detemir (Levemir)</td>
<td>3 - 8 hrs</td>
<td></td>
<td>6 - 24 hrs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glargine (Lantus)*</td>
<td></td>
<td></td>
<td>No peak</td>
<td><strong>Side effects</strong>: hypoglycemia, weight gain.</td>
</tr>
<tr>
<td></td>
<td>Glargine (Basaglar)</td>
<td>2 - 4 hrs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Degludec (Tresiba)*</td>
<td>~ 1 hr</td>
<td></td>
<td></td>
<td><strong>Typical dosing</strong>: range: 0.5-1.0 units/kg body wt/day. Discard opened insulin vials after 28 days.</td>
</tr>
<tr>
<td><strong>Basal + Bolus</strong></td>
<td>Combo of NPH + Reg 70/30 = 70% NPH + 30% Reg 50/50 = 50% NPH + 50% Reg</td>
<td>30 - 60 min</td>
<td></td>
<td>10 - 16 hrs</td>
<td></td>
</tr>
<tr>
<td>Intermediate + short</td>
<td>Novolog® Mix - 70/30</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Humalog® Mix - 75/25 or 50/50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate + rapid</td>
<td>Ryzodeg Mix 70/30 (degludec/aspart)</td>
<td>5 - 15 min</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Concentrated versions of these insulins are available.

*Insulin action times can vary with each injection, time periods listed here are general guidelines only; please consult prescribing information for details.
### Inhaled Insulin

<table>
<thead>
<tr>
<th>Action</th>
<th>Insulin Name</th>
<th>Dose Range</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolus – Rapid-acting</td>
<td>Afrezza Inhaled regular human insulin</td>
<td>4, 8, and 12 unit cartridges before meals</td>
<td>15 mins</td>
<td>1 hr</td>
<td>3 hrs</td>
<td>Assess lung function before starting. Avoid in chronic lung disease — <strong>acute bronchospasm risk</strong>. Side effects: hypoglycemia, cough, throat irritation.</td>
</tr>
</tbody>
</table>

### Injectables That Lower Glucose

<table>
<thead>
<tr>
<th>Class/Main Action</th>
<th>Name</th>
<th>Dose Range</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLP-1 Agonist</td>
<td>exenatide (Byetta)</td>
<td>5 or 10 mcg BID (renally excreted)</td>
<td><strong>Side effects for all:</strong> Nausea, vomiting, weight loss, injection site reaction. Report signs of acute pancreatitis (severe abdominal pain, vomiting), stop med. <strong>Black box:</strong> Thyroid C-cell tumor warning for liraglutide, exenatide XR, albiglutide, and dulaglutide (avoid if family history of medullary thyroid cancer, notify MD of hoarseness, throat lump).</td>
</tr>
<tr>
<td></td>
<td>exenatide XR (Bydureon)</td>
<td>2mg 1x a week (renally excreted)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>liraglutide (Victoza)</td>
<td>0.6 - 1.8 mg daily</td>
<td></td>
</tr>
<tr>
<td></td>
<td>albiglutide (Tanzeum)</td>
<td>30 and 50 mg 1x a week pen injector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>dulaglutide (Trulicity)</td>
<td>0.75 and 1.5 mg 1x a week pen injector</td>
<td></td>
</tr>
<tr>
<td>Amylin Mimetic</td>
<td>pramlintide (Symlin)</td>
<td>Type 1: 15 - 60 mcg; Type 2: 60 - 120 mcg immediately before major meals</td>
<td>**For Type 1 or 2 on insulin. ** <strong>Black box warning:</strong> severe hypoglycemic risk 3 hrs post injection. Prevent hypoglycemia, decrease insulin dose when starting pramlintide. Side effects: nausea, weight loss.</td>
</tr>
</tbody>
</table>

*The information listed here are general guidelines only; please consult prescribing information for details.*
What is possible. Meet the “first vegan Navajo baby” – now a toddler!

Nevaeh Yazzie-Manuelito
Born Jan. 17, 2015