Helping with Diabetes – Avoiding Harm

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Carol Greenlee MD FACP

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- I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.
A few things to think about with diabetes...

How can we help our patients with diabetes avoid the **harms** of diabetes?

What does the A1c tell you?

Why do my patients with diabetes always seem to get worse over time?

How do I get my patients with diabetes to do what I tell them?

Our main focus – Avoid harm of **hyperglycemia**

**Major Complications of Diabetes**

**Microvascular**

- **Eye**: High blood glucose and high blood pressure can damage eye blood vessels, causing retinopathy, cataracts, and glaucoma.

- **Kidney**: High blood pressure damages small blood vessels and excess blood glucose over time can damage the kidneys, resulting in nephropathy.

- **Neuropathy**: High blood glucose damages nerves in the peripheral nervous system. This may result in pain and/or numbness. Feet wounds may go undetected, get infected, and lead to gangrene.

**Macrovascular**

- **Brain**: Increased risks of stroke and cardiovascular diseases, including transient ischemic attack, cognitive impairment, etc.

- **Heart**: High blood pressure and insulin resistance increase risk of coronary heart disease.

- **Extremities**: Peripheral vascular disease results from narrowing of blood vessels, increasing the risk for reduced or lack of blood flow in legs. Foot wounds are likely to heal slowly contributing to gangrene and other complications.

Hyperglycemia defines Diabetes

- Currently main focus in diabetes care is on reducing hyperglycemic acute & chronic complications
  - Can take up to 9 to 20 years to develop chronic complications of hyperglycemia (youth < elderly)
    - Metabolic memory (“Legacy Effect”) – a finite period of intensive control provided benefits that extended for decades after that control ended
  - Tight (“intensive”) glycemic control advocated to prevent the complications from hyperglycemia
  - ADA Standards of Care: “A reasonable A1c goal for many nonpregnant adults is <7%.”

HbA1c is Glycosylated Haemoglobin

Hemoglobin inside RBC
The average RBC life span is 3 months

The HbA1c test reports the amount of HbA1c as a proportion of the total haemoglobin

- 7%
- 9%
- 14%

1976 paper ➔ “The Memory Test”

“The Cheat Test”

From: https://www.slideshare.net/PeninsulaEndocrine/new-hb-a1c-numbers-presentation
A1c correlates with & predicts complications

![Graph showing correlation between A1c and complications]

A 1% point reduction lowers the risk of serious complications by 40-50%

**A good population metric**


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Some caveats for A1c for **individual** patients

- **Assay Accuracy** (how accurately reflects actual average glucose)
  - Anything that lengthens or shortens the RBC lifespan or alters glycosylation rate or interferes with assay
    - Interfering substances/conditions
    - Age and ethnic/race difference – A1c higher for average BG
- **Assay Precision** (how precise or reproducible is the result)
  - Having a target range is probably better than a cut-point
- **Glucose Variability** (daily ups & downs) not represented
- **Short-term change in glucose control** not reflected
  - Start prednisone or atypical anti-psychotic med that raise BGs
  - Start new diet, exercise or medication that lowers glucose levels
- **Need for individualized targets**
  - Based on benefits vs risk of tight control
Accuracy Issues with A1c assays

- **Assay accuracy** (how well the A1c result represents actual glycemia (blood glucose levels))
- **RBC life span**
  - Iron deficiency (increased RBC lifespan - increased A1c)
  - Sickle Cell trait (reduced RBC lifespan - lower A1c)
- **Altered glycosylation rates**
- **Other genetic or environmental factors**
- **Interfering substances/conditions**
  - Abnormal Hemoglobin molecules
  - Uremia
- **Age and ethnic/race difference**
  - Different alignment with "estimated glucose"  
    - African American: A1c ~0.4 higher for same level of blood sugars  
    - Elderly reported to have higher A1c as well

[Table of Conditions Associated with Falsey Elevated or Lowered A1c]

Assay Precision

From: https://slideplayer.com/slide/15740866/

Glucose Variability

Help from Technology

- “Artificial Pancreas”
  - Continuous Subcutaneous Insulin Infusion (CSII)
    - Insulin pumps
  - Continuous Glucose Monitoring (Sensor) (CGM)

- CGM for T2DM & T1DM
  - Example – Freestyle Libre
    - “Flash” glucose monitoring

Can provide a more accurate & complete picture

From: https://www.niddk.nih.gov/health-information/diabetes/overview/managing-diabetes/continuous-glucose-monitoring
And https://www.freestylelibre.us/

Ambulatory Glucose Profile (AGP)

Need for Individualized Targets – Clinical Equipoise in setting glycemic goals

No single HbA1c level is appropriate for all patients…

- “we should abandon the notion that HbA1c levels ≤7% are well controlled and levels > 7% are uncontrolled.”

- This arbitrary dichotomy does not adequately portray whether we are optimizing
  - the benefits of treatment,
  - quality of life, and
  - value for individuals
Individualized glucose targets


Hypoglycemia Stats

- Leading cause of ED & Hospital Admissions for people with diabetes — (T2DM, not just T1DM)
- ~300,000 ED visits annually for Hypoglycemic events for T1DM and T2DM
- >30,000 Hospitalizations per year
  - Hospitalization as a result of hypoglycemia is associated with
    - 18.1% 30-day readmission rate and
    - 5% 30-day mortality rate (up to 30% in elderly patients)
- In the elderly → 105/100,000 person-years admissions for hypoglycemia vs 70/100,000 person-years for hyperglycemia

- Second leading Adverse Drug Event concern
  - Patients on insulin experience on average of 24 hypoglycemic episodes per year, ranging from mild to severe
Hospital Admissions for Hypoglycemia Now Exceed Those for Hyperglycemia in Medicare Beneficiaries
Rita F. Redberg, MD, MSc  JAMAInternMed.2014;174(7):1125

…From 1999 to 2011 rates of hospital admissions for hypoglycemia have risen by 11.7% in US Medicare beneficiaries.
• There were 40% more admissions for hypoglycemia than for hyperglycemia over the 12-year period.
• The 1-year mortality rate after a hypoglycemia admission was higher (22.6%) than the rate after a hyperglycemia admission (17.6%) in 2010.

Our patients are now more likely to experience adverse events related to overtreatment of diabetes mellitus. Striving for too low a hemoglobin A1c target level puts patients at risk for this dangerous adverse effect.

Defense against Hypoglycemia
Counter-Regulatory Hormones

Hypoglycemia in Patients with Diabetes

Hypoglycemia defined as blood glucose <70 for people with diabetes = “Low Blood Sugar” – recommended classification:

- **Level 1 Hypoglycemia**: measured glucose <70 but >54 mg/dl
- **Level 2 Hypoglycemia**: glucose < 54 mg/dl
- **Level 3 (Severe) Hypoglycemia**: a severe event characterized by altered mental and/or physical status requiring assistance

- **Asymptomatic Hypoglycemia -Hypoglycemic Unawareness** defined as not getting the adrenergic & cholinergic warning symptoms of hypoglycemia
- **Relative or Pseudo-Hypoglycemia** - Some patients, especially with T2DM & poorly controlled DM, get symptoms of hypoglycemia with a blood sugar >70
- **Fear of Hypoglycemia** — can be cause for high blood sugars and/or roller-coaster blood sugars
Hypoglycemic Effects

- Neurocognitive effects
  - cognitive effects & impairment, coma, seizures, brain dead, dementia
- Increased falls and trauma
  - Impaired driving/ accidents
  - Fractures, lacerations, Traumatic Brain Injury
- Increased CVD and Mortality
  - Acute Ischemia
  - Atherogenic effects
    - Pro-inflammatory/ Pro-coagulant
    - Greater at BG 50 than BG 200;
    - Elevated for >7-8 days after event
  - Arrhythmogenic effects
    - “Dead in bed”

From: https://www.murphy-law.com/bike-accidents/

From: https://www.top10home Remedies.com/home-remedies/home-remedies-clogged-arteries.html

Mechanisms by which hypoglycemia may affect cardiovascular events.

Desouza C V et al. Dia Care 2010;33:1389-1394

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Hypoglycemia Risk
-in patients taking *Insulin & Insulin secretagogues*

- Intensive or tight control & targets
  - Risk in T2DM: in ACCORD trial highest risk with A1c >9%
- Risk higher with longer duration of diabetes
- Increased in the elderly
  - especially if cognitive impairment (*vicious cycle*)
- Renal and/or Hepatic Impairment
  - Prolonged t 1/2 and reduced Gluconeogenesis (GNG)
- Medication errors & safety
  - literacy, numeracy, lack of education
- Missed / irregular meals
  - food insufficiency
- EtOH (alcohol), opioids, benzodiazepines
  - Reduced counter-regulatory responses
  - EtOH blocks Hepatic glucose output
- Exercise / Increased activity
  - Increased glucose utilization and insulin sensitivity (3days)
  - Blunted counter-regulatory response (autonomic failure)

Strongest Risk Factor?

- In patients with T2DM on insulin and/or sulfonylurea meds (glyburide, glipizide, Amaryl -glimepiride) – what do you think is the leading risk factor for hypoglycemia (low blood sugar)?
Causes of Severe Hypoglycemia

Irregular or Insufficient Food Intake

- Missed / Delayed / Reduced Meals
- Job demands, travel, meetings, etc.
- Fasting for tests or procedures
- Illness (eat less or unable to eat or vomiting)
- Lack of nutritional knowledge (carbs) (eggs & bacon)
  - Struggles with numeracy (carb counting & insulin dose)
- Reduced ability to shop for or prepare meals
  - Aging, widower, loss of vision, amputations, etc.
- Lack of food (food insecurity)
  - Insufficient money or SNAP funds for purchasing food
Hypoglycemia and food Insecurity

Does your care team have an approach to help prevent harm from hypoglycemia?

Clinician & Care Team Education

- Awareness that people with T2DM can have serious hypoglycemic & harm from hypoglycemia
- Symptoms and consequences
  - How to recognize hypoglycemia
  - When to think about it and ask about it
- How to treat hypoglycemia
- How to teach patients & families / caregivers about hypoglycemia
- Appropriate targets (risk vs benefit)
- Medication management

**ADA standards of care for Hypoglycemia**

- **Recommendation** - Individuals at risk for hypoglycemia should be *asked* about symptomatic and asymptomatic hypoglycemia at each encounter
  - *patients on insulin or sulfonylurea/glinide medications*

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**Symptoms of Hypoglycemia**

**Early “mild” symptoms (adrenergic/cholinergic):**
- Sudden moodiness or confusion
- Dizziness
- Feeling shaky or trembling
- Hunger
- Headaches
- Irritability
- Pounding heart; racing pulse
- Skin turning pale
- Sweating or clammy
- Weakness
- Anxiety

**Late severe symptoms (neurocognitive):**
- Poor coordination
- Poor concentration or confusion
- Difficulty speaking or slurred speech
- Numbness around mouth & lips or other localized neurologic symptoms
- Seizures or convulsions
- Passing out
- Coma
- Death
Symptoms of Hypoglycemia

Nighttime symptoms:

- Damp sheets or bed clothes due to perspiration
- Nightmares or bad dreams
- Tiredness
- Irritability, headache or confusion upon waking
- Not waking up


ADA standards of care for Hypoglycemia

- Recommendation - Counsel patients to treat hypoglycemia with fast-acting carbohydrate
  - *Pure Glucose (15-20 g) is the preferred treatment* for the conscious individual with hypoglycemia (glucose alert value of <70) although any form of carbohydrate that contains glucose may be used.
  - Fifteen minutes after the treatment, if SMBG shows continued hypoglycemia, the treatment should be repeated.
  - Once SMBG returns to normal, the individual should consume a meal or snack to prevent recurrence of hypoglycemia – ongoing insulin activity or insulin secretagogues
Sources of Carb (want “rapid” Carbs for fast absorption)

- Great Sources of Carbohydrate for a Low Blood Sugar
  - Glucose gels (cake gels) (absorbed from lining of mouth)
  - Glucose tabs
  - Smarties
  - Pixie Sticks
  - These are all dextrose and glucose and are broken down and in your system within 10 minutes. Dextrose is very similar to glucose in terms of its molecular structure, which makes it a fast source of carbohydrate for a low.

- Pretty Good Sources of Carbohydrate for a Low Blood Sugar
  - Juice box
  - Soda
  - Dried fruit
  - Jelly beans
  - These sources can take at least 20 minutes to break down and get into your bloodstream (e.g. jelly beans have a lot of additives and fillers, which your body has to break down first, before digesting the carbohydrates)

- Not-So-Great Sources of Carbohydrate for a Low Blood Sugar
  - Milk
  - Peanut Butter Sandwiches
  - Chocolate bars
  - Cookies
  - Ice cream
  - These sources of carbohydrates are loaded with fats and proteins, which will slow down the digestion process and delay your body’s ability to get that glucose into your bloodstream. *In T2DM protein can further increase insulin release

ADA standards of care for Hypoglycemia

- Recommendation
  - **Glucagon** should be prescribed for all individuals at increased risk of clinically significant hypoglycemia, (defined as blood glucose < 54) so that it is available should it be needed.
  - **Caregivers, school personnel, or family members of these individuals should know where it is and when and how to administer it.**
  - Glucagon administration is not limited to health care professionals
Joslin Diabetes Center Patient Guide

If you pass out [from low blood sugar]
• If ... you do not take care of low blood glucose, you may pass out.
• If you do, a drug called glucagon should be injected into your skin, like you do with insulin.
• This can be done by a family member or friend who has been taught how to do it.
• Since glucagon may cause you to vomit, you should be placed on your side when the injection is given.
• If no one knows how to give the injection, you should be taken to a hospital.
• You need a prescription for a glucagon kit.
• You should awaken about 10 minutes after the glucagon is injected. If you do not, you should be taken at once to a hospital.

Patient Education

• What is low blood sugar
• Why is it dangerous
• What are the symptoms
• How do you treat
• Sick day rules
• Prevention
  • Snacking for extra physical activity (or reduce insulin)
  • Carry rapid glucose on person
  • Mealtime insulin guides (don’t take if don’t eat)
• Call care team if experience low blood sugar, especially if unexplained
Individualized glucose targets

- Consideration of more intensive treatment only if the potential absolute benefits outweigh the harms
- …with a thorough understanding of the
  - patient’s risks
  - prognosis (i.e. age, comorbidities, and functional status)
  - socio-personal context (e.g. lifestyle, social support, workload capacity)
  - perceived or experienced treatment burden
  - values and preferences for care

Framework to assist in determining Glycemic Treatment Targets in patients with Type 2 Diabetes


©2011 by American College of Physicians
**VA/ DOD 2017 Guidelines**

“We recommend setting an HbA1c target RANGÉ based on absolute risk reduction of significant microvascular complications, life expectancy, patient preferences and social determinants of health.”

<table>
<thead>
<tr>
<th>Major Comorbidities or Physiologic Age</th>
<th>Microvascular Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Absent or Mild</td>
</tr>
<tr>
<td>Absent &gt;10-15 years life expectancy</td>
<td>6.0-7.0%</td>
</tr>
<tr>
<td>Present 5-10 years of life expectancy</td>
<td>7.0-8.0%</td>
</tr>
<tr>
<td>Marked &lt;5 years of life expectancy</td>
<td>8.0-9.0%</td>
</tr>
</tbody>
</table>


**Diabetes in Older Adults - Endocrine Society Guidelines 2019**

[Diagram showing health categories and glucose target ranges](https://www.endocrine.org/guidelines-and-clinical-practice/clinical-practice-guidelines/diabetes-in-older-adults)

Medication adjustment

- Our patients change & diabetes changes
  - May just need to reduce/adjust for these changes (renal, hepatic, cognitive, weight, etc.)
- Common insulin issues
  - Too much basal insulin
  - “blanket insulin”

Common insulin issues
- Adding pre-meal insulin, especially at supper meal and not reducing overnight basal insulin

A few things to think about with diabetes...

Why do my patients with diabetes always seem to get worse over time?

How do I get my patients with diabetes to do what I tell them?
Natural History of Diabetes is to Progress ("get worse")

Disease Progression is not "the Patient's Fault"

Researchers looking for the "Holy Grail"...

- To find something to halt the progressive worsening of diabetes following diagnosis
  - Reduce loss of beta cells
    - T1DM – immune modulators
    - T2DM – trials looking at treatment durability
  - The earlier the better – prevention

From: [https://slideplayer.com/slide/4477419/](https://slideplayer.com/slide/4477419/)

From: [https://www.webmd.com/diabetes/guide/glycated-hemoglobin-test-hba1c](https://www.webmd.com/diabetes/guide/glycated-hemoglobin-test-hba1c)
Current T2DM Care Paradigm

- 90% of patients with T2DM cared for in primary care setting
  - <25% referred to specialists
    - Major reason for referral: initiation of / difficulty with Insulin therapy
- PCP serves as primary provider of diabetes education
  - Low use of Certified Diabetes Educator (CDE) resources
    - <25% of patients counseled by CDE annually
    - 24% have no access to CDE in geographic region
- Major obstacles to optimal diabetes care cited by PCPs
  - Insufficient time / Insufficient staff & Patient adherence
  
Endocrine Practice Dec 2011; Brauer et al

- Pressure to meet performance metrics (A1c < 7%, < 8%, > 9%)

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**DIABETES OVERWHELMUS**

- Foot exams
- Ketones
- Hypoglycemia
- A1c
- Lipids
- Eye Exams
- Blood Pressure
- Noncompliant patients
- Pills
- Injections
- Meters
- BMI
- Test Strips
- Uma
Non-adherence
(not doing what the doctor wants you to do)

Obligation to be a "good" patient. Fear of being labeled a difficult patient
Threat of being expelled if fail to comply ("If you don’t ----, I can’t take care of you any more")

From: https://www.gettyimages.co.uk/detail/photo/court-judge-holding-gavel-and-bible-close-up-high-res-stock-photographs/886836-001
Words Matter: Study shows importance of language choices in diabetes care

- Health care providers who use "negative terms," such as "nonadherent" or "noncompliant" may create a disconnect leading to negative health outcomes for diabetes patients.
- Stereotypes or language choices that place blame can cause patients to disengage with health services and develop diabetes-related distress and sub-optimal diabetes self-management.
- Carefully chosen language can have a positive effect.
- Researchers recommend using more appropriate language in clinical settings to support patients' diabetes self-management and psychosocial well-being.

Ditch the “IC” word

Example:
- Lonnie has diabetes. Lonnie has lived with diabetes for ten years.
- Instead of
- Lonnie is a diabetic. Lonnie has been a diabetic for ten years.

“Focus on the person, not the diagnosis. You’ll treat both more effectively that way.”
Expectations .... Stigma

From Health Care professionals:

- “I have no patience for people who cause themselves to become ill, lose limbs, and disregard their medication/diet regimen.”

- “… many of those who have diabetes are noncompliant and don’t take care of themselves.”

Patients influenced by stigma (expectations impact behavior):

- Guilt, shame, blame, embarrassment, isolation
- Higher BMI
- Higher A1C
- Self-reported blood glucose variability

Why doesn’t my patient follow the treatment plan/ take control?

Points from the Behavioral Diabetes Institute

- Perceived Worthlessness
  - Pointlessness (what good does it do?)
  - Hopelessness

- Too Many Personal Obstacles
  - Depression / Diabetes Distress
  - Medication Misperceptions/Fears
  - Lack of education and Self management skills
  - Environmental(Patient Context / “Needs & Circumstances”) (LIFE)

- The Absence of Support & Resources
  - Diabetes slips to the background (serious but not urgent)
  - Infrequent supportive interaction with HCP (dialogue)
Diabetes Distress
associated
with
Worse
Engagement
and
Outcomes
for
Patients

45% of patients
Report DD
Only 24% report
that their HC team
asked them how
Diabetes affected
their lives

From: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2797978/
The 7 major sources of Diabetes Distress

1. Powerlessness
   - Feeling that one’s blood sugar numbers have a life of their own; e.g., “feeling that no matter how hard I try with my diabetes, it will never be good enough.” (Hopelessness- pointless)

2. Negative Social Perceptions
   - Concerns about the possible negative judgments of others; e.g., “I have to hide my diabetes from other people.”

3. Physician Distress
   - Disappointment with current health care professionals; e.g., “feeling that I don’t get help I really need from my diabetes doctor.”

4. Friend/Family Distress
   - There is too much or too little attention paid to diabetes amongst loved one; e.g., “my family and friends make a bigger deal out of diabetes than they should.”

5. Hypoglycemia Distress
   - Concerns about severe hypoglycemic events; e.g., “I can’t ever be safe from the possibility of a serious hypoglycemic event.”

6. Management Distress
   - Disappointment with one’s own self-care efforts; e.g., “I don’t give my diabetes as much attention as I probably should.”

7. Eating Distress
   - Concerns that one’s eating is out of control; e.g., “thoughts about food and eating control my life.”

True or False

Diabetes is the leading cause of adult blindness, amputations and kidney failure.
False

Poorly Controlled Diabetes is the leading cause of adult blindness, amputations and kidney failure.

Well Controlled Diabetes is the leading cause of... Nothing.

Need to Provide:

- Evidence-Based HOPE
- “With good care, odds are pretty good you can live a long and healthy life with diabetes”
Fear of Complications → large contributor to Diabetes Distress

The Language of Diabetes Complications: Communication and Framing of Risk

- Messages in North American and Australasian Diabetes-Specific Media (from American Diabetes Association, Canadian Diabetes Association, etc.)
- Linda J. Beeney and Elizabeth J. Fynes-Clinton – Clinical Diabetes 2018

- Majority had loss-framing (e.g. “having diabetes is the leading cause of blindness”) with few if any risk reduction strategies offered → hopelessness

vs

- Gain-framing (“early diagnosis & treatment of diabetic retinopathy can prevent up to 98% of severe vision loss”) plus strategies - “get annual eye exam” → more effective (evidence based)

Need to Provide: (WHP)

- Evidence-Based HOPE ... and strategies
  - “With good care, odds are pretty good you can live a long and healthy life with diabetes”

- Tangible Sense that their efforts make a difference
  - Establish Treatment Efficacy
    - Discovery Learning (structured BG testing or professional CGM study)
Knowledge, skills & confidence - first line of defense against Diabetes Distress

- Start with focused diabetes education (DSME) for areas of concern —
  - Show the evidence
  - Teach the strategies
    - May be lacking in some educational materials
  - Ensure Self-management knowledge & skills —> Know-How & confidence (teach back,”show me how you..”)
- Refer to Behavioral Health if education efforts fail to improve the Diabetes Distress

What’s the Answer – Diabetes is Hard

How can we help our patients with diabetes avoid the harms of diabetes? — Individualize care & targets and avoid stigma

What does the A1c tell you? – Not the whole story of glycemia

Why do my patients with diabetes always seem to get worse over time? – Don’t blame the patient - the diabetes gets worse over time - progressive loss of beta cells (insulin secretion)

How do I get my patients with diabetes to do what I tell them? – Don’t “tell them what to do” ➔ be in it all-together with them & provide hope, evidence and strategies
Idea Sharing

cgreenlee@westslopeendo.com