Reducing Hypoglycemic Events in The Elderly

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Harvard Medical School
Objectives

• Prevalence of diabetes and hypoglycemia in the elderly
• Risk factors for hypoglycemia in the elderly
• Goals, and strategies for managing diabetes in the elderly with focus on lower risk of hypoglycemia
• Issues related to transition of care in elderly with diabetes
Population by Age 2000-2010

US Census Bureau 2000-2010
Diagnosed and Undiagnosed Diabetes

Difficulty in Measuring Prevalence of Hypoglycemia

- Definitions vary in research studies
  - Whipple’s triad
  - Severity of symptoms/signs
  - Measured levels
- Methods of measurements vary in studies
- Most hypoglycemia in elderly remain unrecognized
Annual Rates Among Patients with Severe Hypoglycemia: ADVANCE cohort


Annual Rates of Severe Hypoglycemia According to Treatment

**A**

- Severe Hypoglycemia (%) vs. Months
- Standard treatment
- Intensive treatment

**B**

- No. of Adverse Outcomes vs. Months from Hypoglycemia to Event
- Macrovascular event
- Microvascular event
- Death from any cause
- Cardiovascular death
- Noncardiovascular death
National Trends in US Hospital Admissions for Hyper/Hypoglycemia
Medicare Beneficiaries 1999-2011

Absolute risk of hypoglycemia; 100,000 ED admissions /year

Lipska et al; JAMA intern Med 2014; 174(7): 1116-24
Risk Factors for Hypoglycemia in Elderly: A Heterogeneous population
Age as a Risk Factor for Hypoglycemia
Medicare Beneficiaries 1999-2011

Duration of DM as Risk Factor for Hypoglycemia

Proportion reporting at least one severe hypoglycaemic episode

- Treated with sulphonylureas
- <2 years of insulin treatment
- >5 years of insulin treatment

T2DM

T1DM

UK hypoglycemia study group; Diabetologia 50;1140-47, 2007
Socioeconomic Status and Education as Risk Factors for Hypoglycemia
cross-sectional analysis from DISTANCE study

- 14,357 multi language, ethnically-stratified sample
- Mean age: 58 years
- Severe hypoglycemia common – 11%
- Low vs high income – 16% vs 8.8%
- Low vs high education – 11.9% vs 8.9%

Berkowitz S et al; J Health Care Poor Underserved; 29; 2; May 2014
Cognitive Dysfunction Associated with Hypoglycemia in Older Veterans

• Increased incidence of dementia and cognitive impairment with age
  – 13.1% in 65-74 Yrs
  – 24.2% >75 Yrs
• DM was managed more intensively in older veterans with dementia and cognitive impairment
  – Insulin use 30% vs 24%
• Dementia and cognitive impairment were independently associated with greater risk of hypoglycemia
  – 26.5% vs 14.4%

Feil DG et al JAGS 2011;59;12;2266
Higher risk of Hypoglycemia with cognitive Impairment and Increased Complexity of Regimen
Goal- Setting

Glycemic Goal

Hypoglycemia
Social support and
Living situation
Financial issues
Overall Health Goal
Life expectancy
Physical abilities
Glycemic Goal

Hyperglycemia (A1C) vs. Hypoglycemia
Fallability of A1C as Marker of Glycemic Control in Elderly

- Increases with increasing age
- Affected by red cell life span
- Role of renal dysfunction and anemia of chronic diseases not known
- Reflects average glucose – miss BG fluctuations
A1C - 8.2%
Insulin only

A1C - 8.3%
Insulin and oral
Hypoglycemia in older adults

Noncompliance
Hypoglycemia unawareness
Cognitive dysfunction interfering with identification/treatment of hypoglycemia
Co-morbidities mimicking hypoglycemic symptoms

Hypoglycemia & Fear of hypoglycemia

Insulin therapy in older adults

Noncompliance
Falls, hospital visits
Exacerbation of chronic conditions

Even mild hypoglycemia may result in poor outcome
Frequent Hypoglycemic Episodes Detected by CGM
age > 70 yrs; A1C > 8%; n = 40

Patients with hypoglycemia n = 26 (65 %)

Patients with A1C 8-9 % 14 (54 %)
Patients with A1C > 9 % 12 (46 %)

Severity of hypoglycemic episodes

60-69 mg/dl 100 %
50-59 mg/dl 73 %
< 50 mg/dl 46 %

Munshi et al; Arch Intern Med. 2011;171(4):362-364
## Hypoglycemia Episodes Characteristics

<table>
<thead>
<tr>
<th></th>
<th>n = 26</th>
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</thead>
<tbody>
<tr>
<td><strong>Number of hypo episodes</strong></td>
<td></td>
</tr>
<tr>
<td>60-69 mg/dl</td>
<td>102</td>
</tr>
<tr>
<td>50-59 mg/dl</td>
<td>52</td>
</tr>
<tr>
<td>&lt; 50 mg/dl</td>
<td>20</td>
</tr>
<tr>
<td><strong>Mean duration (hours)/patient</strong></td>
<td></td>
</tr>
<tr>
<td>60-69 mg/dl</td>
<td>3</td>
</tr>
<tr>
<td>50-59 mg/dl</td>
<td>1.4</td>
</tr>
<tr>
<td>&lt; 50 mg/dl</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Mean duration of nocturnal episodes (10 pm-6 am) (hrs)</strong></td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Number of episodes not recognized by finger-stick or symptoms</strong></td>
<td>95</td>
</tr>
</tbody>
</table>

Munshi et al; Arch Intern Med. 2011;171(4):362-364
Hypoglycemic Events and Fall-related Fractures in T2DM patients on Medicare

- Type 2 DM patients
  - with coded hypoglycemic event (n=16,936)
  - Without coded hypoglycemic event (n=344,274)
- Risk of any fall-related fractures: 5.24% vs 2.67%
- Approximately 70% higher odds of having a fall-related fracture event

Johnston SS et al; Diabetes obesity and metabolism 14;634-43, 2012
A1C and Mortality: U-Shaped curve

Interpretation: goal setting

Who Benefits?
- Younger patients
- Short duration of disease
- No macro/microvascular disease
- Low comorbidity burden
- Better overall health
- Longer life expectancy

Who Is at Risk?
- Old and frail
- Long duration of diabetes
- Presence of macro/microvascular disease
- Multiple comorbidities
- Unable to follow given regimen safely
- Shorter life expectancy
Diabetes in Older Adults

M. Sue Kirkman, MD
Vanessa Jones Briscoe, PhD, NP, CDE
Nathaniel Clark, MD, MS, RD
Hermes Florez, MD, MPH, PhD
Linda B. Haas, PHC, RN, CDE
Jeffrey B. Halter, MD

Elbert S. Huang, MD, MPH
Mary T. Korytkowski, MD
Medha N. Munshi, MD
Peggy Soule Odegard, BS, PharmD, CDE
Richard E. Pratley, MD
Carrie S. Swift, MS, RD, BC-ADM, CDE
### A Framework for Treatment Goals

<table>
<thead>
<tr>
<th>Patient characteristics / health status</th>
<th>Rational</th>
<th>A1C</th>
<th>BP</th>
<th>Lipids</th>
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</thead>
<tbody>
<tr>
<td>Healthy</td>
<td>Longer life expectancy</td>
<td>&lt;7.5%</td>
<td>&lt;140/80</td>
<td>Statins unless not tolerated</td>
</tr>
<tr>
<td>- few co-existing illnesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- intact cognitive status</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>- intact functional status</td>
<td></td>
<td></td>
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<tr>
<td>Complex/Intermediate</td>
<td>Intermediate life expectancy</td>
<td>&lt;8%</td>
<td>&lt;140/80</td>
<td>Statins unless not tolerated</td>
</tr>
<tr>
<td>- Multiple co-existing illnesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mild-moderate cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2+ instrumental ADL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Complex/Poor Health</td>
<td>Limited life expectancy</td>
<td>&lt;8.5%</td>
<td>&lt;150/90</td>
<td>Consider risks and benefits</td>
</tr>
<tr>
<td>- LTC care residents</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>- end-stage chronic illnesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Moderate-severe cognitive impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2+ ADL dependencies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Kirkman MS et al; Diabetes Care. 2012 Dec;35(12):2650-64
Potential Overtreatment of Diabetes in Older Adults

Lipska KJ et al; JAMA internal medicine: Jan 2015
Missing Piece

Identify individual characteristics

How to get there

Identify Goals
Adult > 65 Years with Diabetes

Type of Medications

- Oral only: 60%
- Insulin + Oral: 15%
- Insulin only: 8%
- Neither: 17%
National Estimates of Insulin-Related Hypoglycemia and Errors

National Electronic Adverse Drug Event Surveillance Project

- 97,648 ED visits for IHE annually
- 1/3 resulted in hospitalization
- BG<50 mg/dl in over half of the cases
- Severe neurological sequelae in over 60%
- Insulin-treated patients >80 years were more than twice likely to visit ED and 5 times likely to be subsequently hospitalized
Higher Risk of CV Events and All Cause Mortality in Insulin-treated patients

<table>
<thead>
<tr>
<th></th>
<th>HR for CV Event</th>
<th>HR for All Cause Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With CVD</td>
<td>Without CVD</td>
</tr>
<tr>
<td>T1DM</td>
<td>1.51</td>
<td>1.61</td>
</tr>
<tr>
<td>T2DM</td>
<td>1.60</td>
<td>1.49</td>
</tr>
</tbody>
</table>

Median time from first hypoglycemic event to first CV event: 1.5 years

Khunti K et al: Diabetes Care; online December 2014
Hypoglycemia and Inpatient Mortality in Insulin-treated Patients

<table>
<thead>
<tr>
<th>Hypoglycemia Status</th>
<th>Inpatient Mortality</th>
<th>Crude OR</th>
<th>Adjusted OR (age, gender, comorbidities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No hypoglycemia</td>
<td>3.8 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>6.5 %</td>
<td>1.73 %</td>
<td>1.66 %</td>
</tr>
<tr>
<td>Severe hypoglycemia</td>
<td>7.6 %</td>
<td>2.17 %</td>
<td>1.44 %</td>
</tr>
<tr>
<td>Non-severe hypoglycemia</td>
<td>5.6 %</td>
<td>1.49 %</td>
<td>1.45 %</td>
</tr>
</tbody>
</table>

Length of stay increased with hypoglycemia 8.2 days vs 5.8 days

Brodovicz KG et al; Current medical research and opinion; 29; 2; Feb 2013
Su + Insulin is Associated with Increased Mortality Compared to Metformin + Insulin

All Cause Mortality

Cardiovascular deaths

Composite endpoints

Mogensen UM et al; Diabetologia; 58; 50-58, 2015
Goal-setting Algorithm in Elderly

Current A1c

- <7%
  - Multiple Comorbidities or medications that may cause hypoglycemia
  - Liberalize Goal

- 7 – 8%
  - Few Comorbidities and Medications unlikely to cause hypoglycemia
  - At goal with caution (Continually assess for hypoglycemia)

- > 8%
  - Medications likely to cause hypoglycemia
  - Carefully assess for hypoglycemia or glucose excursions
  - Medications unlikely to cause hypoglycemia
  - At Goal

-Multiple Co-morbidities
-Limited Life Expectancy
-Difficulty coping

Present Not Present
Management of Hyperglycemia in Type 2 Diabetes, 2015: A Patient-Centered Approach

Update to a Position Statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD)

http://care.diabetesjournals.org/content/38/1/140.full.pdf+html?with-ds=yes
Figure 2. Anti-hyperglycemic therapy in T2DM: General recommendations
**Figure 2. Anti-hyperglycemic therapy in T2DM: General recommendations**

*Healthy eating, weight control, increased physical activity & diabetes education*

### Monotherapy

<table>
<thead>
<tr>
<th>Efficacy</th>
<th>Hypo risk</th>
<th>Weight</th>
<th>Side effects</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>high</td>
<td>low risk</td>
<td>neutral/loss</td>
<td>GI / lactic acidosis</td>
</tr>
</tbody>
</table>

- If HbA1c target not achieved after ~3 months of monotherapy, proceed to 2-drug combination (order not meant to denote any specific preference – choice dependent on a variety of patient & disease-specific factors):

#### Dual therapy

<table>
<thead>
<tr>
<th>Drug Combination</th>
<th>Efficacy</th>
<th>Hypo risk</th>
<th>Weight</th>
<th>Side effects</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin + Sulfonylurea</td>
<td>high</td>
<td>moderate risk</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>low</td>
</tr>
<tr>
<td>Metformin + Thiazolidinedione</td>
<td>high</td>
<td>low risk</td>
<td>gain</td>
<td>edema, HF, fx</td>
<td>low</td>
</tr>
<tr>
<td>Metformin + DPP-4 inhibitor</td>
<td>intermediate</td>
<td>low risk</td>
<td>neutral</td>
<td>rare</td>
<td>high</td>
</tr>
<tr>
<td>Metformin + SGLT2 inhibitor</td>
<td>intermediate</td>
<td>low risk</td>
<td>loss</td>
<td>GU, dehydration</td>
<td>high</td>
</tr>
<tr>
<td>Metformin + GLP-1 receptor agonist</td>
<td>high</td>
<td>low risk</td>
<td>loss</td>
<td>GI</td>
<td>high</td>
</tr>
<tr>
<td>Metformin + Insulin (basal)</td>
<td>highest</td>
<td>high risk</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>variable</td>
</tr>
</tbody>
</table>

- If HbA1c target not achieved after ~3 months of dual therapy, proceed to 3-drug combination (order not meant to denote any specific preference – choice dependent on a variety of patient & disease-specific factors):

#### Triple therapy

<table>
<thead>
<tr>
<th>Drug Combination</th>
<th>Efficacy</th>
<th>Hypo risk</th>
<th>Weight</th>
<th>Side effects</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin + DPP-4-i or SGLT2-i or GLP-1-RA or Insulin</td>
<td>high</td>
<td>moderate risk</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>low</td>
</tr>
<tr>
<td>Metformin + DPP-4-i or SGLT2-i or GLP-1-RA or Insulin</td>
<td>high</td>
<td>moderate risk</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>low</td>
</tr>
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<td>Metformin + DPP-4-i or SGLT2-i or GLP-1-RA or Insulin</td>
<td>high</td>
<td>moderate risk</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>low</td>
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<td>Metformin + DPP-4-i or SGLT2-i or GLP-1-RA or Insulin</td>
<td>high</td>
<td>moderate risk</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>low</td>
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<tr>
<td>Metformin + DPP-4-i or SGLT2-i or GLP-1-RA or Insulin</td>
<td>high</td>
<td>moderate risk</td>
<td>gain</td>
<td>hypoglycemia</td>
<td>low</td>
</tr>
</tbody>
</table>

- If HbA1c target not achieved after ~3 months of triple therapy and patient (1) on oral combination, move to injectables, (2) on GLP-1 RA, add basal insulin, or (3) on optimally titrated basal insulin, add GLP-1-RA or mealtime insulin. In refractory patients consider adding TZD or SGL T2-i:
**Figure 2. Anti-hyperglycemic therapy in T2DM: General recommendations**

Healthy eating, weight control, increased physical activity & diabetes education

<table>
<thead>
<tr>
<th>Monotherapy</th>
<th>Metformin</th>
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<th>Metformin</th>
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</thead>
<tbody>
<tr>
<td>Efficacy</td>
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<td>high</td>
<td>intermediate</td>
<td>high</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>Hypo risk</td>
<td>moderate</td>
<td>low</td>
<td>low</td>
<td>intermediate</td>
<td>intermediate</td>
<td>highest</td>
</tr>
<tr>
<td>Weight</td>
<td>gain</td>
<td>low risk</td>
<td>low risk</td>
<td>gain</td>
<td>low</td>
<td>gain</td>
</tr>
<tr>
<td>Side effects</td>
<td>hypoglycemia</td>
<td>edema, HF, fx</td>
<td>edema, HF</td>
<td>edema, HF, fx</td>
<td>GU, dehydration</td>
<td>edema, HF, fx</td>
</tr>
<tr>
<td>Costs</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
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</tr>
</tbody>
</table>

**If HbA1c target not achieved after ~3 months of monotherapy, proceed to 2-drug combination (order not meant to denote any specific preference – choice dependent on a variety of patient- & disease-specific factors):**

<table>
<thead>
<tr>
<th>Metformin +</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Sulfonylurea</td>
<td>Thiazolidinedione</td>
<td>DPP-4 inhibitor</td>
<td>SGLT2 inhibitor</td>
<td>GLP-1 receptor agonist</td>
<td>Insulin (basal)</td>
<td></td>
</tr>
<tr>
<td>high</td>
<td>high</td>
<td>intermediate</td>
<td>intermediate</td>
<td>high</td>
<td>highest</td>
<td></td>
</tr>
<tr>
<td>moderate risk</td>
<td>low risk</td>
<td>low risk</td>
<td>low risk</td>
<td>high</td>
<td>high</td>
<td></td>
</tr>
<tr>
<td>gain</td>
<td>gain</td>
<td>neutral</td>
<td>neutral</td>
<td>low</td>
<td>gain</td>
<td></td>
</tr>
<tr>
<td>hypoglycemia</td>
<td>edema, HF, fx</td>
<td>edema, HF</td>
<td>edema, HF</td>
<td>GU, dehydration</td>
<td>edema, HF</td>
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</tr>
<tr>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>low</td>
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<td></td>
</tr>
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<table>
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<td>Insulin (basal)</td>
<td></td>
</tr>
<tr>
<td>TZD</td>
<td>SU</td>
<td>SU</td>
<td>SU</td>
<td>SU</td>
<td>TZD</td>
<td>TZD</td>
</tr>
<tr>
<td>or</td>
<td>or</td>
<td>or</td>
<td>or</td>
<td>or</td>
<td>or</td>
<td>or</td>
</tr>
<tr>
<td>DPP-4-i</td>
<td>T2-i</td>
<td>GLP-1-RA</td>
<td>SGLT2-i</td>
<td>DPP-4-i</td>
<td>GLP-1-RA</td>
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<td>SGLT2-i</td>
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</tr>
<tr>
<td>GLP-1-RA</td>
<td>Insulin</td>
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Healthy eating, weight control, increased physical activity & diabetes education

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</tr>
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<tbody>
<tr>
<td>high</td>
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<td>low risk</td>
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<tr>
<td>neutral/loss</td>
<td>neutral/loss</td>
<td>neutral/loss</td>
<td>neutral/loss</td>
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<td>neutral/loss</td>
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<tr>
<td>GI / lactic acidosis</td>
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<tr>
<td>low</td>
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</tr>
</tbody>
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If HbA1c target not achieved after ~3 months of monotherapy, proceed to 2-drug combination (order not meant to denote any specific preference – choice dependent on a variety of patient- & disease-specific factors):

<table>
<thead>
<tr>
<th>Monotherapy</th>
<th>Dual therapy†</th>
<th>Triple therapy</th>
<th>Combination injectable therapy†</th>
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<tbody>
<tr>
<td>Efficacy†</td>
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<td>Hypo risk</td>
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<td>Weight</td>
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<td>Side effects</td>
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<td>Costs</td>
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If HbA1c target not achieved after ~3 months of dual therapy, proceed to 3-drug combination (order not meant to denote any specific preference – choice dependent on a variety of patient- & disease-specific factors):

If HbA1c target not achieved after ~3 months of triple therapy and patient (1) on oral combination, move to injectables, (2) on GLP-1 RA, add basal insulin, or (3) on optimally titrated basal insulin, add GLP-1 RA or mealtime insulin. In refractory patients consider adding TZD or SGL T2i:

Diabetes Care 2015;38:140-149; Diabetologia 2015;10.1077/s00125-014-3460-0
Figure 2A. Anti-hyperglycemic therapy in T2DM: 
Avoidance of hypoglycemia
Approach to Starting and Adjusting Insulin in T2DM

Basal Insulin
(with metformin ± other non insulin agents)

Start: 10 u/day or 0.1-0.2 u/kg/day
Adjust 10-15% or 2-4 u once-twice/week to reach FBG target
For hypo: determine & address cause, ↓ dose by 10-20% or 4 units

In Older Patients
- Start basal insulin in the morning
- Go up slower, come down faster
- Avoid chasing high bedtime numbers
- Expect frequent adjustments during acute illnesses, social stresses

Diabetes Care 2015;38:140-149; Diabetologia 2015;10.1077/s00125-014-3460-0
Higher contribution of post-prandial glucose in hyperglycemia in older vs younger adults

Figure 3. Approach to starting & adjusting insulin in T2DM

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

- **Start:** 10U/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 & address cause; ↓ dose by 4 units or 10-20%.

If not controlled after FBG target is reached (or if dose > 0.5 U/kg/day), treat PPG excursions with meal-time insulin.
(Consider initial GLP-1-RA trial.)

Add ≥2 rapid insulin* injections before meals ('basal-bolus')!

- **Start:** 4U, 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%.

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%.

Add 1 rapid insulin* injection before largest meal

- **Start:** 4U, 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.

If not controlled, consider basal-bolus.
Use of serum c-peptide to simplify regimen in older adults

- Normal/high serum C-peptide: 65/100
- Age: 79±14 yrs, DM duration: 21±13 yrs
- Number of medications: 11 (range 4-18)

- Simplification completed in 35 patients
- In 19 patients, patients completely off insulin
- In 16 patients number of insulin injections were decreased significantly

- Number of hypoglycemic episodes decreased
- A1c improved from 8% to 7.4% (p<0.002)

Munshi et al; American Journal of Medicine 2009;122;395-97
Simplification of Regimen

A1c 7.5%
Time < 70mg/dL: 590 min
Aspart Mix 70/30 30 units BID
Metformin 1000mg QAM, 500mg QPM

Munshi et al; abstract presentation at ADA June 2013

A1c 7.2%
Time < 70mg/dL: 0 min
Glargine 40 units QAM
Metformin 1000mg BID

Munshi et al; abstract presentation at ADA June 2013
Screening

5 Month

A1c 7.4% Humalog 70/30 70 units QAM, 45 units QPM
Metformin 500mg BID

8 Month

A1c 7.0% Lantus 66 units QAM, Metformin 1000mg BID,
Glipizide 10mg BID
Failing/Difficulty coping with treatment regimen

Algorithm for simplifying insulin regimen in older patients

Measure serum c-peptide

Normal/high C-peptide

Consider age and comorbidities

- Younger age (<90 yrs)
- Stable renal function
- Metformin not tolerated
- Stable health & eating pattern, cost concerns
- Frail/older patient
- High risk of hypoglycemia
- Cognitive dysfunction
- No contraindications

- Add metformin with meals
- Titrate dose to replace bolus injection
- Add sulfonylurea at mealtime
- Titrate dose to replace bolus injection
- DPP4 inhibitors, GLP 1 agonist, SGLT-2 inhibitors for post prandial coverage in am with long acting insulin
- Watch renal function
- Watch for weight loss, N/V, anorexia
- Assess periodically for hypoglycemia
- May add another agent based on SMBG

Add 2<sup>nd</sup> or 3<sup>rd</sup> agent <b>or</b> switch to alternate agent with/without basal insulin
Failing/Difficulty coping with treatment regimen

Algorithm for simplifying insulin regimen in older patients

Measure serum c-peptide

Low C-peptide or Unable to tolerate orals

Consider cognitive function, physical ability, caregiver support

Twice a day am/HS NPH to control fasting and pre-supper readings

Mixed dose 70/30 with long acting all in am. No prandial dose

Fixed dose bolus pre-meal instead of sliding scale and once a day basal

• Adjust AM dose of NPH to control pre-supper BS
• Adjust PM dose of NPH to control fasting BS

- titrate long acting insulin for fasting glucose
- titrate 70/30 for prelunch and presupper glucose

• Avoid problem solving
• Take control away from the patient if possible
# Prevention of Hypoglycemia

## General Recommendations

**Patient education**
- Recognition
- Treatment
- Knowledge about meds
- Education and analysis of hypo event, frequency, severity, timing, cause etc

**Dietary measure**
- Understanding of carb content
- Flexible meal plans
- Flexible treatment regimen
- Excess to quick treatment

**Physical exercise**
- Recognition of association with type, duration, timing of activity
- Prophylactic snacks
- More monitoring

**Glucose monitoring**
- Routine and ad hoc monitoring
- Good record keeping
- Continuous glucose monitoring

## Challenges in the Elderly

- High prevalence of hypo-unawareness – autonomic dysfunction, medications, memory problems
- Many conditions mimic hypo symptoms – orthostatic hypotension, TIA, weakness, dementia
- Commonly have difficulty in identifying and/or reporting hypo event to medical provider
- Change in other health status or life stresses may impact appetite, taste perception
- May forget to eat
- Activity may not be consistent due to other health issues, causing glucose excursions
- Vision, dexterity can be problems
- Frequent monitoring can add to treatment burden with other comorbidities

ADA and Endocrine society work group
Challenges in Reducing Hypoglycemia in Elderly

- True prevalence is not known
  - Consequences of hypo (falls, fractures, cognitive decline, cardiovascular events) are multifactorial. Hypoglycemia may not be recognized as an etiological factor
  - Majority of hypo episodes in elderly are not recognized by patients/family members
Challenges in Reducing Hypoglycemia in Elderly

- Risk of hypoglycemia changes with acute and chronic illnesses, hospitalizations, social stresses
- Traditional model of care with assessment at every clinic visit is not adequate to prevent hypoglycemia in between the clinic visits
- Practical protocols are lacking to manage diabetes and risk of hypoglycemia in elderly
Challenges in Reducing Hypoglycemia in Elderly

• Sole dependence of A1C value as marker of glycemic control should be deemphasized
• New quality indicators are needed to define both optimal management as well as overtreatment of diabetes in elderly
Summary

• **Prevalence of diabetes and hypoglycemia**
  – Both diabetes and hypoglycemia are common and morbid issues in the elderly
  – Prevalence of hypoglycemia is increasing and can be more harmful than the disease itself in the elderly population

• **Risk factors for hypoglycemia**
  – Age, Duration of DM, cognitive dysfunction and highly complex treatment regimen increase the risk of hypoglycemia in the elderly.

• **Current recommendations and strategies**
  – Individualization of DM management should include clinical, functional, and psychosocial aspects in elderly
  – Complex regimen have limited benefit and possible harm

• **Transition of Care in elderly with diabetes**
  – Close followup and supervision needed
Transition of care

Set of action designed to ensure the coordination and continuity of health care between different locations or different levels of care at the same location

Acute care hospital
   → Rehab
       → Home
           → Primary / subspecialty care offices
Prevalence
2001 Harris poll by the Robert Wood Johnson Foundation

- hospital discharge (>65 yrs)
  - 23% to another institutions
  - 11.6% with home care
19% transferred back from SNF to hospital within 30 days
42% transferred within 24 months

- older adults with $\geq 1$ chronic condition see 8 different MDs/year
Diabetes-Specific Challenges

- BG and insulin need change during acute hospitalization
- BG and insulin need do not return to baseline at the time of discharge
- Interaction between illness, anorexia, delirium post hospitalization
- Discomfort felt by medical providers in changing diabetes regimen
Diabetes-specific Complications
Post-hospitalization

• Hypoglycemia
  if insulin dose is not lowered when acute illness resolves, inadequate meals or weight loss

• Hyperglycemia
  if inadequate insulin for persisting illness

• Stress for patient and caregivers
  if discharged on new regimen/sliding scales
<table>
<thead>
<tr>
<th><strong>Diabetes regimen</strong></th>
<th><strong>Reasons for change in regimen from previous</strong></th>
<th><strong>Anticipated change in diabetes treatment as patient recover</strong></th>
</tr>
</thead>
</table>
| At the time of hospitalization | - Oral meds  
- Fixed dose insulin  
- Sliding scale regimen | - Hyperglycemia due to acute illness  
- Hypoglycemia due to low oral intake  
- Fluctuating blood glucose  
- Oral agent contraindicated  
- Formulary issues | - Discontinue sliding as tolerated  
- Discontinue insulin as tolerated  
- Restart oral medications as tolerated  
- Increase dose of insulin as tolerated  
- Increase dose of oral meds as tolerated |
| At the time of hospital discharge | - Oral meds  
- Fixed dose insulin  
- Sliding scale regimen | - Hyperglycemia due to acute illness  
- Hypoglycemia due to low oral intake  
- Fluctuating blood glucose  
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- Discontinue insulin as tolerated  
- Restart oral medications as tolerated  
- Increase dose of insulin as tolerated  
- Increase dose of oral meds as tolerated |
| At the time of PCP visit | - Oral meds  
- Fixed dose insulin  
- Sliding scale regimen |  |
|  |  |  |  |
Challenges in Transition of Care and Prevention of Rehospitalization

• Develop a better system to improve the handoff esp. for patients with diabetes

• Provide access to a diabetes educator for patient/caregiver for help after hospitalization (pharmacy clinics without diabetes management expertise is not adequate)

• Develop care plan that is generalizable to all communities