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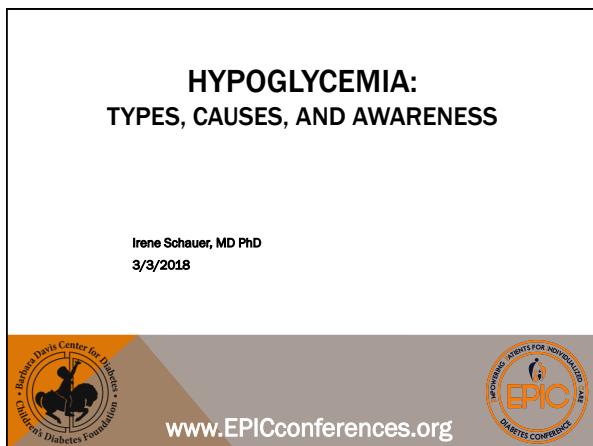
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**EPIC DIABETES CONFERENCE**  
MARCH 3, 2018 | SHERATON DOWNTOWN DENVER

**EMPOWERING PATIENTS FOR INDIVIDUALIZED CARE**

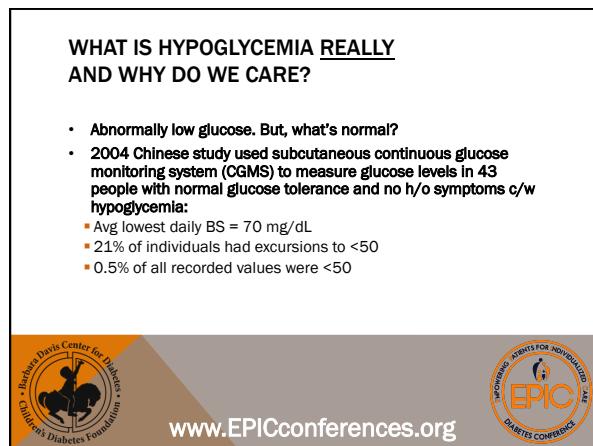
**Barbara Davis Center for Diabetes Children's Diabetes Foundation**



## HYPOGLYCEMIA: TYPES, CAUSES, AND AWARENESS

Irene Schauer, MD PhD  
3/3/2018

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### WHAT IS HYPOGLYCEMIA REALLY AND WHY DO WE CARE?

- Abnormally low glucose. But, what's normal?
- 2004 Chinese study used subcutaneous continuous glucose monitoring system (CGMS) to measure glucose levels in 43 people with normal glucose tolerance and no h/o symptoms c/w hypoglycemia:
  - Avg lowest daily BS = 70 mg/dL
  - 21% of individuals had excursions to <50
  - 0.5% of all recorded values were <50

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**WHY DO WE CARE?**



Frank discovered one of the many pitfalls of treating low blood sugar at three o'clock in the morning.

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**WHY DO WE REALLY CARE?**

- In people without diabetes: Almost NEVER an emergency. The metabolically normal body/brain is good at keeping glucose from going dangerously low (EXCEPTION = insulinoma)
- **BUT!** Different in diabetes:
  - Potential for blood sugars to drop VERY low
  - Risk of seizure, heart arrhythmia, coma, death
  - Need to leave time to respond/treat, so we target avoiding lows that would be normal in people without diabetes

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**CAUSES OF HYPOGLYCEMIA IN DIABETES**

**Bottom-line: Too much insulin OR certain oral diabetes meds for the situation:**

- Eating less
- Exercising more
- Insulin needs have changed over time

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**MEDICATIONS**

Little or no hypoglycemia risk:

- Metformin
- SGLT2 inhibitors (flosins)
- DPP4 inhibitors (gliptins)
- GLP1 agonists (tides)
- Thiazolidenediones (glitazones)

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### OTHER CAUSES/CONTRIBUTORS

**Exercise**

- Intense: can first cause high blood sugars, then lows for up to 24 hours after exercise
- Moderate: lows during and after exercise

**Other causes**

- Illness
- Weight loss
- Other medications
- Adrenal insufficiency
- Liver problems

### CATEGORIES OF HYPOGLYCEMIA

**Table 6.3—Classification of hypoglycemia\***

Level	Glycemic criteria	Description
Hypoglycemia alert value (level 1)	$\leq 70$ mg/dL (3.9 mmol/L)	Sufficiently low for treatment with fast-acting carbohydrate and dose adjustment of glucose-lowering therapy
Clinically significant hypoglycemia (level 2)	$< 54$ mg/dL (3.0 mmol/L)	Sufficiently low to indicate serious, clinically important hypoglycemia
Severe hypoglycemia (level 3)	No specific glucose threshold	Hypoglycemia associated with severe cognitive impairment requiring external assistance for recovery

**Severe hypoglycemia = <45, 50, 54, 55 depending on where you look**

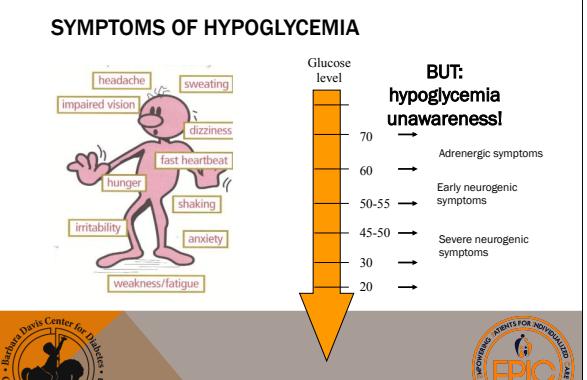
**What about symptoms?**



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### SYMPTOMS OF HYPOGLYCEMIA



### CASE:

- 74 yo man with type 1 diabetes in clinic for follow up
- Recently had surgery to remove several feet of damaged intestines
- Lost 20 pounds during the admission, but he was sent home on the same doses of insulin as before
- In clinic he seemed completely fine, but did admit that he was having "some low blood sugars" without any symptoms
- Blood drawn that morning showed a glucose of 33
- On the way home he ran into a lightpole in a parking lot. At the time of the accident he was about 1 mile off the route to his home. He could not remember why he was in that area at all. He had had no symptoms to alert him that his blood sugar was low.



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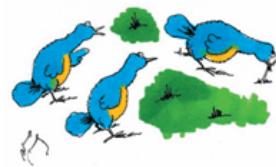


### HYPOGLYCEMIA UNAWARENESS:

- Development of symptoms at lower blood sugars or not at all
- Failure to develop symptoms of hypoglycemia in time to take action to prevent severe hypoglycemia
- Happens when low blood sugars happen more than a few times a week and the body adjusts
- Common in diabetes (about 25% of people with diabetes have some degree of it), but it is preventable and usually reversible if low sugars are avoided



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"It's funny how we met. I mistook his hypoglycemic episode for the mating dance."  
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### HYPOGLYCEMIA

- Risk Factors
- Prevention
- Detection
- Treatment

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WHAT'S MY A1C??

HEADACHY HUNGRY  
SWEATY CONFUSED  
SHAKY DIZZY  
GRUMPY

Rate of Severe Hypoglycemia (per 100 patient-years)

Glycosylated Hemoglobin (%)

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### HYPOGLYCEMIC RISK FACTORS

<b>PATIENT CHARACTERISTICS</b> <ul style="list-style-type: none"> <li>- Older age</li> <li>- Female gender</li> <li>- African American ethnicity</li> <li>- Longer duration of diabetes</li> <li>- Neuropathy</li> <li>- Kidney impairment</li> <li>- Previous hypoglycemia</li> <li>- Tight Control</li> </ul>	<b>BEHAVIORAL</b> <ul style="list-style-type: none"> <li>- Using "old" Insulin regimens</li> <li>- Missed meals</li> <li>- Taking insulin after the meal</li> <li>- Over correcting a high blood sugar in between meals</li> <li>- Exercise</li> </ul>
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## PREVENTION

KNOWLEDGE IS POWER

Advances in the Care of Persons With Diabetes

- Development of insulin analogues
- Insulin pump therapy
- Home Glucose Monitoring
- Use of Continuous Glucose Monitoring

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### "OLD" INSULIN REPLACEMENT STRATEGY

INSULIN EFFECT

REG

NPH/Lente

REG

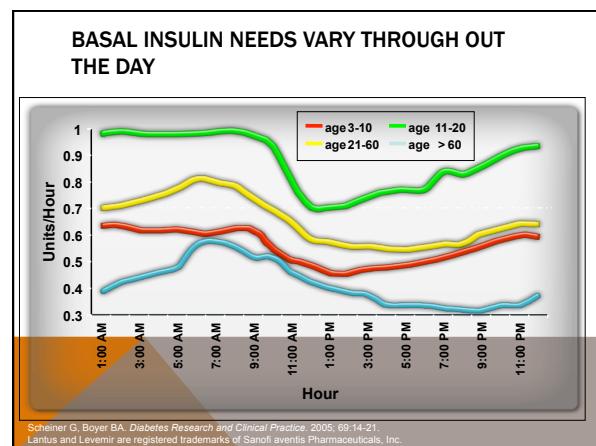
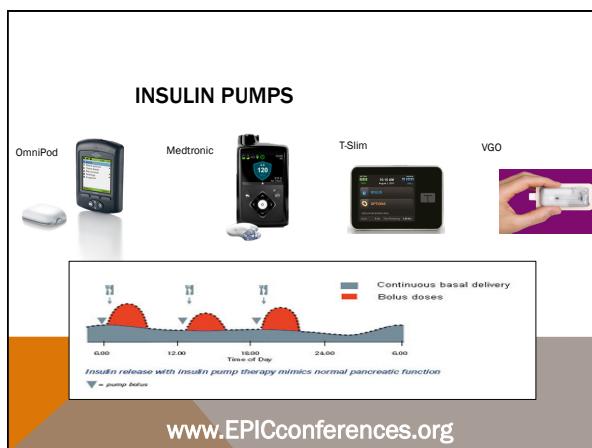
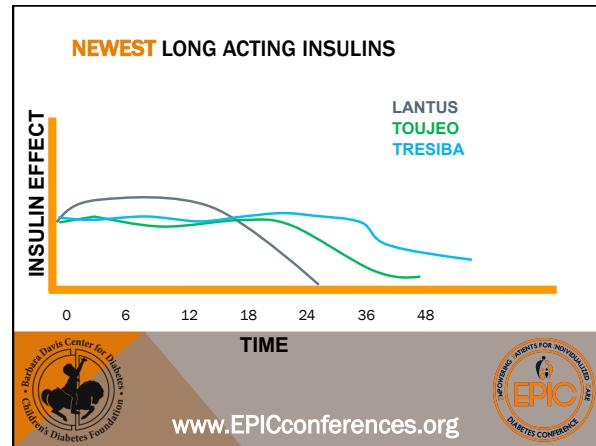
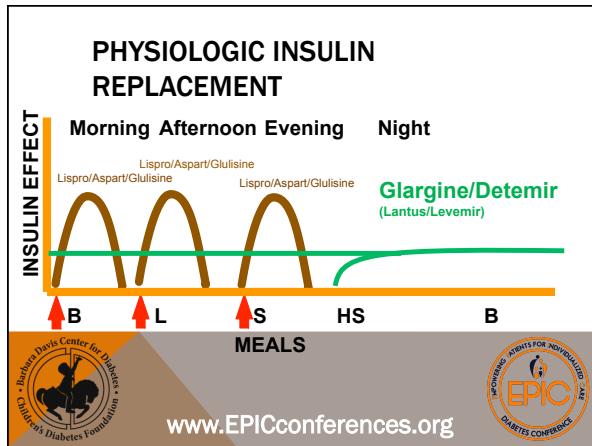
NPH/Lente

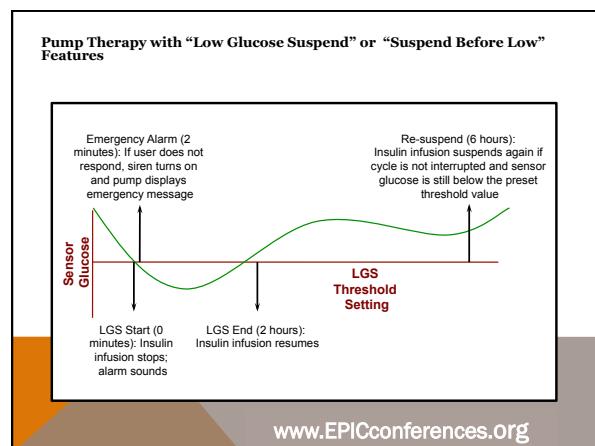
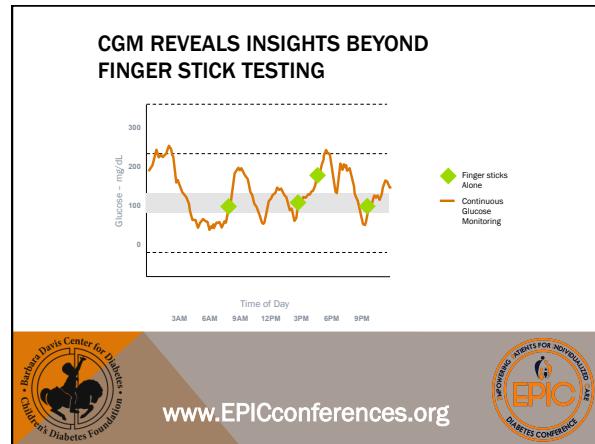
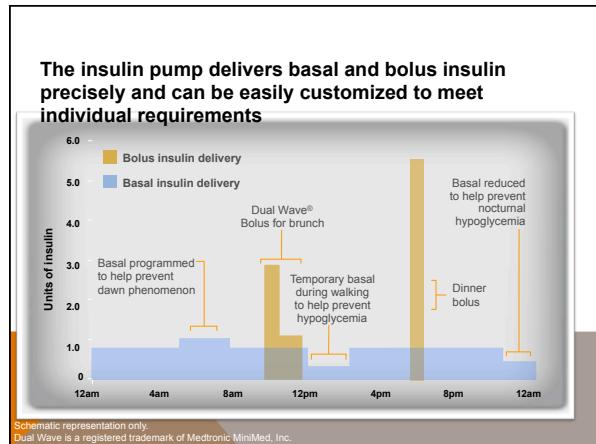
MEALS

B L D HS B

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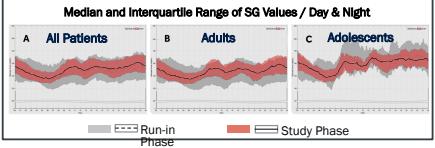
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### Reduced Glycemic Variability

Modal Day Sensor Glucose Tracings



Hybrid closed loop resulted in:  
 Increased time in range  
 Reduced time spent low and high  
 Reduced variability  
 Less post-prandial excursion

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### HYPOGLYCEMIA TREATMENT

- 15/15 Rule depending on degree of Hypoglycemia (most adults 11-2 gms; most kids 6-16 grams)
- Always carry Rapid Acting Glucose
- Glucagon



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