Using Continuous Glucose Monitoring for Glycemic Control

Presented By Shirl Earon, RN, FNP, CWOCN, GNP
Capital Nursing Education

Made possible by a grant from **Shield** HealthCare

Goals of Presentation

- 1. Understand what CGM is and how it can be utilized.
- Have an appreciation for the history of technology in Diabetes.
- Understand the indications for CGM and who is appropriate for it.
- Able to describe how CGM functions, and how it can improve glycemic control
- Understand reimbursement for CGM and how it is changing continuously

- *PROVIDER APPROVED BY THE CALIFORNIA BOARD OF REGISTERED NURSING/Provider Number 16028, approved for 1 CE contact hour/Provider: Kathleen J. Ellis*


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Ambulatory Glucose Monitoring

- Urine glucose monitoring developed by Benedict in 1908 and was used for 50 years
- 1965 Ames developed Dextrostix blood monitoring strip using glucose oxidase in doctor's offices
- Blood glucose meters were developed in 1970 and marketed as Dextrometer in 1980

Diabetes & Technology

- No endocrine disorder lends itself better to clinician-employed use of technology to assist with patient care than diabetes
- Diabetes technological advancements are growing exponentially
- Begin the process of embracing and incorporating technology into your diabetes care

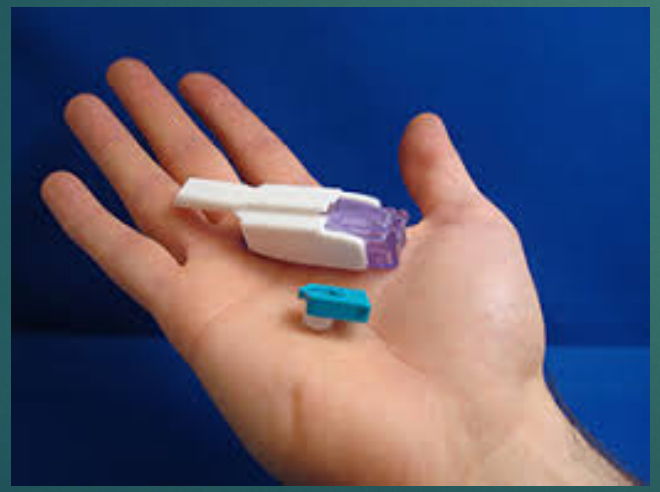
Technology Advances

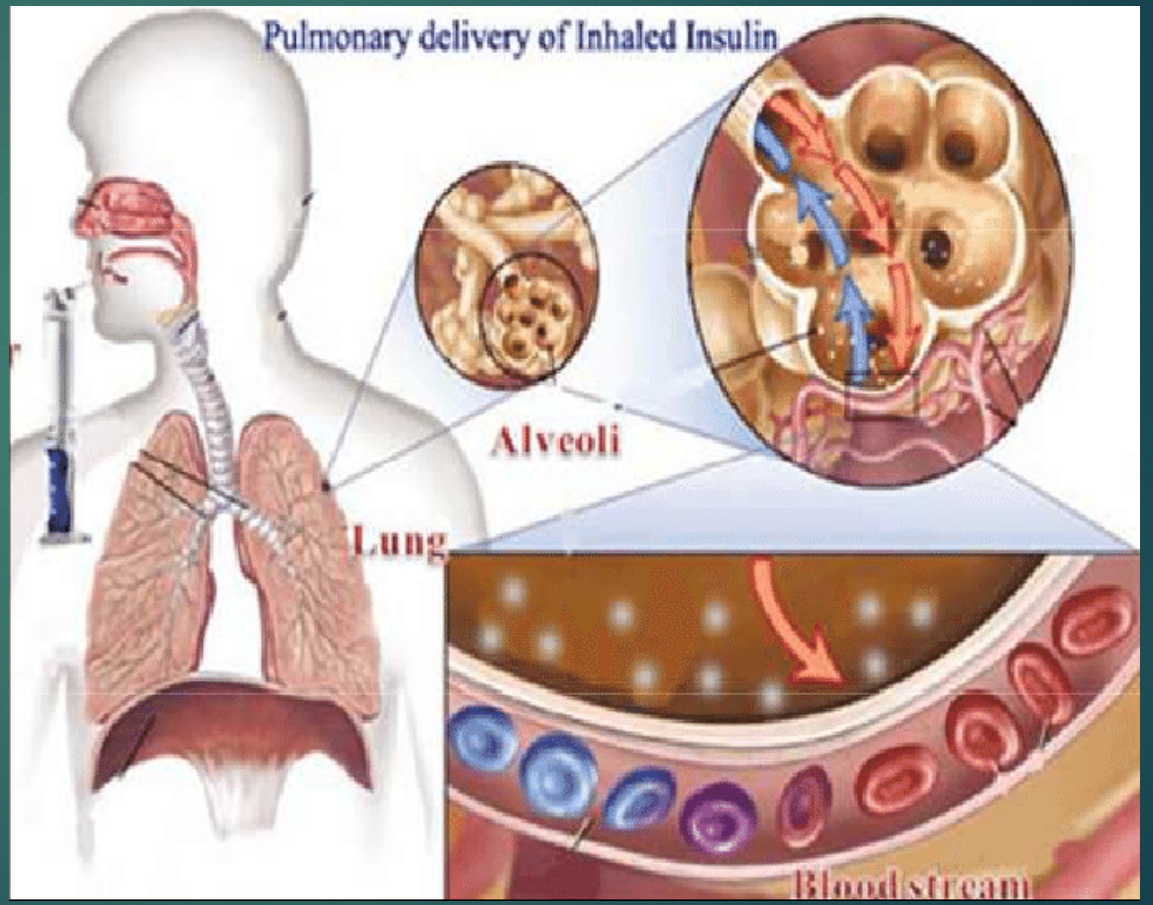
- Smart Insulin Pens
- Insulin Pump
- Artificial Pancreas
- Continuous Glucose Monitors
- Smart pumps

Smart Pen Technology

- Reusable insulin pen which accepts pre-filled insulin cartridges
- Automatically tracks insulin dosing
- Missed dose alerts
- Provides decision support via bolus calculator
- Can be combined with SMBG or CGM to better understand insulin use and impact on glycemic control

Inhaled Insulin



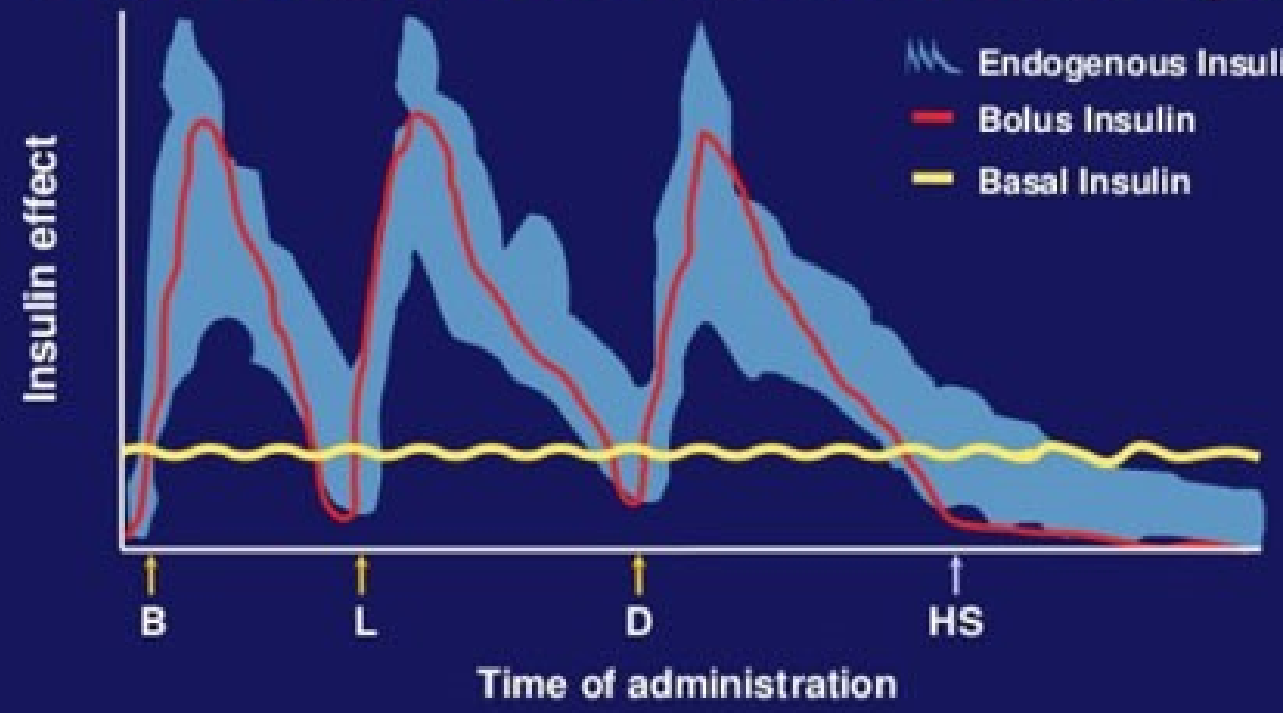


Insulin Pumping 101

- Rapid acting insulin only
- Patients wear pumps continuously
- Insulin deliver divided into three categories:
  - Basal insulin delivery
  - Bolus insulin delivery
  - Correction insulin

Inhaled Insulin (Afrezza)

Normal Insulin Secretion: The Basal-Bolus Insulin Concept



B = breakfast; L = lunch; D = dinner; HS = bedtime.

1. Leahy JL. In: Leahy JL, Cefalu WT (eds). *Insulin Therapy*. Marcel Dekker Inc., New York, 2002.
2. Bolli GB, et al. Diabetologia 1999; 42:1151-67.

Chronic Care Model.

The Chronic Care Model includes six core elements to optimize the care of patients with chronic disease:

1. Delivery system design (moving from a *reactive* to a *proactive* care delivery system where planned visits are coordinated through a team-based approach)
2. Self-management support
3. Decision support (basing care on evidence-based, effective care guidelines)
4. Clinical information systems (using registries that can provide patient-specific and population-based support to the care team)
5. Community resources and policies (identifying or developing resources to support healthy lifestyles)
6. Health systems (to create a quality-oriented culture)

Improving Care and Promoting Health in Populations:
Standards of Medical Care in Diabetes - 2019. *Diabetes Care* 2019;42(Suppl. 1):S7-S12

Lifestyle Behavior Change for Diabetes Prevention

3.2 Refer patients with prediabetes to an intensive lifestyle behavior change program modeled on the Diabetes Prevention Program to achieve and maintain 7% loss of initial body weight and increase moderate-intensity physical activity (such as brisk walking) to at least 150 min/week.

3.3 A variety of eating patterns can be considered to prevent diabetes in individuals with prediabetes.

Patient-centered Collaborative Care

4.1 A patient-centered communication style that uses person-centered and strength-based language and active listening; elicits patient preferences and beliefs; and assesses literacy, numeracy, and potential barriers to care should be used to optimize patient health outcomes and health-related quality of life.

4.2 People with diabetes can benefit from a coordinated multidisciplinary team that may draw from diabetes care and education specialists, primary care providers, subspecialty providers, nurses, dietitians, exercise specialists, pharmacists, dentists, podiatrists, and mental health professionals.

Lifestyle Behavior Change for Diabetes Prevention (continued)

3.4 Based on patient preference, certified technology-assisted diabetes prevention programs may be effective in preventing type 2 diabetes and should be considered.

3.5 Given the cost-effectiveness of lifestyle behavior modification programs for diabetes prevention A, such diabetes prevention programs should be covered by third-party payers.

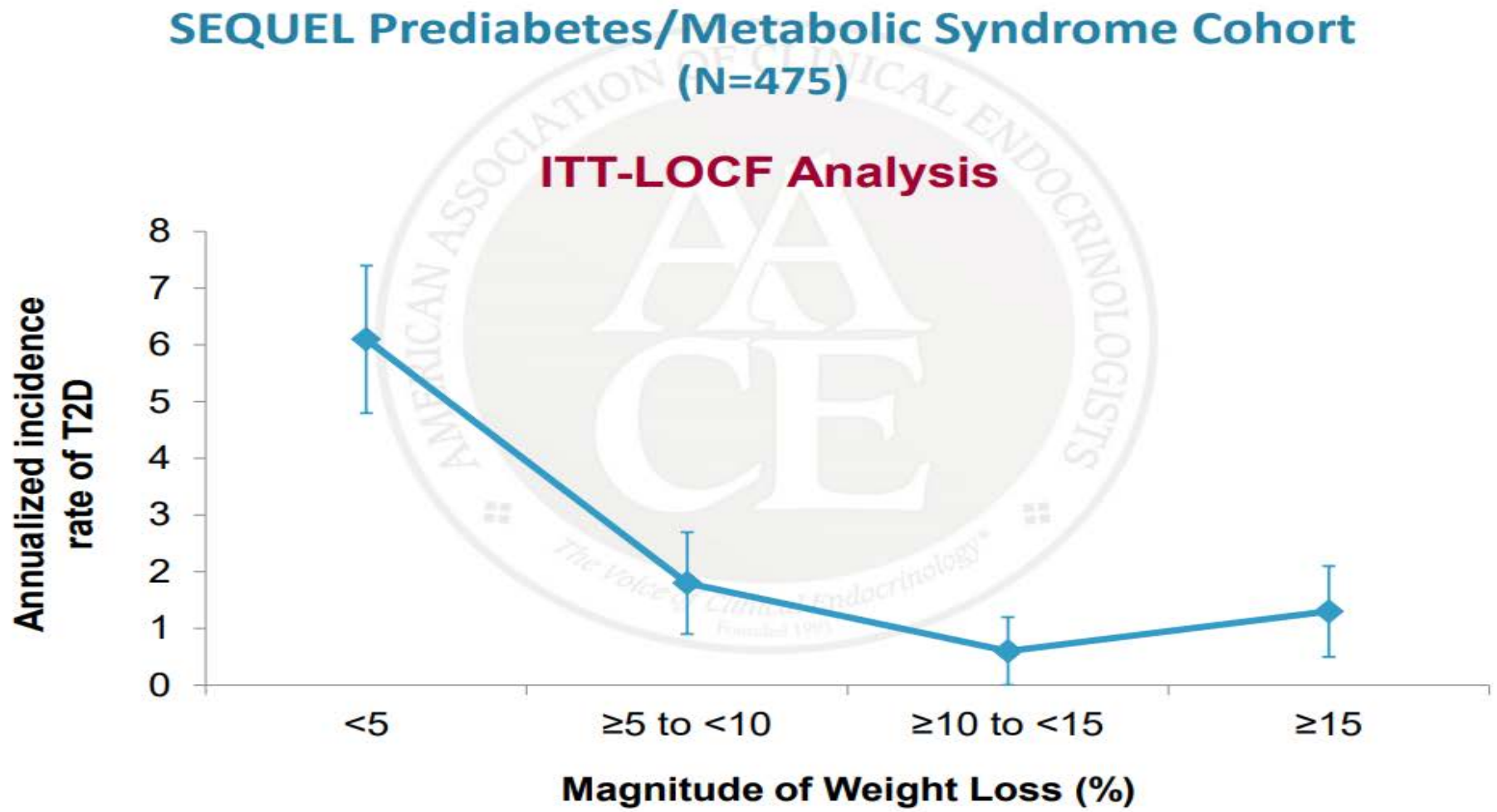
Consequences of Obesity in Diabetes

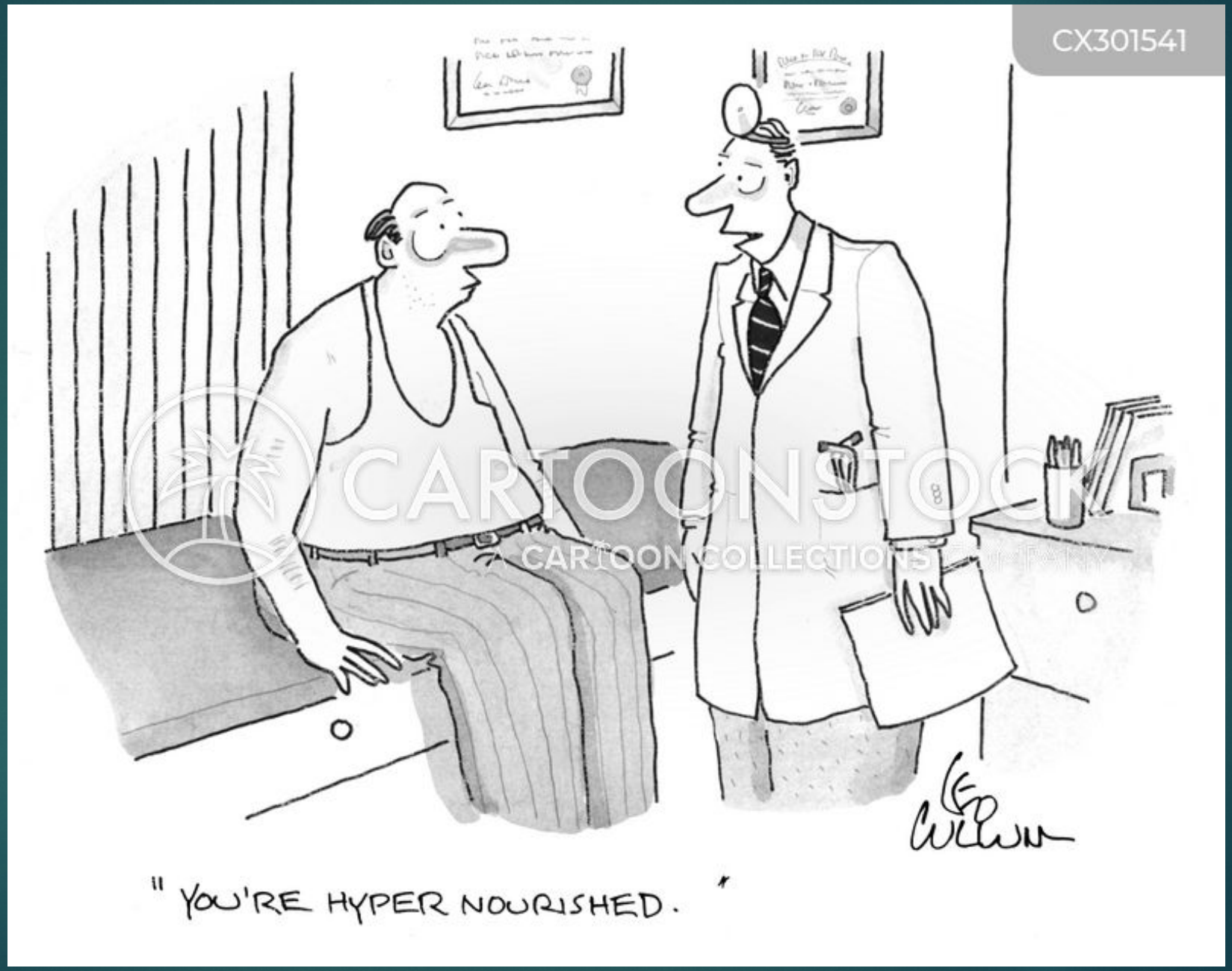
- Increases risk of cardiovascular comorbidities
  - Hypertension
  - Dyslipidemia
  - Atherosclerosis
- May limit ability to engage in physical activity
- Increases insulin resistance
  - Worsens glucose tolerance
  - Necessitates higher exogenous insulin doses
- Changes neuroendocrine signaling and metabolism
- Reduces quality of life

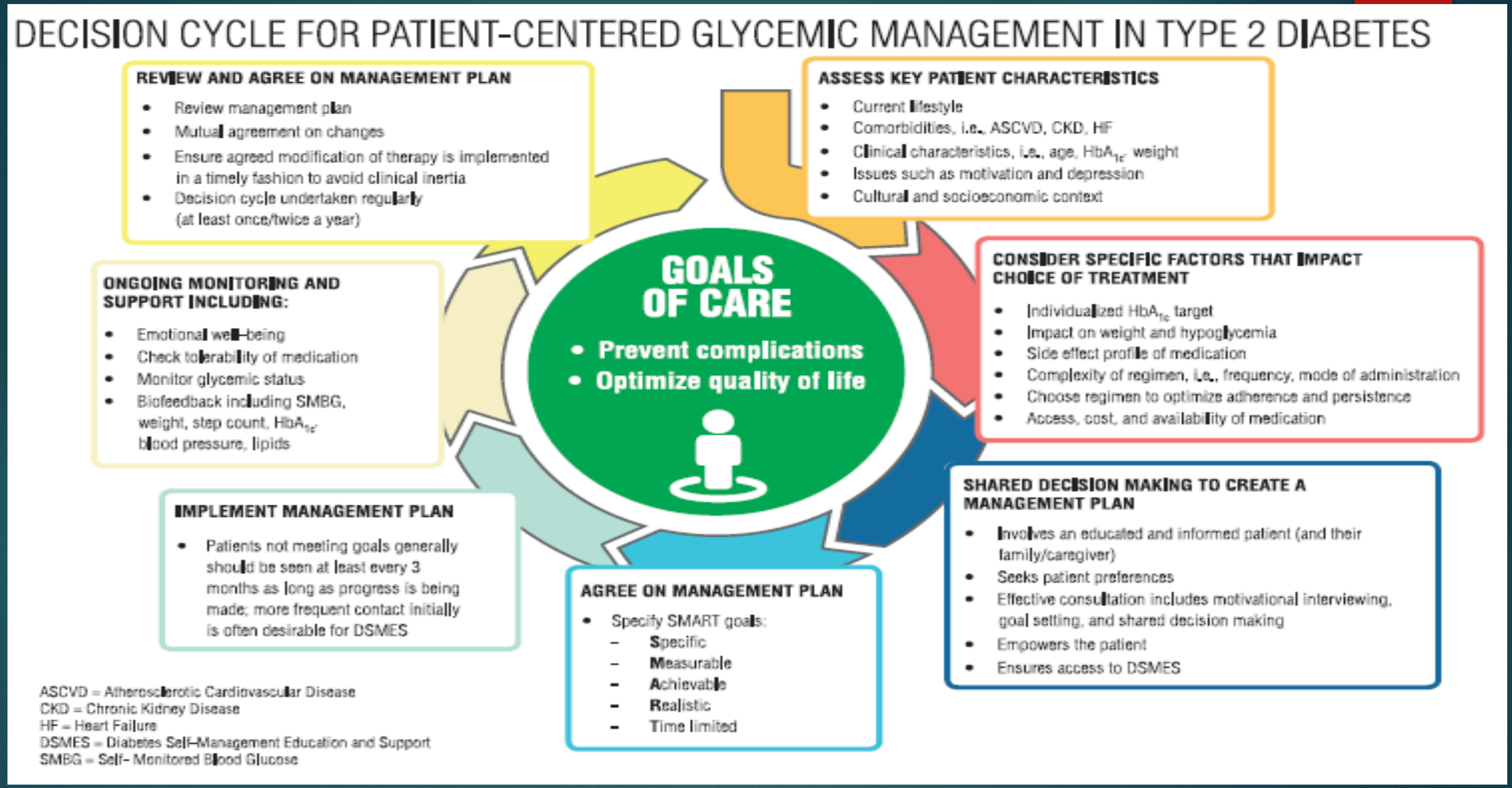
Goal: 5% to 10% weight loss

Handelsman Y, et al. *Endocr Pract*. 2015;21(suppl 1):1-87.

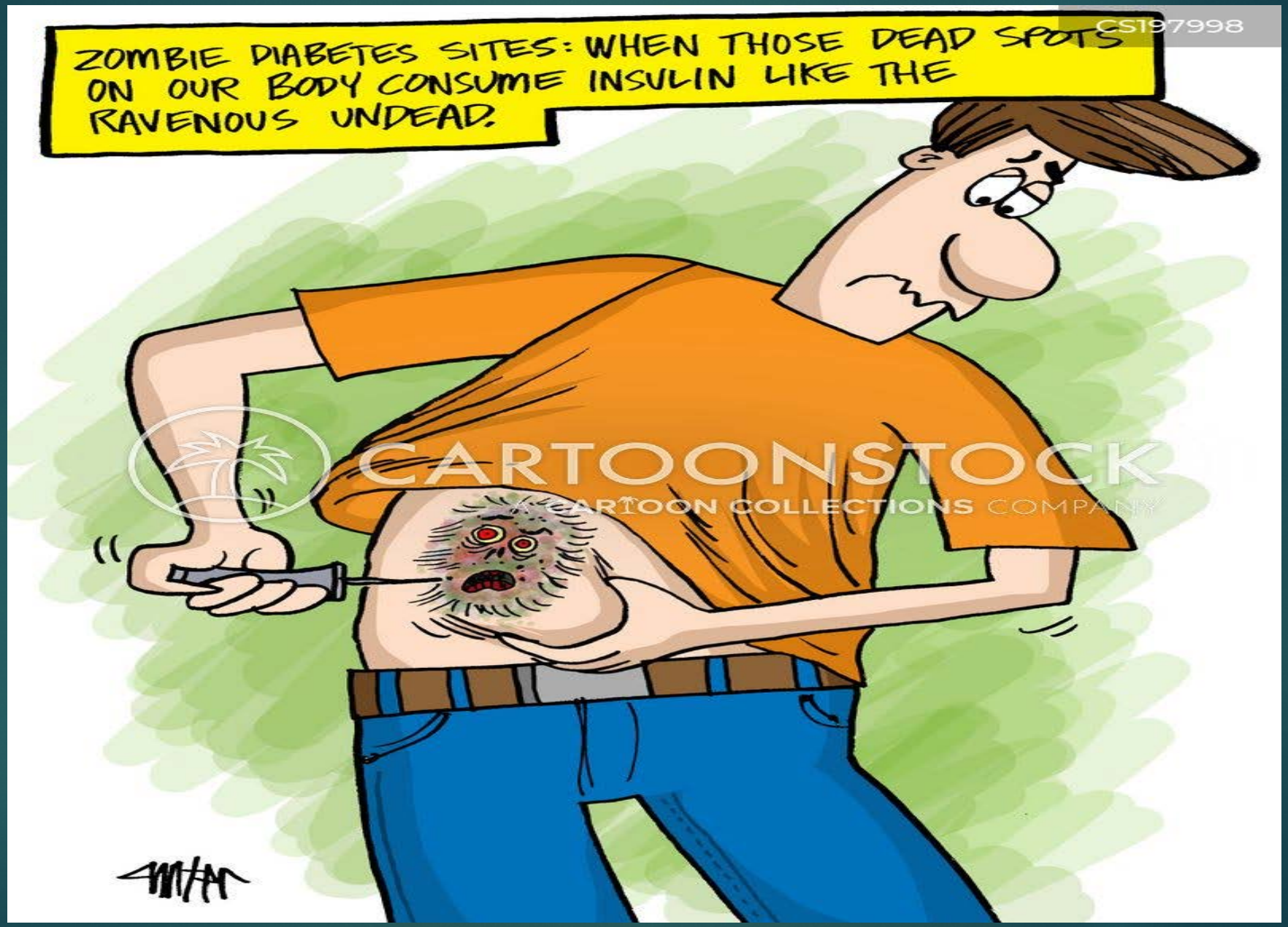
Relationship Between Weight Loss and Prevention of Type 2 Diabetes




CX301541
" YOU'RE HYPER NOURISHED. "



Comprehensive Medical Evaluation and Assessment of Comorbidities:
***Standards of Medical Care in Diabetes - 2021*. *Diabetes Care* 2021;44(Suppl. 1):S40-S52**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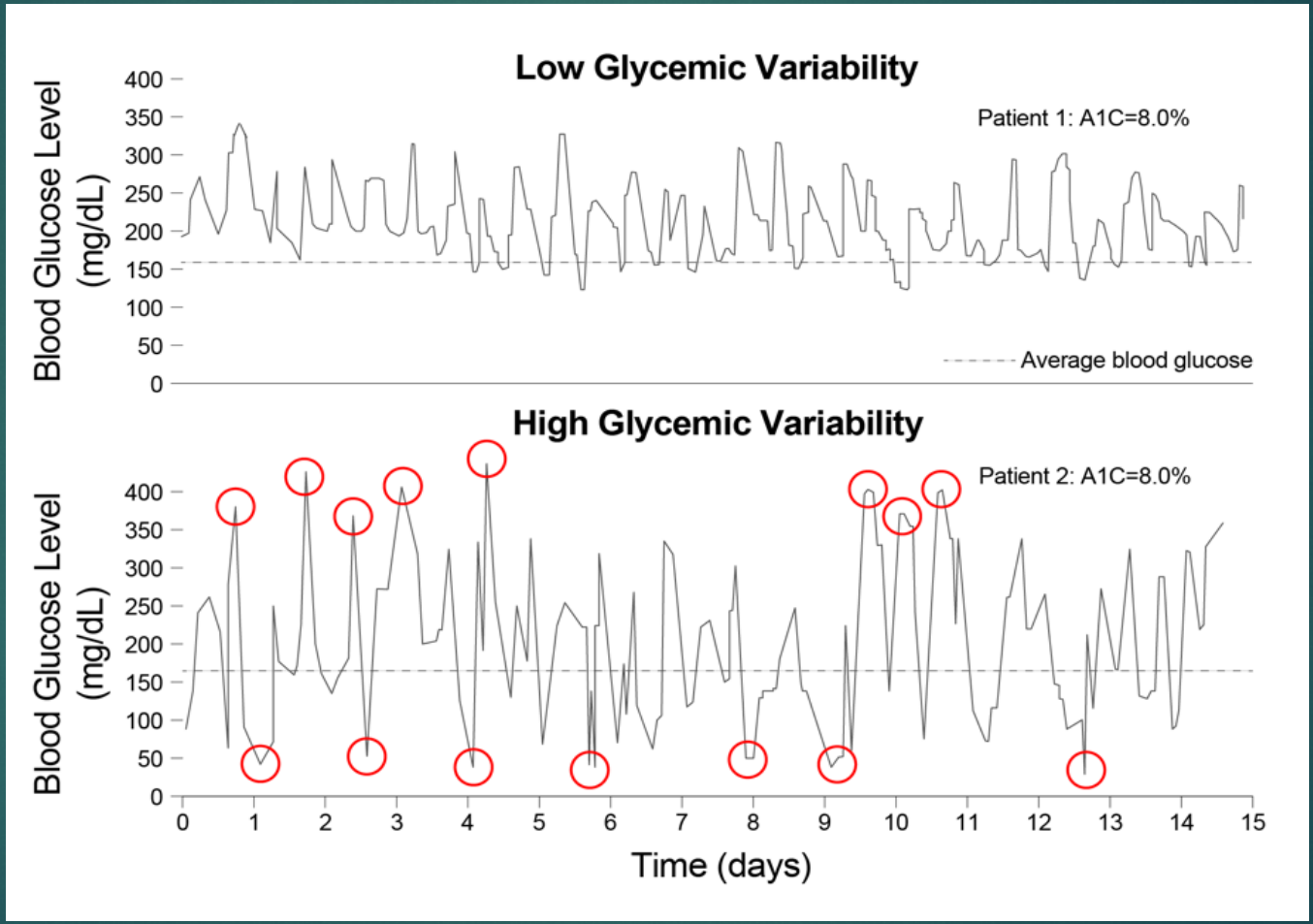
Limitations of HbA1c



A1C & SMBG Targets

Summary of Glycemic Recommendations for Many Nonpregnant Adults With Diabetes	
A1C	<7.0%*
Preprandial capillary plasma glucose	80-130 mg/dL*
Peak postprandial capillary plasma glucose†	<180 mg/dL*

Indications for CGM

- International Consensus:1 All patients with T1D T2D treated with intensive insulin therapy, not meeting glycemic goals Those with problematic hypoglycemia
- American Diabetes Association: T1D not meeting goals, consider in type 2 diabetes, Hypoglycemia unawareness, Sensor augmented Pump Therapy, consider in pregnancy
- AACE: T1D not meeting goals or with hypoglycemia unawareness, Type 2 on insulin therapy or with hypoglycemic unawareness, or unappreciated hyperglycemia.

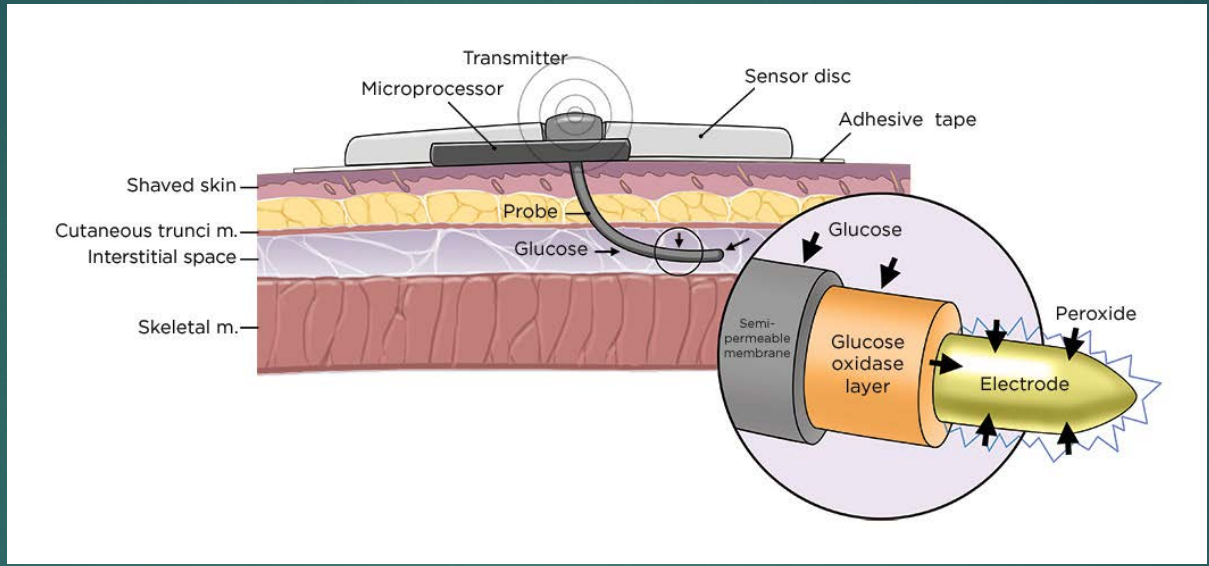
SMBG

- 1980s, 1990s and 2000s saw meters improve in accuracy and simplicity
  - Less blood, less time, less pain
- Professional CGM first launched in 1999
- Real Time CGM
  - Glucowatch Biographer – 1999
  - Medtronic Guardian REAL Time CGM – 2004
  - DEXCOM G4– 2012 (G5 – 2015, G6– 2018)
  - Freestyle Libre (Pro – 2016; Personal - 2017)
- HCL Pump/Sensor
  - Medtronic Guardian Sensor 3 – 2017
  - Tandem T-Slim/DEXCOM G6 -2019
  - Omnipod 5/DEXCOM G6 -2022

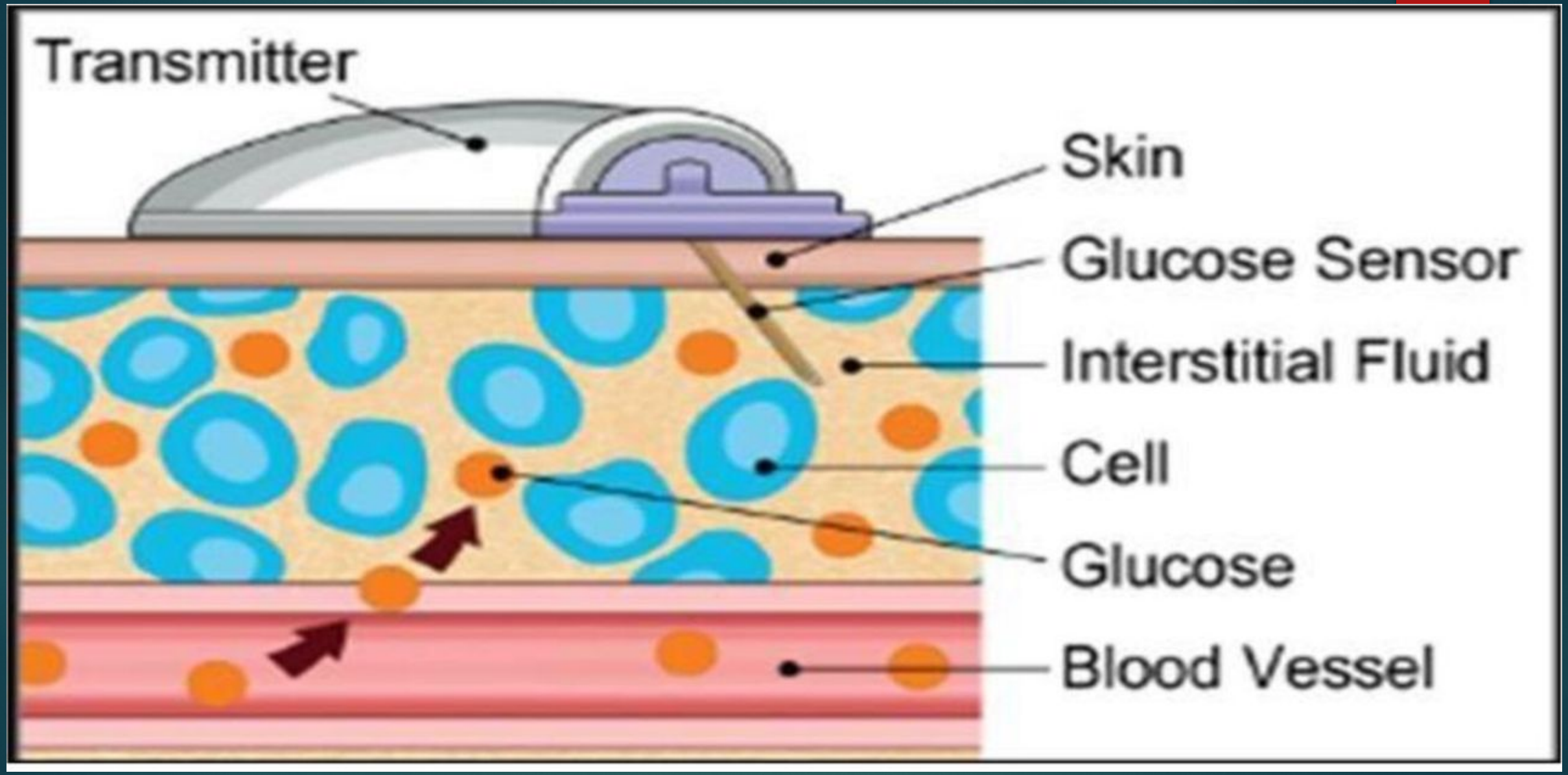
Continuous Glucose Monitoring

- Real Time: rt CGM
  - Medtronic
  - DEXCOM G6
  - Eversense
- Intermittently Scanned: is CGM
  - FreeStyle Libre 2

CGM Electrochemistry



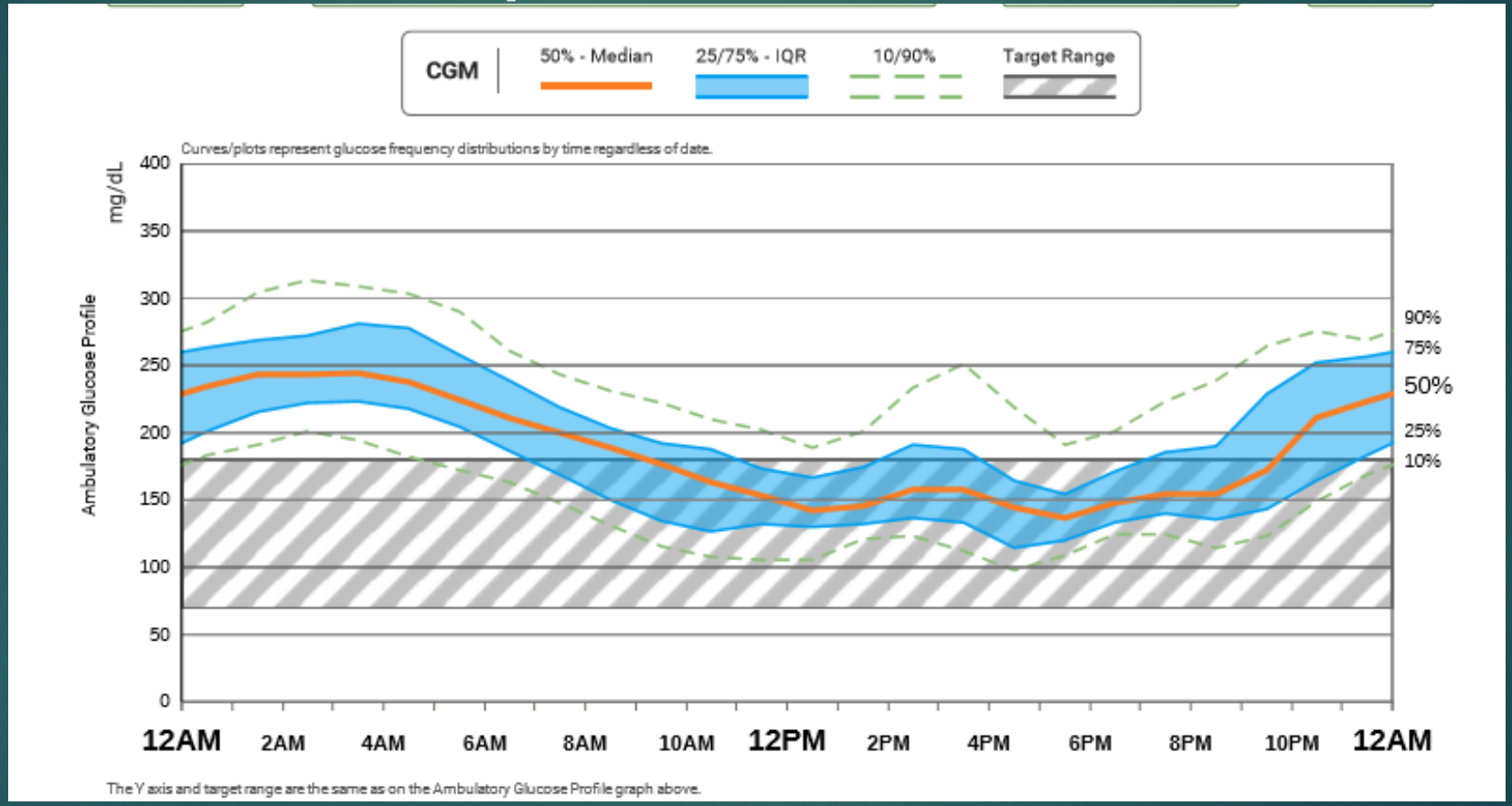
- CGM uses glucose oxidase chemical reaction to generate an electrical signal
- Enables highly accurate estimate of interstitial glucose



Continuous Glucose Monitoring


90-day
Implantable
Sensor
subcutaneous
Removable
Transmitter
worn over skin
Mobile
Applicatio
109

Getting Started with CGM Interpretation



CGM Interpretation
Step 1: Review Summary Data

Overview

14 days | Fri Jul 31, 2020 - Thu Aug 13, 2020

Glucose

Average Glucose

190 mg/dL

Standard Deviation	GMI
55 mg/dL	**7.8%**

AGP Report

May 7, 2020 - May 20, 2020 (14 Days)

GLUCOSE STATISTICS AND TARGETS

May 7, 2020 - May 20, 2020	**14 Days**
% Time CGM is Active	**95%**

Ranges And Targets For: Type 1 or Type 2 Diabetes

Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose	**172** mg/dL
Glucose Management Indicator (GMI)	**7.4%**
Glucose Variability	**31.1%**

Defined as percent coefficient of variation (%CV); target ≤36%

CGM Interpretation
Step 2: Evaluate TIR

ATTD: Advanced Technologies & Treatments for Diabetes

Overview

14 days | Fri Jul 31, 2020 - Thu Aug 13, 2020

dexcom CLARITY

| DOB: Sep 17, 1943

Glucose

Average Glucose

190 mg/dL

Standard Deviation

55 mg/dL

GMI

7.8%

Time in Range

15% Very High

39% High

45% In Range

<1% Low

0% Very Low

Target Range: Day (6:00 AM - 10:00 PM): 70-180 mg/dL
Night (10:00 PM - 6:00 AM): 80-150 mg/dL

Sensor Usage

Days with CGM data

100%

14/14

Avg. calibrations per day

0.0

AGP Report

May 7, 2020 - May 20, 2020 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

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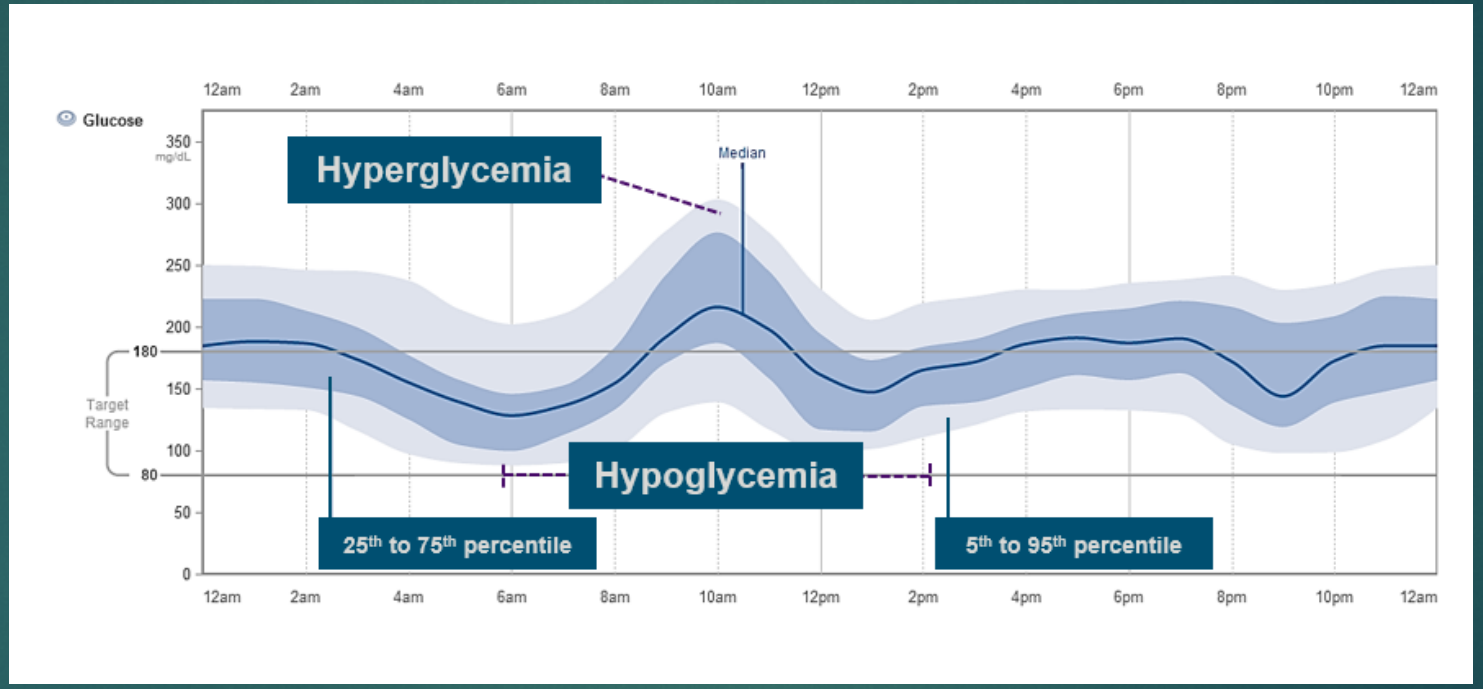
Glucose Management Indicator (GMI)	**7.4%**
Glucose Variability	**31.1%**

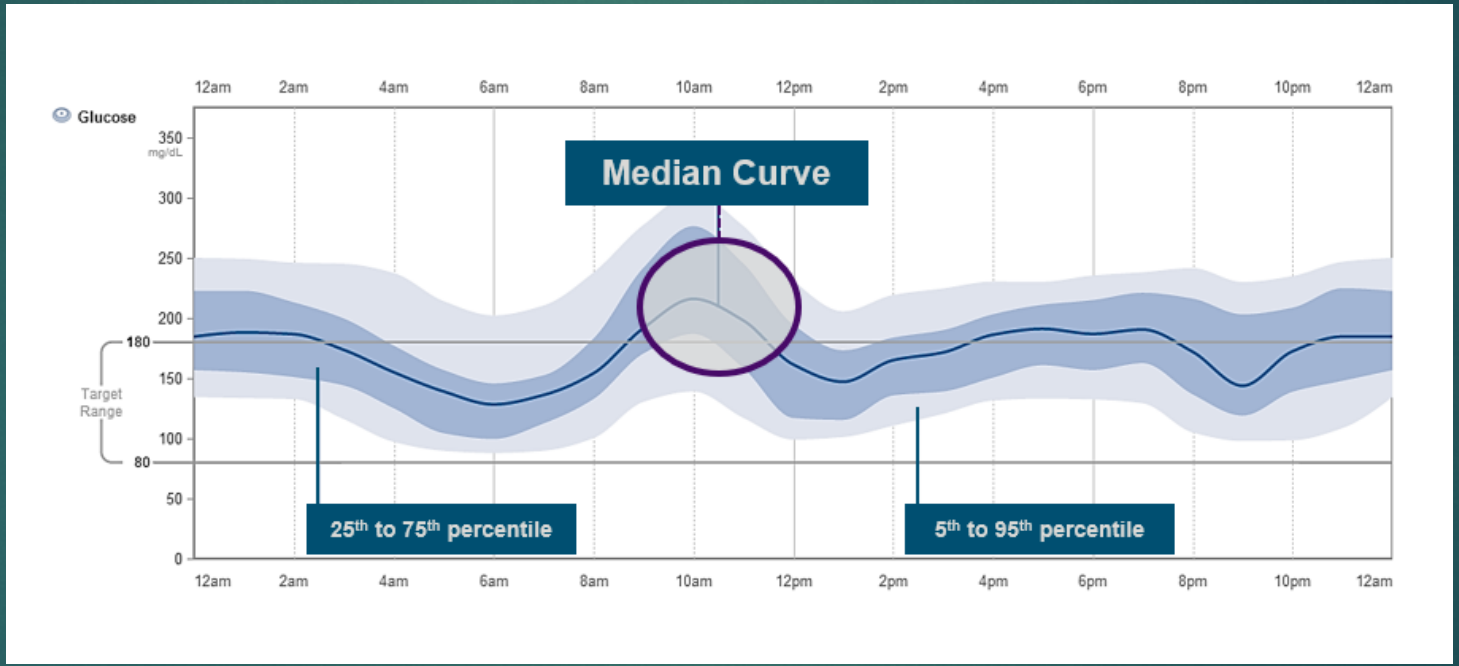
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

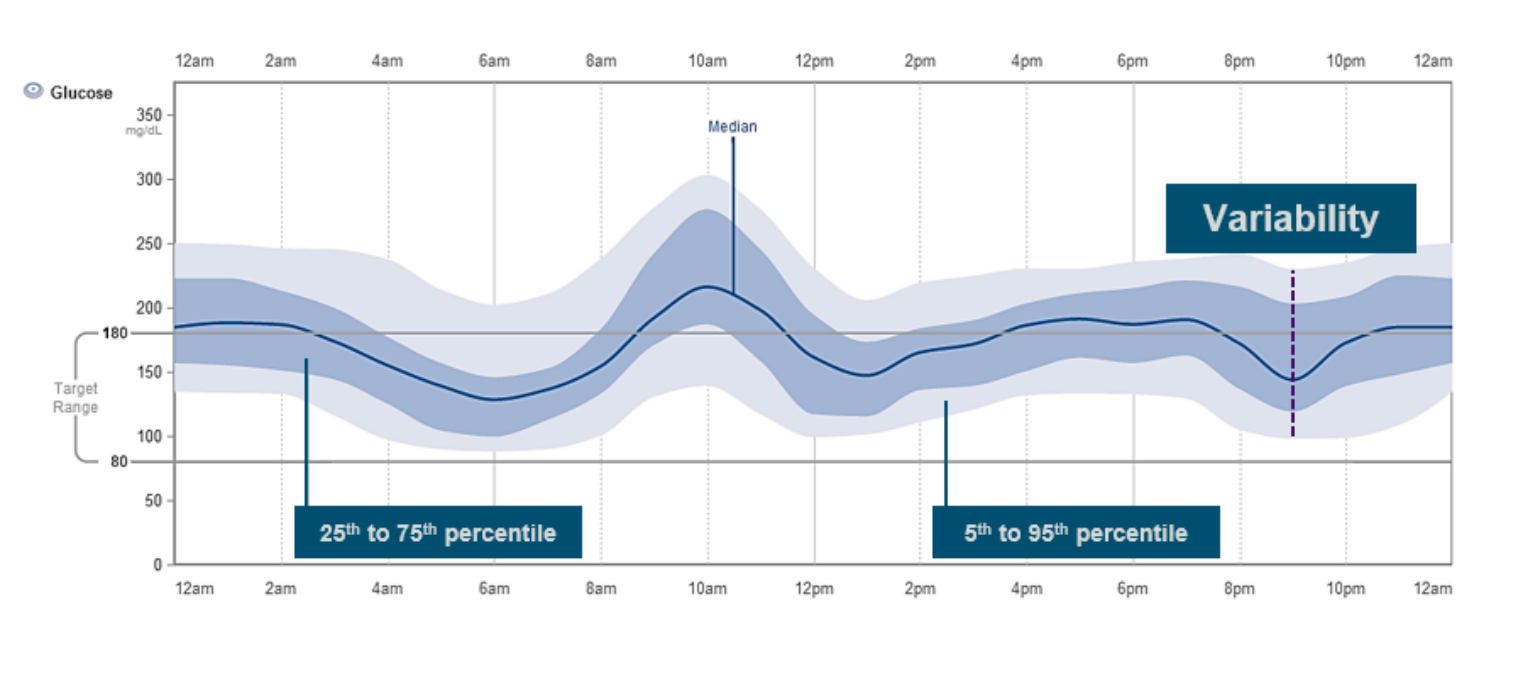
Step 3 Interpreting the AGP: Identify Glycemic Excursions



Interpreting the AGP: Analyze Shape of Median Curve



Interpreting the AGP: Review the Variability



Interpreting the AGP: Review the Variability

CASE STUDY

T2D: metformin, GLP-1 RA and basal insulin

- MB - 46 yo female with T2D
- HPI – presents for Telemedicine f/u. Blood sugars are better since staring Trulicity and FSL. No labs done due to COVID-19. Last A1c 11.5% three months ago prior to starting GLP-1 RA.

- PMHx
  - DM2
  - Yeast infections on SGLT-2i

- Meds
  - Trulicity 1.5 mg/wk
  - Metformin 1000 mg BID
  - Levemir 10 units HS

AGP Report

May 7, 2020 - May 20, 2020 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

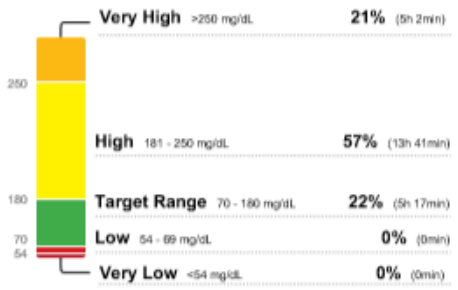
May 7, 2020 - May 20, 2020	**14 Days**
% Time CGM is Active	**63%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)
Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.	

Average Glucose	**216** mg/dL
Glucose Management Indicator (GMI)	**8.5%**
Glucose Variability	**19.0%**

Defined as percent coefficient of variation (%CV); target ≤36%

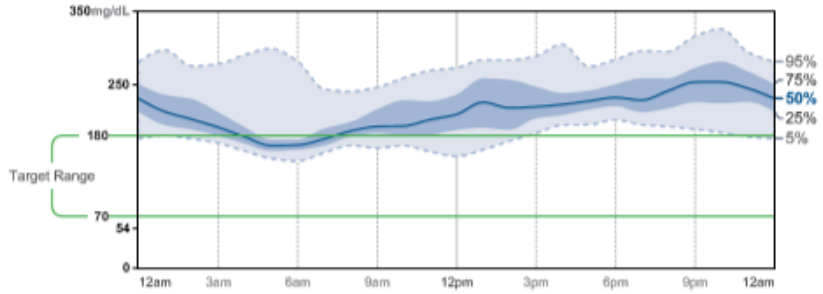
TIME IN RANGES



Very High	>250 mg/dL	**21%** (5h 2min)
High	181 - 250 mg/dL	**57%** (13h 41min)
Target Range	70 - 180 mg/dL	**22%** (5h 17min)
Low	54 - 69 mg/dL	**0%** (0min)
Very Low	<54 mg/dL	**0%** (0min)

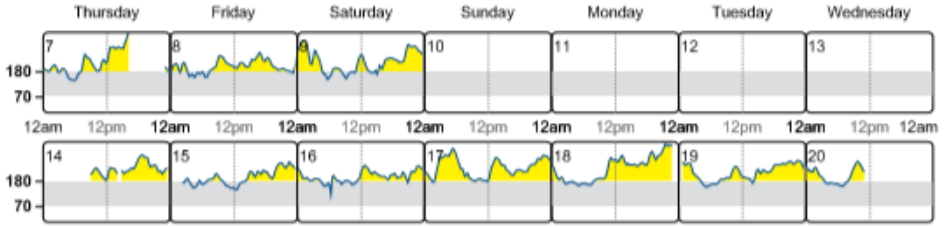
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the upper left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

Inadequate Basal Insulin

T2D Combination Oral Rx

- VS – 50 yo female with T2D
  - Feels well
  - Didn't do labs: last A1c 7.9% 3 months ago
  - Less active but doing better on her diet

- **PMHx:** T2D, HTN, hypothyroidism, hyperlipidemia

- **Meds**
  - Metformin 1000 mg BID
  - Steglatro 15 mg QD
  - Levothyroxine 88 mcg QD
  - Atenolol/Chlorthalidone 100/25 mg QD

AGP Report

February 4, 2020 - February 17, 2020 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

February 4, 2020 - February 17, 2020	**14 Days**
% Time CGM is Active	**40%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose	**162** mg/dL
Glucose Management Indicator (GMI)	**-**
Glucose Variability	**15.1%**

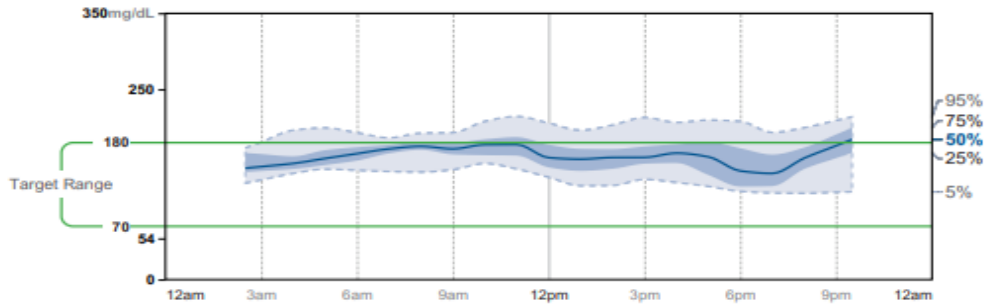
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

Very High	>250 mg/dL	**0%** (0min)
High	181 - 250 mg/dL	**20%** (4h 48min)
Target Range	70 - 180 mg/dL	**80%** (19h 12min)
Low	54 - 69 mg/dL	**0%** (0min)
Very Low	<54 mg/dL	**0%** (0min)

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



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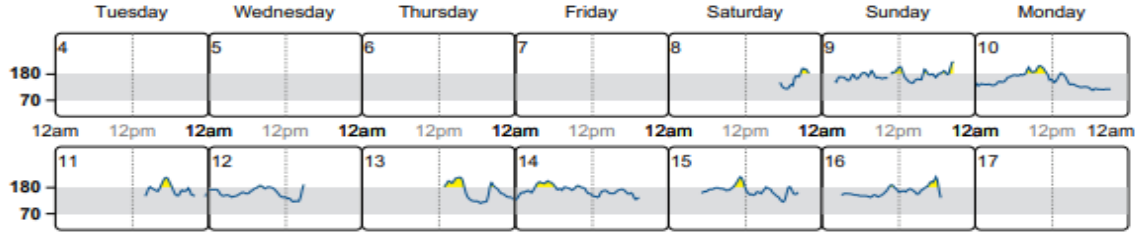
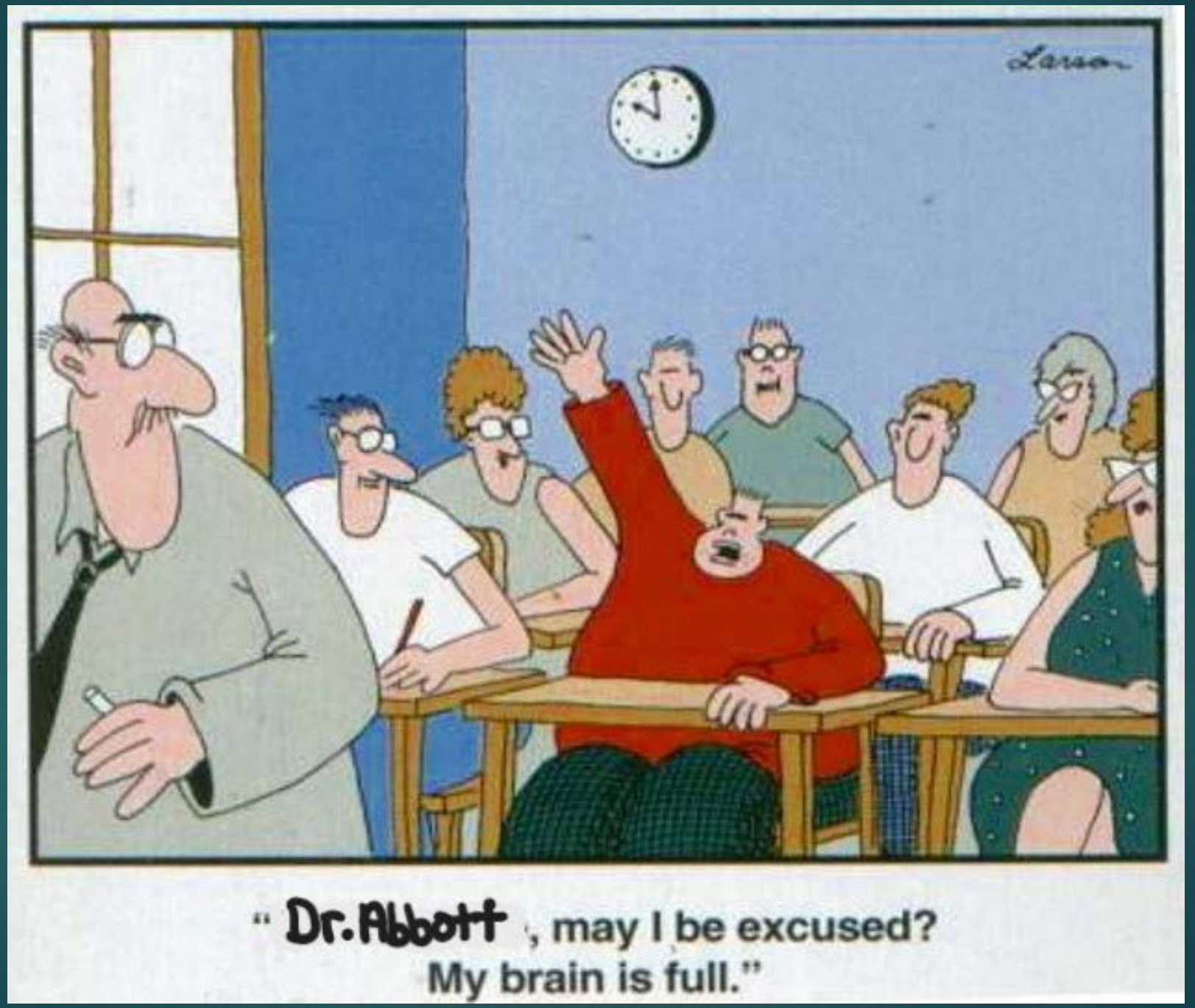


Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

Overnight Hyperglycemia


Larson
" Dr. Abbott , may I be excused?
My brain is full."

References:

Fred Toffel, MD, FACP, FACE
Diabetes Technology for the PCP
April 2, 2022 Reno, NV
Slides #'s 8, 9, 21, 22, 24, 25, 26, 39, 42

Lisa Abbott, MD, Associate Professor, UNR
Pharmacology Update Addressing the Critical Role of the GLP-1 Agonists and SGL-T2 Inhibitors in the Treatment Algorithm
April 2, 2022 Reno, NV
Slides #'s 10, 11, 17

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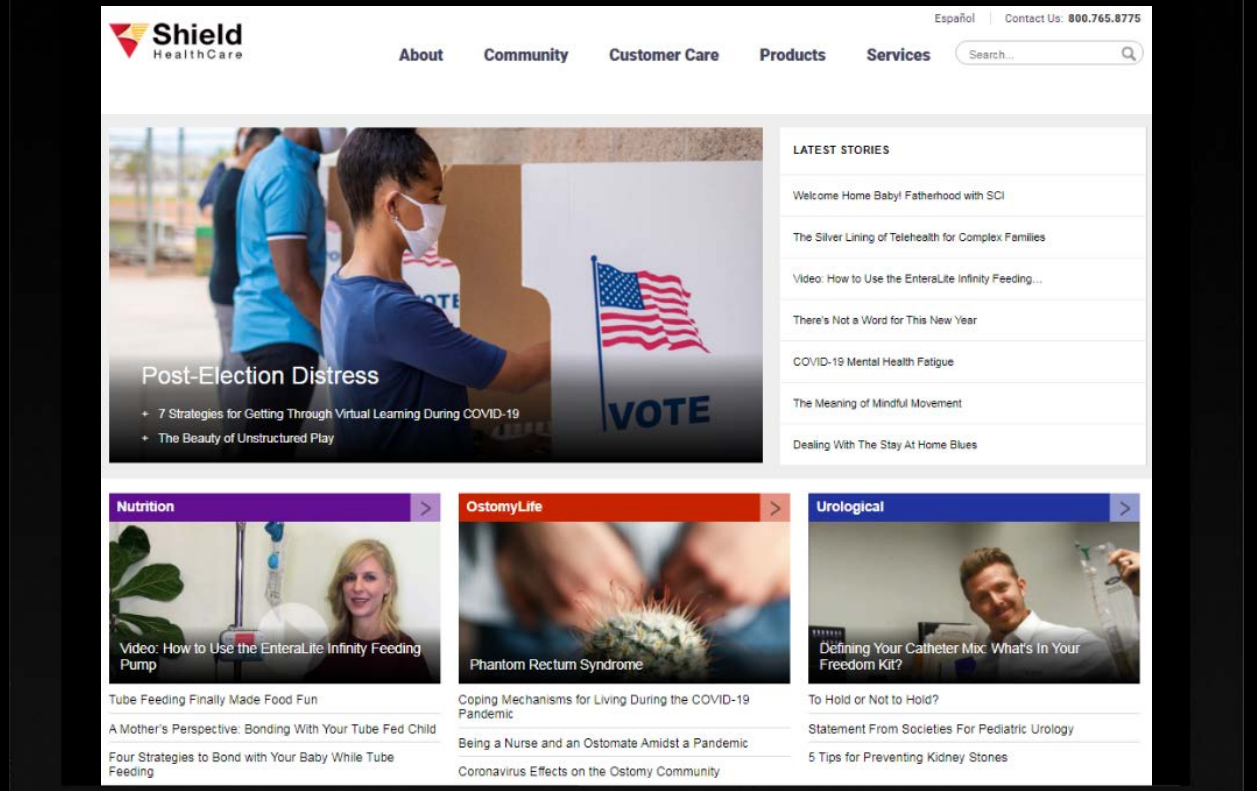

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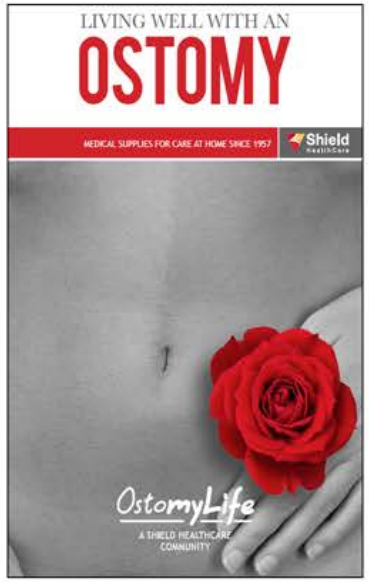

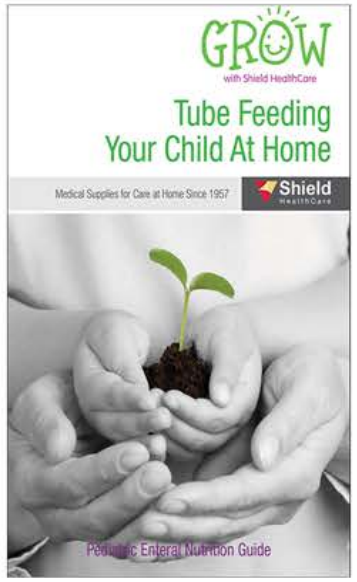

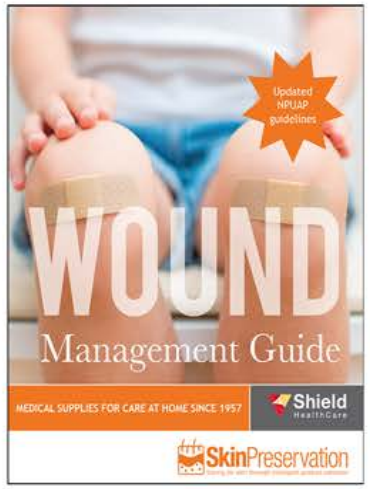

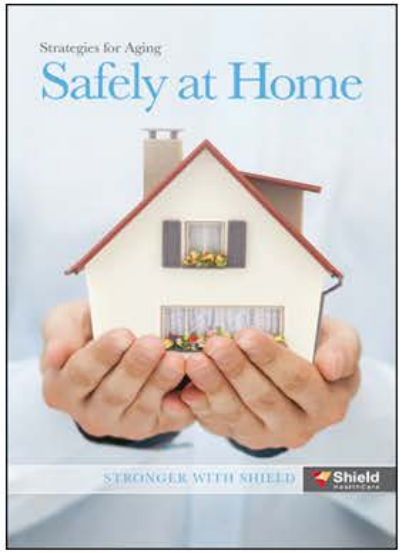

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