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# Part 2: The Effects of Type II Diabetes on the Body

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CAPITAL NURSING EDUCATION

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

# Objectives

- ▶ Look at statistical data
- ▶ General Review of pathophysiology of Type II Diabetes
- ▶ Review symptoms of Type II Diabetes
- ▶ Explore basic anatomy
- ▶ Discuss prevalent health conditions related to Type II Diabetes and how Type II Diabetes is a major risk factor for these conditions.
- ▶ Address what can be done to manage Type II Diabetes for optimal outcomes

# Prevalence

- Approximately 34 million Americans have a form of Diabetes
- **90-95%** of those people have Type II Diabetes
- As of 2018, approximately 7.3 million people have yet to be diagnosed



# Hospitalizations

- ▶ In 2016, approximately 8 million hospital discharges were reported with diabetes being a listed diagnosis
- ▶ 1.7 million discharges for major cardiovascular diseases including 438,000 for ischemic heart disease and 313,000 for stroke
- ▶ 130,000 discharges for lower-extremity amputation
- ▶ 209,000 discharges for hyperglycemia crisis

# Emergency Department Visits

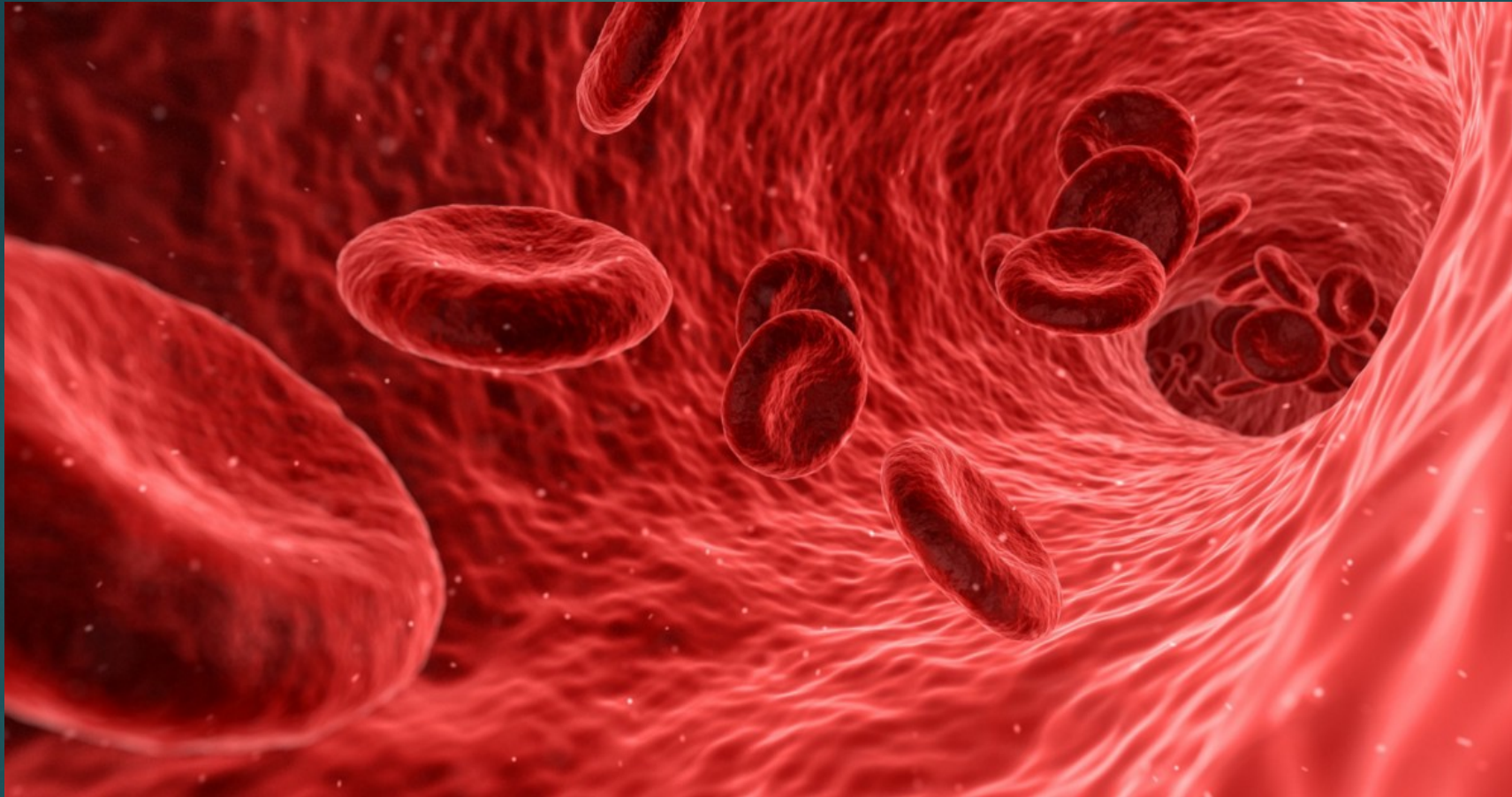
- ▶ In 2016 approximately 16 million emergency department visits were reported with diabetes as any listed diagnosis among adults
- ▶ 235,000 visits for hypoglycemia
- ▶ 224,000 for hyperglycemic crisis

# The Cost of Diabetes in the U.S.

- The total estimated cost of diagnosed diabetes cases in the U.S. in 2017 was **\$327 billion**
- The total of **direct estimated costs** of diabetes increased from \$188 billion in 2012 to \$237 billion in 2017
- Between 2012 and 2017, excess medical costs per person associated with diabetes increased from \$8,417 to \$9,601



# Pathophysiology of Type II Diabetes



# How does it work?

- ▶ Type II Diabetes Mellitus (T2DM), a very common metabolic disorder, is caused by a combination of two primary factors:
  1. Defective insulin secretion by pancreatic  $\beta$ -cells
  2. The inability of insulin-sensitive tissues to respond appropriately to insulin

# Pathophysiology continued

- ▶ Insulin release and action have to be exact in meeting the metabolic demand
- ▶ The molecular mechanisms involved in the synthesis and release of insulin, as well as the insulin response in tissues must be tightly regulated
- ▶ The development of the disease involves a malfunctioning of the feedback loops between insulin action and insulin secretion that results in abnormally high glucose levels in blood
- ▶ Insulin resistance (IR) contributes to increased glucose production in the liver and decreased glucose uptake both in the muscle, liver and adipose tissue

# Physical Manifestations or Symptoms of Type II Diabetes

- ▶ Frequent urination
- ▶ Increased thirst
- ▶ Increased Hunger
- ▶ Unintended weight loss
- ▶ Fatigue
- ▶ Blurred vision
- ▶ Slow healing wounds
- ▶ Frequent infections
- ▶ Numbness or tingling in hands and feet
- ▶ Areas of darkened skin usually in arm pits or neck

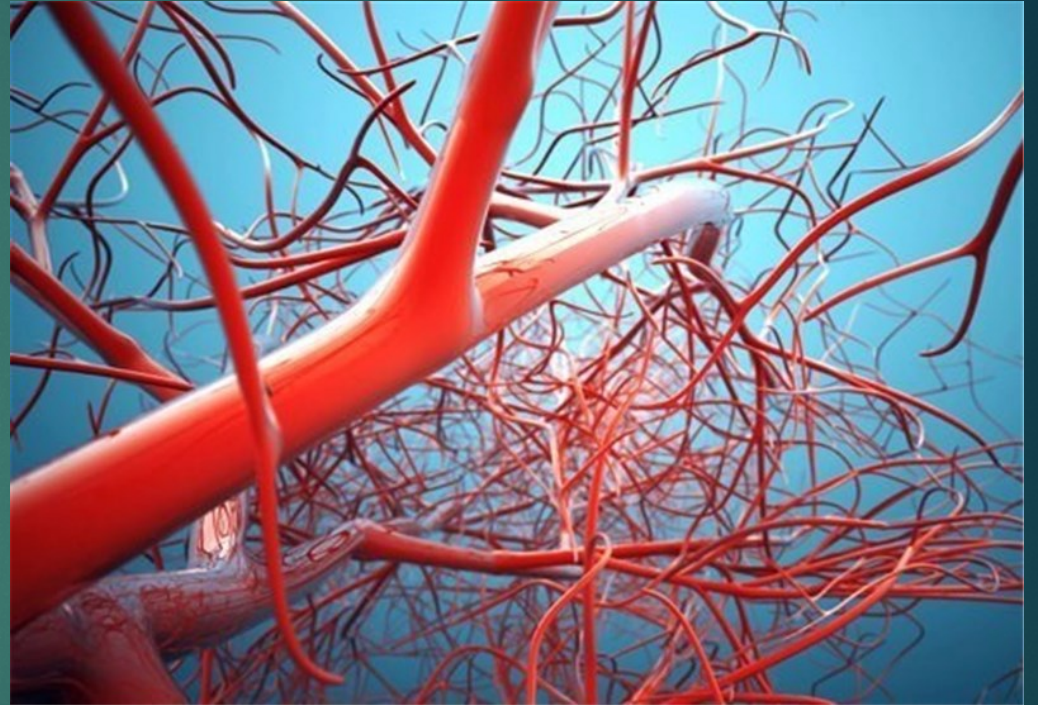
# Basic Anatomy

Just the basics, I promise!



# Blood Vessels

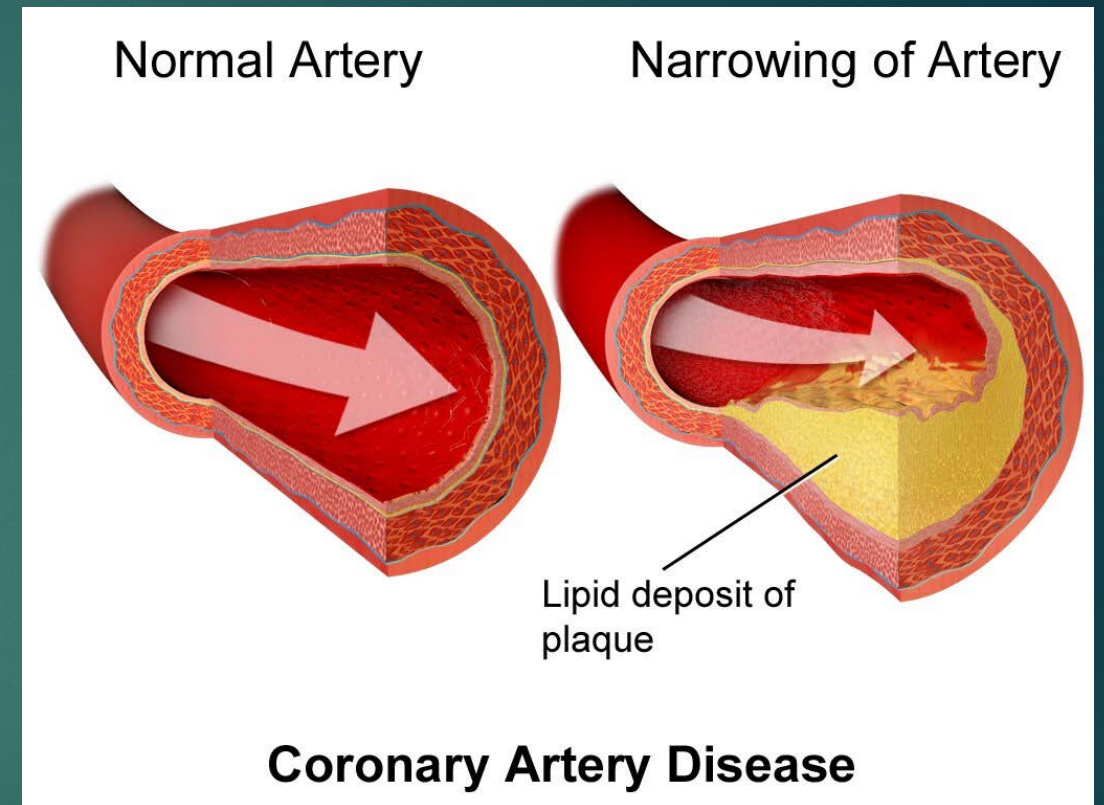
- ▶ Arteries
- ▶ Capillaries
- ▶ Veins



# Vessels Continued

- ▶ Arteries carry oxygenated blood to the organs and muscles
- ▶ Capillaries are very small blood vessels which transfer oxygen and nutrients to cells and collect waste products from the cells
- ▶ Veins are the blood vessels that carry the deoxygenated blood back to the heart

- Blood vessels play an important role in diabetes as they carry the glucose in the blood as well as hormones such as insulin
- Excess glucose in the blood for long periods of time damages these vessels





# How does the damage occur?

Studies have shown that high blood sugar has two effects on cells lining blood vessels as part of atherosclerosis

- ▶ It increases the production of free radicals
- ▶ This process also reduces the availability of nitric oxide (NO), which would otherwise enable blood vessels to relax and blood flow to increase

# Nervous System

- ▶ **Central Nervous System**
  - ▶ Brain and Spine
- ▶ **Peripheral Nervous System**
  - ▶ All other Nerves
    - ▶ Autonomic Nervous System (Involuntary)
      - ▶ Heart, stomach, intestines, sweating, bladder

# Types of Nerves

- ▶ **Sensory**

- ▶ Afferent nerves, carry impulses from sensory receptors towards the brain

- ▶ **Motor**

- ▶ Efferent nerves, carry impulses away from the brain to muscles and glands

# How do the nerves get damaged?

- ▶ Nerves need to be kept fueled with oxygen and other nutrients by the vessels
- ▶ If the vessels are damaged and unable to provide adequate blood supply to the nerves, then over time the nerves are unable to function properly

# Microvascular vs. Macrovascular

- ▶ **Microvascular**

Microvascular disease tends to occur predominantly in tissues where glucose uptake is independent of insulin activity

- ▶ **Macrovascular**

Macrovascular complications of diabetes are primarily diseases of the coronary arteries, peripheral arteries, and cerebrovasculature

# Lack of blood flow

- The damaged vessels that are responsible for delivering blood and nutrients to your body's cells are compromised and cannot effectively do their job



# Major Organs Involved

- ▶ Heart
- ▶ Eyes
- ▶ Kidneys
- ▶ Nervous System
- ▶ Inflammatory Response

# Common complications secondary to Type II Diabetes

## Heart and Blood vessel Disease

Stroke, Heart Attack, PAD, CAD

## Nerve Damage

Diabetic Neuropathy

## Kidney Disease

Chronic and End Stage Kidney Disease

## Eye Damage

Glaucoma, Diabetic Retinopathy, Cataracts, Blindness

## Delayed Wound Healing

Diabetic Ulcer, Chronic wounds, Osteomyelitis



# Heart Disease

- ▶ Heart disease is the leading cause of death in the U.S.
- ▶ The CDC lists **Type II Diabetes** as one of the leading risk factors for heart disease

# What causes Heart Disease?

- ▶ Heart Disease is a term that is used to describe several conditions
- ▶ The process of the coronary artery becoming blocked is called atherosclerosis
- ▶ Atherosclerosis is the process by which cholesterol, fats and other substances build up on the artery wall

# Signs and Symptoms of CAD

1. Chest Pain
2. Weakness
3. Light Headed
4. Nausea
5. Cold Sweat
6. Pain or discomfort in arms and shoulders
7. Shortness of breath

# Nerve Damage

Types of Neuropathy associated with Type 2 Diabetes:

1. Peripheral
2. Autonomic
3. Proximal neuropathy (diabetic polyradiculopathy)
4. Mononeuropathy (focal neuropathy)

# Peripheral Neuropathy

It's the most common type of Diabetic Neuropathy

## Common Symptoms

- Numbness or reduced ability to feel pain or temperature changes
- Tingling or burning sensation
- Sharp pains or cramps
- Increased sensitivity to touch (sometimes a bed sheet can cause pain)
- Serious foot problems, such as ulcers, infections, and bone and joint pain

# Autonomic

The autonomic nervous system controls your heart, bladder, stomach, intestines, sex organs and eyes

- ▶ A lack of awareness that blood sugar levels are low (hypoglycemia unawareness)
- ▶ Bladder or bowel problems
- ▶ Slow stomach emptying (gastroparesis), causing nausea, vomiting and loss of appetite
- ▶ Changes in the way your eyes adjust from light to dark
- ▶ Decreased sexual response

# Proximal neuropathy (diabetic polyradiculopathy)

Proximal neuropathy affects nerves in the thighs, hips, buttocks or legs.

➤ Symptoms are usually on one side of the body, though in some cases symptoms may spread to the other side

1) Sudden, severe pain in your hip and thigh or buttock

2) Weakness and shrinking of the thigh muscles

3) Difficulty rising from a sitting position

# Mononeuropathy (focal neuropathy)

- Mononeuropathy involves damage to a specific nerve. The nerve may be in the face, torso or leg.
- Although mononeuropathy can cause severe pain, it usually doesn't cause any long-term problems.

## Symptoms

- 1) Difficulty focusing your eyes, double vision or aching behind one eye
- 2) Paralysis on one side of your face (Bell's palsy)
- 3) Pain in your shin or foot
- 4) Pain in the front of your thigh
- 5) Chest or stomach pain

## Symptoms of carpal tunnel syndrome

- 1) Numbness or tingling in your fingers or hands, especially in your thumb, index finger, middle finger and ring finger
- 2) Loss of strength with a sense of weakness in your hand and a tendency to drop things



# Chronic Kidney Disease (CKD)

- ▶ CKD is characterized as having a gradual loss of kidney function over time.

There are 5 stages

- ▶ eGFR ( Estimated Glomerular Filtration Rate)
  1. Stage 1 eGFR 90 or greater
  2. Stage 2 eGFR 60-89
  3. Stage 3 eGFR 30-59
  4. Stage 4 eGFR 15-29
  5. Stage 5 eGFR <15

# Chronic Kidney Disease (CKD)

- The estimated prevalence of chronic kidney disease was 37.0% between 2013-2016
- In 2017, there were 58,372 new cases of end-stage kidney disease with diabetes as primary cause
- **Diabetes** is the most common cause of Kidney Disease in the U.S. according to the CDC.

# Kidney Function

- ▶ The main function of the kidneys is to filter waste and extra water out of your blood through urine.
- ▶ Kidneys contain millions of tiny blood vessel clusters called glomeruli and these are the “filters”
- ▶ Type 2 Diabetes if left uncontrolled for a long period of time can cause severe damage to the kidneys.
- ▶ CKD is also referred to as Diabetic nephropathy. “Disease of the Nephron”

# CKD continued

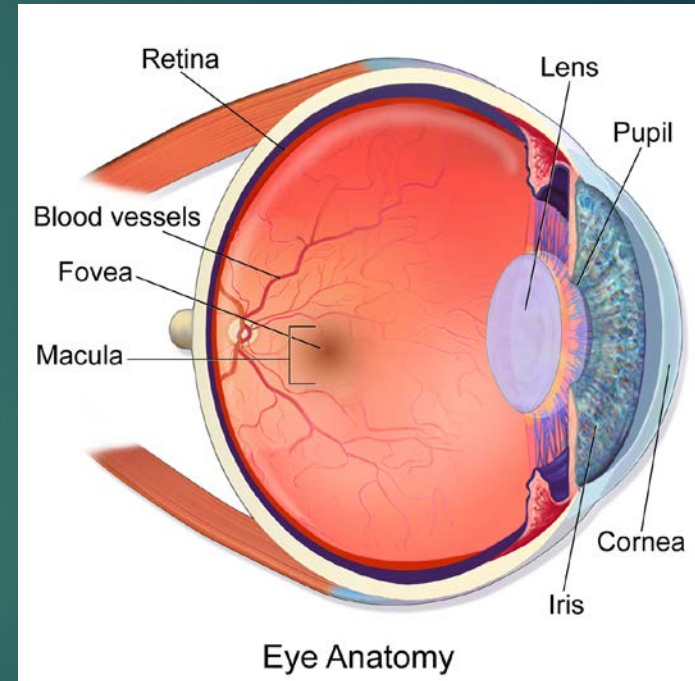
## Late Stages signs and symptoms

1. Worsening blood pressure control
2. Protein in the urine
3. Swelling of feet, ankles, hands or eyes
4. Increased need to urinate
5. Reduced need for insulin or diabetes medicine
6. Confusion or difficulty concentrating
7. Shortness of breath
8. Loss of appetite
9. Nausea and vomiting
10. Persistent itching
11. Fatigue

# Eye Damage

Diabetic eye disease is a group of eye problems that can affect people with diabetes.

1. Diabetic retinopathy
2. Diabetic macular edema,
3. Cataracts
4. Glaucoma.



# Eye Diseases

- Diabetic Retinopathy
- Diabetic Macular Edema
- Glaucoma
- Cataracts

# Diabetic Eye Disease Symptoms

- ▶ In many cases there are no early symptoms of diabetic eye disease.

## Symptoms

1. blurry or wavy vision
2. frequently changing vision—sometimes from day to day
3. dark areas or vision loss
4. poor color vision
5. spots or dark strings (also called floaters)
6. flashes of light

# Delayed Healing

- ▶ Neuropathy
- ▶ Poor Circulation
- ▶ Immune System Inefficiency
- ▶ Chronic Inflammation
- ▶ Increased Infection Risk
- ▶ Chronic Wounds





# Delayed Healing continued

- Neuropathy is both a major cause of injury in individuals with diabetes, and also a reason for delayed wound healing
- Feet are often the location for diabetic wounds as they are hard to check especially if someone has mobility issues which is often the case with severe neuropathy
- Circulation of blood at the wound site is critical for wound healing
- High blood sugar levels also lower the body's ability to fight infections. Immune cells aren't able to function as effectively in diabetic wound healing, which causes an increased risk of bacterial infections
- Infected diabetic ulcers are the number one reason limbs are amputated in the United States

# Managing Type II Diabetes

The CDC states the following:

" It's important to keep your blood sugar levels in your target range as much as possible to help prevent or delay long term, serious health problems, such as heart disease, vision loss and kidney disease."



# Management Continued

- ▶ One of the first methods of assessing BG listed on the CDC guidelines is Continuous Glucose Monitoring or **CGM**.

## What is CGM? –

- Continuous glucose monitoring is wearable technology that makes it easier to track your blood sugar levels over time
- **What is Target Range?**
  1. Before Meals 70 mg/dl-130mg/dl
  2. After Meals <180mg/dl

# Management continued

In addition to keeping BG in check, it is important to be aware of all aspects of T2DM management.

- ✓ Have regular follow up with your provider.
- ✓ Take medications as prescribed and discuss with provider regularly to assess need for changes.
- ✓ Weight Loss- Some research suggests that losing just 10% of your body weight can reduce your risk factors.
- ✓ Exercise-Moving the body is important for weight loss but has also been shown to decrease BG levels.
- ✓ Focus on Diet and carbohydrate intake.

# References

- Centers for Disease Control National Diabetes Statistics Report 2020; National Institutes of Health. Accessed Oct. 24<sup>th</sup>, 2021
- [Int J Mol Sci.](#) 2020 Sep; 21(17): 6275.  
Published online 2020 Aug 30. doi: [10.3390/ijms21176275](https://doi.org/10.3390/ijms21176275)  
PMCID: PMC7503727  
PMID: [32872570](https://pubmed.ncbi.nlm.nih.gov/32872570/)  
**Pathophysiology of Type 2 Diabetes Mellitus**  
[Unai Galicia-Garcia](#),<sup>1,2</sup> [Asier Benito-Vicente](#),<sup>2,3</sup> [Shifa Jebari](#),<sup>2,3</sup> [Asier Larrea-Sebal](#),<sup>1,2</sup> [Haziq Siddiqi](#),<sup>4</sup> [Kepa B. Uribe](#),<sup>5</sup> [Helena Ostolaza](#),<sup>2,3</sup> and [César Martín](#)<sup>2,3,\*</sup>
- <https://www.diabetes.co.uk/body/nerves.html>. Accessed Oct 25<sup>th</sup>, 2021
- CDC Sherry L. Murphy, B.S., Jiaquan Xu, M.D., Kenneth D. Kochanek, M.A., and Elizabeth Arias, Ph.D.  
Mortality in the United States, 2017  
NCHS Data Brief No. 328, November 2018
- [https://www.cdc.gov/heartdisease/coronary\\_ad.htm](https://www.cdc.gov/heartdisease/coronary_ad.htm)- Coronary Artery Disease. Accessed October 17<sup>th</sup>, 2021
- Diabetic neuropathy. National Institute of Diabetes and Digestive and Kidney Diseases.  
<https://www.niddk.nih.gov/health-information/diabetes/overview/preventing-problems/nerve-damage-diabetic-neuropathies/all-content>. Accessed Oct 7<sup>th</sup>, 2021

# References continued

- ▶ Diabetes and foot problems. National Institute of Diabetes and Digestive and Kidney Diseases. <https://www.niddk.nih.gov/health-information/diabetes/overview/preventing-problems/foot-problems#healthyfeet>. Accessed Oct. 7th, 2021
- ▶ Diabetic neuropathy: a position statement by the American Diabetes Association. Diabetes Care. 2017; doi:10.2337/dc16-2042
- ▶ Nerve damage (Diabetic neuropathies). National Institute of Diabetes and Digestive and Kidney Diseases. <https://www.niddk.nih.gov/health-information/diabetes/overview/preventing-problems/nerve-damage-diabetic-neuropathies>. Accessed October 25th, 2021
- ▶ Diabetic neuropathy: a position statement by the American Diabetes Association. Diabetes Care. 2017; doi:10.2337/dc16-2042
- ▶ Diabetic neuropathy: a position statement by the American Diabetes Association. Diabetes Care. 2017; doi:10.2337/dc16-2042
- ▶ Nerve damage (Diabetic neuropathies). National Institute of Diabetes and Digestive and Kidney Diseases. <https://www.niddk.nih.gov/health-information/diabetes/overview/preventing-problems/nerve-damage-diabetic-neuropathies>. Accessed October 25th, 2021
- ▶ <https://www.kidneyfund.org/kidney-disease/chronic-kidney-disease-ckd/stages-of-chronic-kidney-disease/#stage-1-ckd>. Accessed October 25<sup>th</sup>, 2021

# References continued

- ▶ [1] Centers for Disease Control and Prevention. *Chronic Kidney Disease in the United States, 2019*. Atlanta, GA: US Department of Health and Human Services. Centers for Disease Control and Prevention; 2019
- ▶ <https://www.niddk.nih.gov/health-information/kidney-disease/kidneys-how-they-work>. Accessed October 25<sup>th</sup>, 2021
- ▶ [1] Centers for Disease Control and Prevention. *Chronic Kidney Disease in the United States, 2019*. Atlanta, GA: US Department of Health and Human Services. Centers for Disease Control and Prevention; 2019
- ▶ Goldman L, et al., eds. Diabetes and the kidney. In: Goldman-Cecil Medicine. 25th ed. Philadelphia, Pa.: Saunders Elsevier; 2016. <https://www.clinicalkey.com>. Accessed Oct. 21, 2019
- ▶ <https://www.niddk.nih.gov/health-information/diabetes/overview/preventing-problems/diabetic-eye-disease>. Accessed October 21st, 2021
- ▶ <https://www.woundsource.com/blog/how-diabetes-impacts-wound-healing>. Accessed October 12<sup>th</sup>, 2021
- ▶ <https://www.cdc.gov/diabetes/managing/manage-blood-sugar.html>. Accessed October 25<sup>th</sup>, 2021
- ▶ <https://www.woundsource.com/blog/how-diabetes-impacts-wound-healing>. Accessed October 12<sup>th</sup>, 2021

# Thank you all for your attention!



**“Some are born great, some achieve greatness,  
and some have greatness thrust upon ‘em.”**  
*-William Shakespeare*



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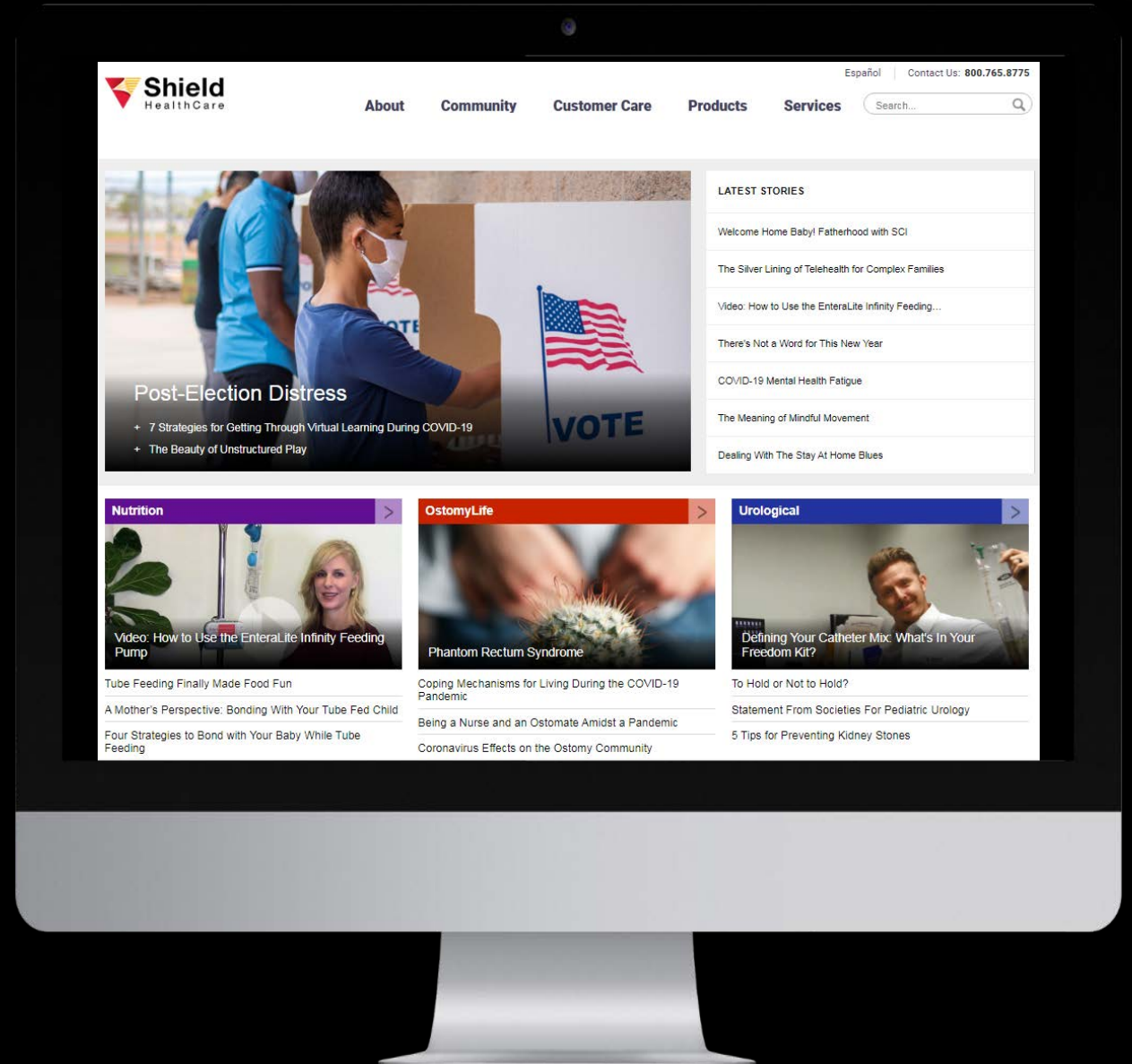


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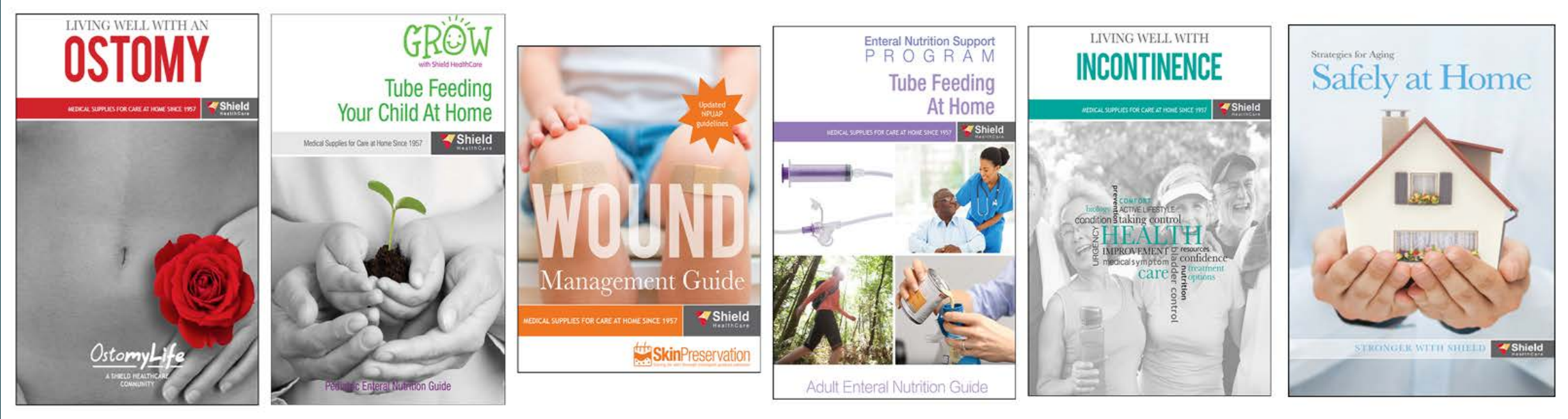
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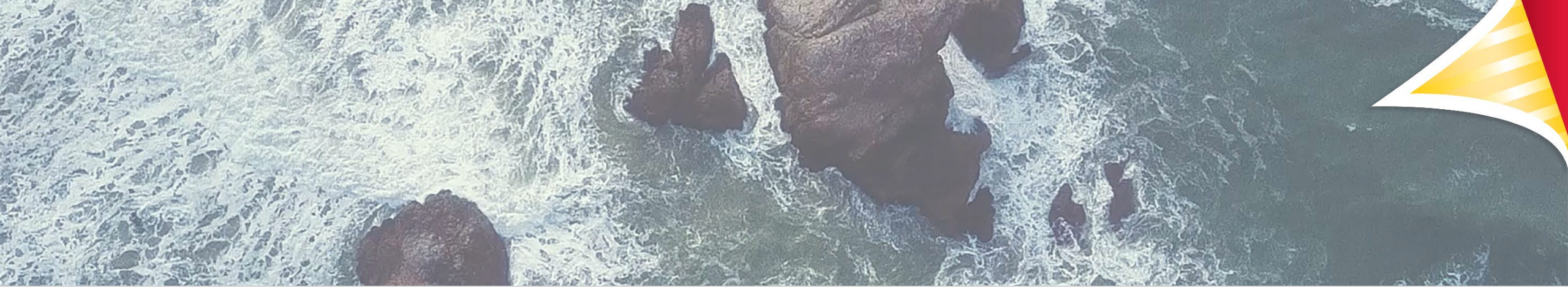


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