

Hoof Beats Sometimes Do Mean Zebras

Chris Kjolhede, MD, MPH

Emeritus Pediatrician
Bassett Healthcare Network
Cooperstown, NY

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Steve North, MD, MPH

Medical Director, Health-e-Schools
Medical Director, MCHP SBHCs

Continuing Education Credits

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Learning Objectives

At the conclusion of this session, learners will be able to:

- 01** Develop a practical approach to adolescents presenting with unusual clinical signs, symptoms, or confusing diagnostic tests
- 02** Identify when to seek specialist consultation or refer for further evaluation
- 03** Apply a comprehensive risk assessment (SHEADDDSS) to all adolescent patients

Morning Report



This Is an Interactive Program

For each case, we will work through:

- Present history
- Provide past medical history (PMHx)
- SHEADDDSS psychosocial assessment
- Physical exam findings
- Test results and imaging
- Diagnosis and further information

Refine your differential diagnosis at every step of the process.

CASE 1

Limping Along Down the Hall

15-year-old male with a limp

01

Limping Along Down the Hall

“

15 y.o. male was observed walking down an empty hall and was noted to have a limp. Patient recalls injuring his 'leg' 2 years ago and states he “always limps.”

Background: Patient observed walking down an empty hall with a noticeable limp.

Medical question: Patient recalls injuring his 'leg' 2 years ago and reports he 'always limps.'



Past Medical History

Rib and shoulder pain: Reported R-sided rib and shoulder pain 1 month ago; injury resulted from an incident in the school hallway; resolved.

Annual visit (10 months ago): No limp noted nor reported.

Allergy: Amoxicillin



SHEADDSS Assessment

Strengths: 'Friendly'

Home: Lives with mom; visits dad's house on weekends

Education: Does 'okay' in school

Activity: Has done some sports (football); nothing currently but goes outside often at dad's house

Diet: Eats 5 fruits & vegetables/day

Drugs: No smoking (though is exposed); no chewing, alcohol, or other drugs

Depression: Denies



SHEADDDSS Assessment (cont.)

Sex: Not sexually active

Safety: Feels safe at both homes; shoots guns with dad; denies abuse; cuts wood at home with dad

INTERACTIVE

Physical Exam



Any questions before we proceed to the physical exam?



Physical Exam

General: WD/WN 14 y.o. male in NAD; Tanner 4; BMI = 96th percentile

Extremities: L leg 1" shorter than R leg; manipulation of L patella = slight pain; no other pain, swelling, or joint erythema

ROM: Full ROM at knees; full ROM at R hip

Key finding: Drehmann sign positive with ROM maneuver at the L hip

CASE 1

What Would You Do Next?



Laboratory studies?



Radiologic studies?



Medication(s)?



Physical therapy?



Referral(s)?

CASE 1

Radiologic Exam of the Pelvis





Left Slipped Capital Femoral Epiphysis (SCFE)

Demographics: More common in males; typically ages 10–16, before Tanner 5

Risk factors: Overweight / obesity is a significant risk factor

Atypical presentations: 26% present with knee pain; 35% present with thigh pain — not classic hip pain

Exam: Affected leg is externally rotated; Drehmann sign positive

Urgency: Requires surgery to avoid avascular necrosis and permanent limp

Outcome

- 1 Referred on a Thursday to Pediatric Surgeon
- 2 Scheduled for surgery early the following week
- 3 Recovered with no evidence of a limp within several months

CASE 2

Throat Pain & Fatigue

16-year-old male with complex medical history

CASE 2

Sunday: Emergency Department Visit

Patient: 16-year-old male presenting with throat pain and fatigue

- 2 weeks of fatigue
- 1 week of sinus pressure, then L ear pain
- Afebrile throughout the entire illness
- Has missed 5 days of school



Past Medical History

- Allergic asthma
- Eczema / atopic dermatitis
- Idiopathic pancreatitis at age 12
- 3 episodes of shingles
- Recurrent sinusitis
- Allergic rhinitis due to animal hair/dander
- Allergic urticaria
- Anaphylactic shock due to tree nuts
- Anaphylaxis with fish and shellfish



SHEADDDSS Assessment

Strengths: Good mechanic

Home: Lives with mom, dad, and younger sister

Education: Sophomore; enrolled in welding and automotive programs

Activities: Races 4-wheelers; works at the family auto garage

Diet: Normal; significant caffeine intake



SHEADDDSS Assessment (cont.)

Drugs: Vapes when pressured by peers; denies marijuana, alcohol, or other drug use

Depression: PHQ-2 negative; denies suicidal ideation

Sexual Health: Not sexually active

Safety: Feels safe at home; uses seatbelt; denies physical or emotional abuse; no legal challenges; owns two hunting rifles in the home



Exam Findings

Vitals: T=98.9; HR=77; Resp=16; BP=118/63; SpO₂=99%

General: NAD; A&Ox3

HEENT: Right eye is erythematous and injected, yellow discharge, PERRLA, EOMI, small blisters on the eyelids. Left eye, a few blisters. Throat: chelitis at both corners of the mouth, whit exudate on the tongue. Otherwise normal, no lymphadenopathy

Respiratory: Clear to auscultation bilaterally

Cardiovascular: RRR; no murmur; 2+ peripheral pulses

Abdomen: Nontender, nondistended; normal bowel sounds; no masses

Skin: Warm; no rashes, bruising, or atypical lesions

Neuro: Grossly intact

INTERACTIVE

Test Results and Imaging



What laboratory and imaging studies would you order based on this presentation?

INTERACTIVE

Test Results and Imaging



Rapid Strep - negative

INTERACTIVE

Diagnosis



Based on the history, exam, and test results — what is your diagnosis?

INTERACTIVE

Sunday ED Diagnosis

Dx: Pink eye and impetigo

Tx: Ceftriaxone IM, oral steroids, erythromycin topical, oral nystatin, viscous lidocaine

CASE 2

Monday: Emergency Department Visit

Patient: 16-year-old male presenting with throat pain and fatigue

- Now with weakness
- Fevers overnight
- Redness and rash have expanded to both eyes
- Increased sore throat and cough



Monday Exam Findings

Vitals: T=98.0; HR=76; Resp=17; BP=138/68; SpO₂=96%

General: ill appearing

HEENT: Crusty and scabbed lesions on face, Bilateral eyes with discharge and conjunctival redness, PERRLA, EOMI

Respiratory: Clear to auscultation bilaterally

Cardiovascular: RRR; no murmur; 2+ peripheral pulses

Abdomen: Nontender, nondistended; normal bowel sounds; no masses

Neuro: Grossly intact

INTERACTIVE

Monday test Results and Imaging



What laboratory and imaging studies would you order based on this presentation?

Monday Test Results and Imaging



CBC – wnl

CMP – Glu: 82 otherwise normal

HIV – negative

RSV – negative

Influenza A/B – negative

Strep A – negative

CXR - negative

INTERACTIVE

Diagnosis



Based on the history, exam, and test results — what is your diagnosis?

INTERACTIVE

Monday ED Diagnosis

Dx: Viral oral lesions, conjunctivitis, thrush

Tx: oral steroids, cephalexin, smx/tmp, continue viscous lidocaine and oral nystatin along with topical erythromycin

CASE 2

Tuesday Morning



Woke up unable
to swallow

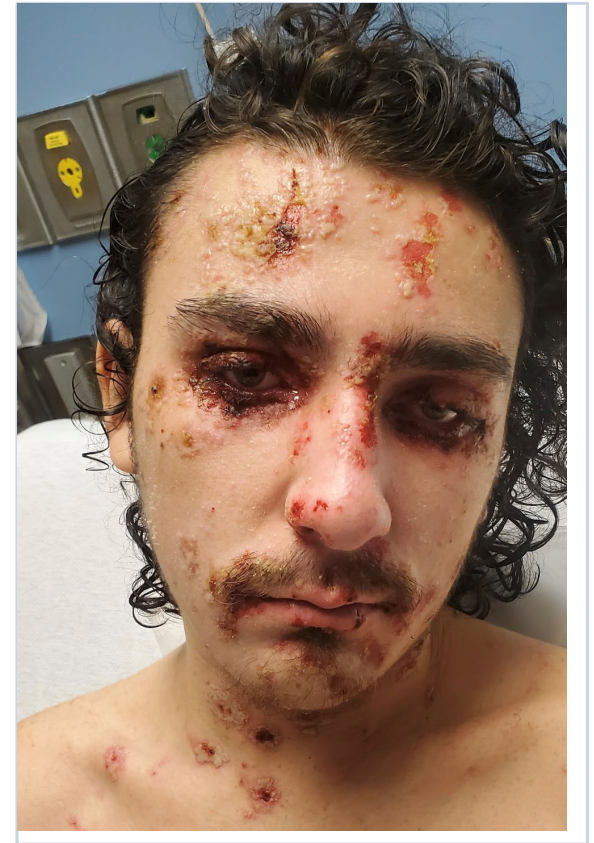
T101.3 overnight

Increased pain

CASE 2

Tuesday: Emergency Department Visit

- Unable to drink or speak
- Increased blistering over eyes
- Increased pain
- No respiratory difficulty





Tuesday Exam Findings

Vitals: T=99.7; HR=75; Resp=17; BP=133/71; SpO₂=98%

General: ill appearing – no acute distress

HEENT: 1.5 cm ulceration to the submucosal tissues, peri-labial ulcerations, struggles to open his mouth due to pain, extensive confluent oral ulcerations on buccal mucosa and floor. Too swollen to see oropharynx

Respiratory: Clear to auscultation bilaterally

Cardiovascular: RRR; no murmur; 2+ peripheral pulses

Abdomen: Nontender, nondistended; normal bowel sounds; no masses

Neuro: Grossly intact

INTERACTIVE

Tuesday test Results and Imaging



What laboratory and imaging studies would you order based on this presentation?

Tuesday Test Results and Imaging



CBC – WBC at 8.5

CMP – WNL

Resp viral profile: + rhino/entero viruses

Cx from yesterday

- Blood Cx– NGTD
- Throat Cx - negative
- Wound Cx from yesterday – Heavy S. Aureus

INTERACTIVE

Diagnosis



Based on the history, exam, and test results — what is your diagnosis?

INTERACTIVE

Tuesday ED Diagnosis

Dx: RIME

Tx: Admit, IV azithro, IV vanc

RIME — Reactive Infectious Mucocutaneous Eruption



Associated infectious triggers:

- Mycoplasma pneumoniae (most common)
- Chlamydia pneumoniae, human metapneumovirus, parainfluenza type 2, influenza B, rhinovirus, enteroviruses (including coxsackievirus), adenovirus, norovirus, and SARS-CoV-2

Pathophysiology:

- Indirect (most accepted): Immune response triggered by distant infection → polyclonal B cell proliferation → immune complex deposition and complement activation → skin damage; molecular mimicry between M. pneumoniae P1-adhesion molecules and keratinocyte antigens may contribute
- Direct: Less supported — M. pneumoniae cannot infect squamous epithelium; hematogenous spread would be required



RIME — Proposed Diagnostic Criteria

Diagnostic criteria include:

- Mucocutaneous eruption involving ≥ 1 site with $< 10\%$ BSA involvement
- Presence of vesiculobullous lesions or scattered, atypical, targetoid lesions on skin
- Noncontributory medication history
- Prodromal symptoms (cough, fever, malaise) in the preceding 7–10 days
- Clinical, radiographic, or lab evidence of infectious trigger (most commonly *M. pneumoniae*, respiratory viruses, or *C. pneumoniae*)

Differential Dx

- Erythema multiforme major
- Stevens-Johnson syndrome / TEN
- Herpetic gingivostomatitis
- Paraneoplastic pemphigus
- Hand, foot & mouth disease
- Aphthous ulcers
- Multifocal fixed drug eruption

Pathophysiology & Epidemiology



What Is RIME?

- Post-infectious mucocutaneous hypersensitivity reaction
- *Mycoplasma pneumoniae* triggers ~80% of cases
- Other triggers: HSV, influenza, EBV, adenovirus
- Distinct from Stevens-Johnson Syndrome — lower morbidity & better prognosis
- Previously categorized under Erythema Multiforme spectrum; now recognized as a separate entity



Who Gets RIME?

Ages 5–20

Peak incidence;
adolescents most
affected

Male ~2:1

Male-to-female
prevalence ratio

Fall/Winter

Seasonal clustering
with *Mycoplasma*
outbreaks

Schools

Clusters follow
Mycoplasma
pneumonia in schools
& dorms

Clinical Presentation & Diagnosis

Mucosal Features (Hallmark)

Oral >90%

Ocular ~70%

Genital/Urethral ~50%

Nasal

Cutaneous Features (Variable)

- Absent or MINIMAL skin lesions — key distinguishing feature from SJS/TEN
- If present: targetoid / atypical target lesions, vesicles, bullae
- Trunk-predominant distribution

Diagnostic Workup

- Mycoplasma PCR (NP swab) or IgM/IgG serology
- Cold agglutinins: elevated in ~50–75% of Mycoplasma cases
- Chest X-ray if respiratory symptoms present
- HSV PCR from mucosal swabs if clinically suspected
- Biopsy rarely needed; shows interface dermatitis, vacuolar change



RIME vs. SJS/TEN — Key Distinctions

Feature	RIME	SJS/TEN
Trigger	Infection (Mycoplasma)	Drug reaction (>80%)
Skin lesions	Minimal / absent	Extensive; >10–30% BSA
Mucosal sites	≥3 sites	Variable; ≥2 sites
Nikolsky sign	Negative	Positive
Mortality	Very low (<1%)	SJS 5–10%; TEN 30–40%
Age peak	Children/adolescents	Any age; elderly at risk
Recurrence	Possible with re-infection	Rare (avoid offending drug)



TREATMENT

Treat the Trigger

- Azithromycin (5-day) or doxycycline (≥ 8 yrs) for Mycoplasma
- Acyclovir/valacyclovir if HSV-triggered

Supportive Care

- Topical/oral anesthetics
- Ophthalmology referral
- Urology if urinary retention
- Analgesics; topical corticosteroids for skin lesions

Systemic Therapy

- Short-course systemic steroids:
- controversial; some evidence supports benefit in severe cases.
- IVIG for refractory disease.

Resolution

Patient: 16-year-old male presenting with throat pain and fatigue

- 8 nights in hospital
- Treated with IV Abx/steroids
- Developed shingles – treated
- Now 18:
 - Asthma has resolved, continues w/allergies and recurrent sinusitis
 - 1 episode of shingles; 1 episode of oral HSV
 - HS grad, working at the family garage, considering further school
 - Asthma resolved with decreased vape smoke exposure post graduation



Cannabis Use Disorder

Frequency of Use and CUD

Frequency	% with CUD
<12 days/yr	3.5%
<4 days/mo	8.0%
<5 days/wk	16.8%
>4 days/wk	36%

Robinson T et al. Drug Alcohol Depend 2022; 238: 109582.

Adolescent CUD by Duration of Use

Length of use	12–17 yo	18–25 yo
< 1 year	10.9%	5.6%
1–2 years	15.3%	7.7%
2–3 years	17.7%	9.1%
>3 years	20.6%	10.5%

Han B et al. Addiction 2019; 114:698–707.



Clinical Pearl: Even 'occasional' use carries measurable CUD risk — duration and frequency both matter when counseling adolescents.

CASE 3

'Pulled a Muscle While Running'

15-year-old male with left thigh pain

CASE 3

"Pulled a Muscle While Running"

“

15 y.o. male who reports that he 'pulled a muscle' one week ago. What would you want to ask or do next?

Chief complaint: L thigh pain — 'pulled a muscle' one week ago while running in gym

He applied ice and 'rested' but has had L thigh pain ever since.



Past Medical History

Annual exam (5 months ago): Normal physical exam; normal ROM of L thigh/leg

Recent history: Reports a tick bite recently; tick was easily removed



SHEADDDSS Assessment

Home: Lives with his parents

Education: Good student in 9th grade

Activity: Plays soccer and runs track

Depression: Negative; though 'OCD about germs'



Physical Exam

General: Well-appearing 15-year-old male

Cardiac / Lung / Abdomen: Normal

Lower extremities: Swelling and tenderness over L vastus medialis; ROM and strength normal and equal bilaterally; sensation intact bilaterally

Key finding: L thigh circumference 4.5 cm > analogous area of R thigh

Left Thigh Pain — Return Visit

- Patient instructed to RICE (rest, ice, compression, elevation)

Repeat exam: Well-defined mass at the distal, medial L thigh; tenderness at edge of mass; no erythema or ecchymosis

Measurements: L thigh circumference 38 cm vs. R thigh 34 cm ($\Delta 4$ cm)

What would you do next? Refer to ortho? Labs? X-ray?

CASE 3

X-Ray of the Left Thigh



INTERACTIVE

Left Thigh Pain — Next Steps



Referred to orthopedics and then to oncology. What laboratory studies would you obtain?



Osteosarcoma, L Distal Femur

- Most common malignant bone tumor in children, adolescents, and young adults
- Approximately 400 cases in the US annually
- Most common between ages 10–20; males > females
- Cause unknown
- Presents with swelling, difficulty walking, or limping
- May lead to pathologic fracture



CASE 5

17-Year-Old with Recurrent Vomiting

A challenging diagnostic journey

02

17-Year-Old Female with Recurrent Vomiting

Chief complaint: Acute upper abdominal pain and vomiting, began after eating a hamburger; some relief with Zofran

History: Prior similar episode in June — negative abd CT, normal labs

Vitals: Afebrile; HR 94; BP 104/61

Exam: Uncomfortable appearing; tender upper abdomen

Labs: Lactate 5.25 (resolves); hCG negative; UDS positive for THC

Discharge Dx: Nausea/vomiting, abdominal pain, mild dehydration; Cannabis Hyperemesis Syndrome mentioned



Past Medical History

Dysmenorrhea / Menorrhagia: Currently on extended cycle OCPs with excellent benefit



SHEADDDSS Assessment

Strengths: Very good student

Home: Lives at home

Education: HS Junior; enjoys history; plans to attend college

Activities: Friends; church youth group

Diet: Regular



SHEADDDSS Assessment (cont.)

Drugs: Denies tobacco, marijuana, alcohol, or other drug use

Depression: PHQ-2 negative; denies suicidal ideation

Sexual Health: Not sexually active

Safety: Feels safe at home; uses seatbelt; no guns; denies physical or emotional abuse

Return ED Visit — Similar Symptoms

Chief complaint: Returns with similar sx after eating soup with meat; now with shortness of breath

Prior episode: June — negative abd CT, normal labs

Vitals: Afebrile; HR 96; BP 119/57

Exam: Uncomfortable appearing; hyperventilating; tender upper abdomen

Labs: Lactate 3.3 (resolves); CBG 123; otherwise normal

Discharge Dx: Nausea/vomiting, mild dehydration; Cannabis Hyperemesis Syndrome again mentioned

Third ED Visit — Persistent Symptoms

Chief complaint: Returns with similar sx; pain with vomiting; pain with deep breathing

Vitals: Afebrile; HR 84; BP 122/74

Exam: NAD; diffuse abdominal tenderness

Labs: WBC 15.8; CT: no abnormalities

Discharge Dx: Nausea/vomiting, abdominal pain; stronger mention of Cannabis Hyperemesis Syndrome

MCHP Follow-Up Visit

History: Pizza hurts her stomach; began omeprazole with benefit after ED visits

Substance history update: "She really does not use marijuana — once or twice in the recent past"

Vitals: BMI 17.2; Wt 113 lbs

Exam: Epigastric tenderness

Assessment: Nonulcer dyspepsia and cyclical vomiting syndrome; Cannabis Hyperemesis Syndrome no longer mentioned



Cannabis-Induced Hyperemesis Syndrome

Definition: Episodic nausea and vomiting in people who use cannabis frequently and for a prolonged period

Mechanism: Disturbances in the gut-brain axis of the endocannabinoid system (ECS); ECS impacts the vomiting center via CB1 and CB2 receptors in the gut

Biphasic GI effects:

- Low doses — reduce nausea
- High doses — induce vomiting (primarily via CB1 receptors)

Reference: *Pharmaceuticals* 2024, 17, 1549. <https://doi.org/10.3390/ph17111549>

Cannabis-Induced Hyperemesis Syndrome

CVS vs. CHS Diagnostic Criteria

Table 1. Criteria for cyclic vomiting syndrome and cannabinoid hyperemesis syndrome.

Cyclic Vomiting Syndrome (CVS)	Cannabinoid Hyperemesis Syndrome (CHS)
• Stereotypical episodes of vomiting acute in onset • At least three discrete episodes in the prior year and two episodes in the past six months, occurring at least one week apart • Absence of vomiting between episodes, but other milder symptoms can be present between cycles • Criteria fulfilled for the last three months with symptom onset at least six months prior to diagnosis	• Symptoms present for past three months with onset at least 6 months prior • Stereotypical episodes lasting <one week • At least 3 episodes in last one year and 2 episodes in last six months (occurring at least one week apart) • No vomiting between episodes • Milder symptoms can be present during this • All these criteria should be associated with chronic use of cannabis and stop after its cessation

Pharmaceuticals 2024, 17, 1549. <https://doi.org/10.3390/ph17111549>

MCHP Work-In Follow-Up Visit

History: Returned to ED on 7/5/25 where CHS was again mentioned; using prn capsaicin; stopped Reglan due to mother's concern re: tardive dyskinesia

Vitals: BMI 16.6; Wt 109 lbs

Exam: Epigastric tenderness

Plan: Expanded differential explored; GI referral placed

Gastroenterology Consultation

History: Similar to prior visits; marijuana use noted as 'intermittent'

Vitals: BMI 16.6; Wt 109 lbs

Exam: Normal

Imaging: Abdominal plain films — 'unremarkable'

Assessment: N/V; abdominal pain; weight loss; marijuana use; anxiety

Plan: Extensive labs and upper GI series ordered

Fluoroscopic Esophagram / Upper GI Series

Esophagus: Normal morphology and motility; no gastroesophageal reflux observed

Stomach: Normal position and morphology

Duodenum: Mild dilatation of the proximal duodenum with to-and-fro peristalsis and delayed passage of contrast across the third portion; vertical impression on the 3rd portion in expected location of the superior mesenteric artery; left lateral decubitus position facilitated more distal passage; duodenojejunal junction in normal position

Impression: Findings consistent with Superior Mesenteric Artery Syndrome

Superior Mesenteric Artery (SMA) Syndrome

Anatomy: Compression of the third portion of the duodenum between the aorta and superior mesenteric artery

Risk factors: Significant weight loss (reduced fat pad between SMA and aorta)

Diagnosis: Requires imaging — fluoroscopic esophagram or CT arteriogram of abdomen

Management:

- Conservative: hydration, nutritional supplementation
- Surgical: duodenojejunostomy if conservative measures fail

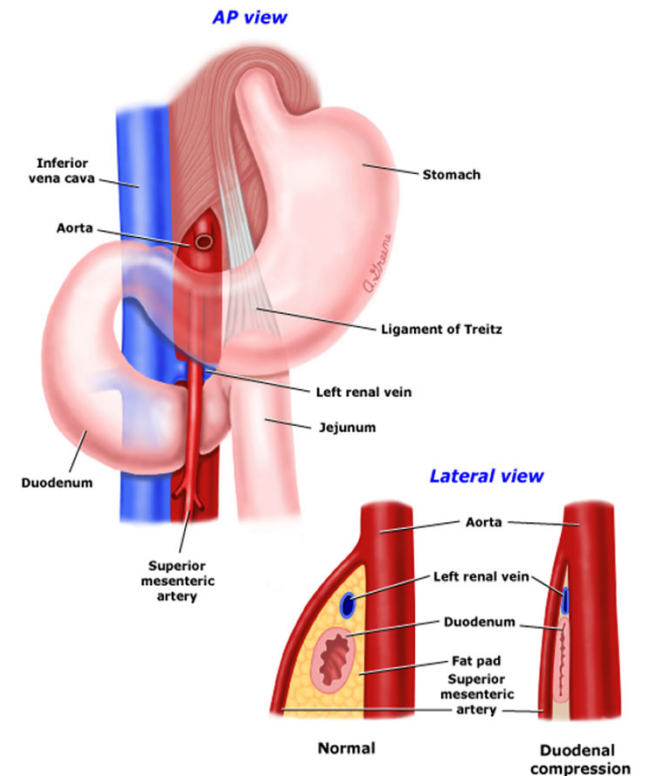


Image Source: UpToDate



Anchoring Bias

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The focus on a single — often initial — piece of information when making clinical decisions, without sufficiently adjusting to later information.

Ly DP, Shekelle PG, Song Z. Evidence for Anchoring Bias During Physician Decision-Making. JAMA Intern Med. 2023 Aug 1;183(8):818–823.



Thank You

Chris Kjolhede, MD, MPH | Steve North, MD, MPH

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Questions & Discussion



Questions & Discussion Welcome