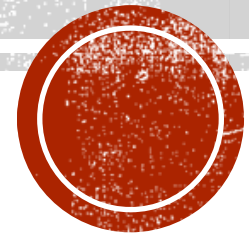


GERIATRIC TRAUMA

UofA Emergency Medicine Residents

May 9, 2023

Rebecca Schonnop, FRCPC





OBJECTIVES

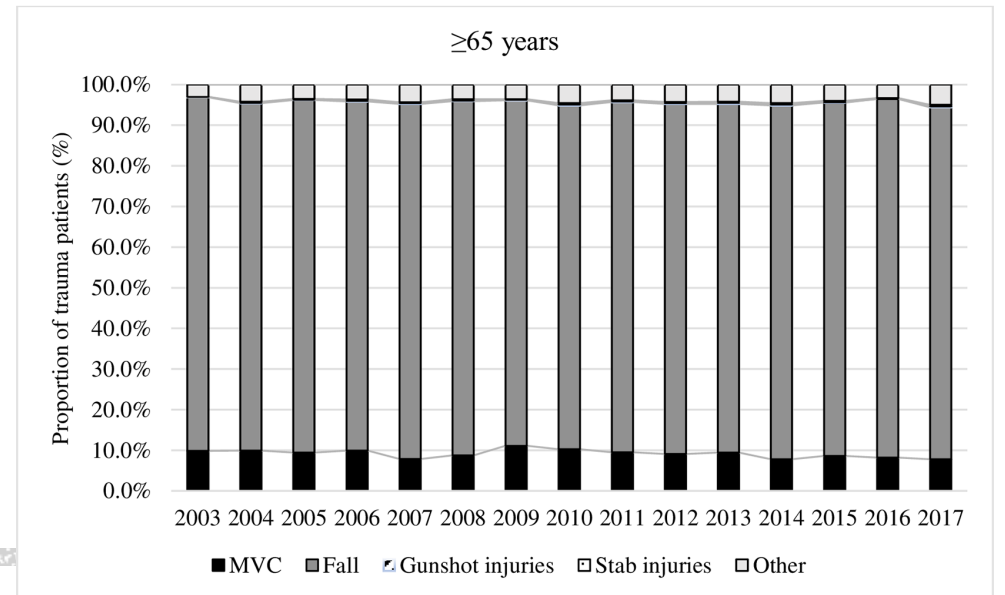
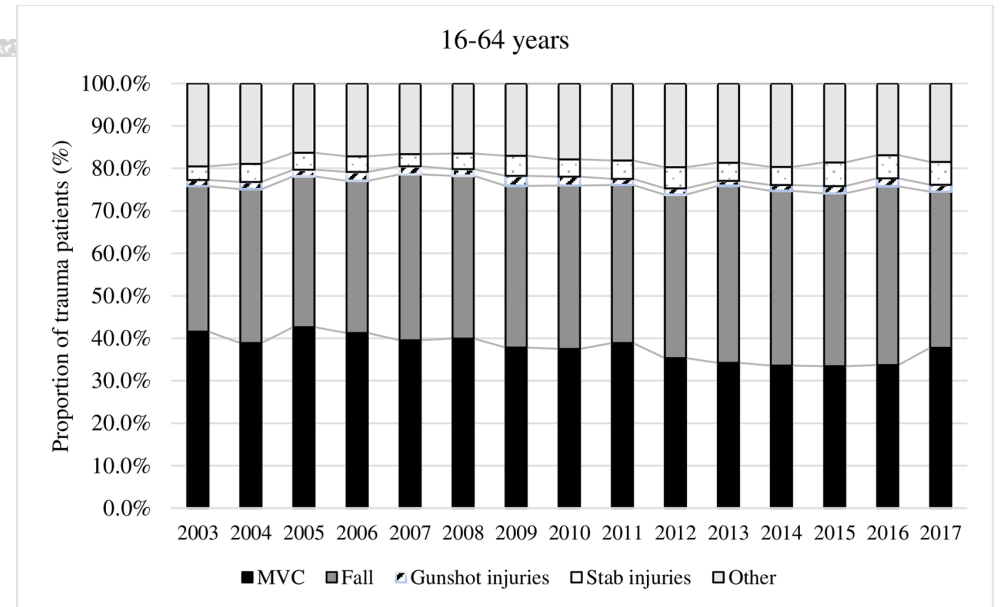
1. Describe how ATLS and trauma principles may be different in older patients
2. Correlate physiologic and anatomic changes in older adults with adapted principles of trauma resuscitation
3. Describe the consequences of undertriage in the older trauma patients and be familiar with adaptations in triage criteria
4. Identify types of injuries most common in older adults
5. Define special trauma management issues in the older patient regarding assessment of shock and management of common injuries
6. Define elder abuse and neglect and recognize patterns of trauma consistent with abuse
7. Screen and manage patients with suspected elder abuse and/or neglect

AGING & TRAUMA

- Increased age in trauma patients associated with:
 - Undertriage
 - Increased hospital LOS
 - Poor outcomes (inc mortality, morbidity, functional deficits)
 - Increased age is independent predictor of poor outcome: **2.4 - 5.6 increased risk of death**
- Frailty is significantly associated with mortality, complications, and adverse dispositions after multisystem trauma
- Medications can impact initial evaluation and care
- Consider other nontraumatic acute events that complicate presentation
- Delirium prevention, medication review, social support review etc.



MECHANISMS OF TRAUMA



TRAUMA TEAM ACTIVATION & TRIAGE

- Older trauma patients are less likely to trigger TTA
- Fewer older trauma patients are initially triaged to trauma centres
- Older patients have worse outcomes compared to younger adults with similar injury severity
- Observational study for geriatric inpatient trauma care at trauma centre:
 - reduction in delirium (51 vs 41%, $P = 0.05$)
 - fewer discharges to long term care (6.5% vs 1.7%, $P=0.03$)
- Distinct elderly triage criteria exist – 8 criteria identified
 - Ohio Geriatric Trauma Triage Criteria



OHIO GERIATRIC TRAUMA TRIAGE

BOX 184.1

Ohio Prehospital Geriatric Trauma Triage Indicators

- Trauma patients ≥ 70 years are defined as having suffered geriatric trauma.
- If an injured older adult has any of the geriatric indicators, he or she must be transported directly to a trauma center.

GERIATRIC ANATOMIC INDICATORS

- Injury sustained in two or more body regions

GERIATRIC PHYSIOLOGIC INDICATORS

- Glasgow Coma scale score < 15 with a known or suspected traumatic brain injury
- Systolic blood pressure < 100 mm Hg

GERIATRIC MECHANISM INDICATORS

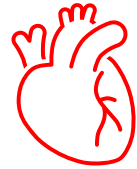
- Fracture of one or more proximal long bones (humerus or femur) sustained in a motor vehicle accident
- Pedestrian struck by a motor vehicle
- Falls from any height—including standing—with evidence of a traumatic brain injury

- Compared to standard adult criteria, this showed increased sensitivity for older adults:
 - Injury severity score (ISS) (96% vs 72%)
 - Mortality (92% vs 82%)
 - ICU stay (87% vs 67%)
- But decreased specificity for all

Adapted from State of Ohio, State Board of Emergency Medical Services, Trauma Committee: Geriatric trauma task force report and recommendations. www.publicsafety.ohio.gov/links/ems_geriatric_triage.pdf.



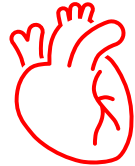
PHYSICAL CHANGES WITH AGE



PHYSICAL CHANGES WITH AGE



- Brain atrophy - Incr risk cerebral injuries
- Stretching of parasagittal bridging veins



- Dec CO- dec cardiac reserve
- Inc SVR
- Dec response to adrenergic catecholamines – may have “normal” vitals



- Dec VC, pulm reserve
- Dec chest wall compliance



- Dec muscle mass
- Dec BMD – inc risk of fractures
- Less collagen and elastin in skin
- Thinning epidermis – skin tears, ulcers, hypothermia



- Dec abdo musculature – inc risk intra-abdo injury
- Altered pain sensation to abdomen – unreliable abdo exam
- Smaller omentum



MODIFICATIONS TO PRIMARY SURVEY

A	• Airway management changes (preoxygenation, BMV, difficult anatomy, RSI medication dose adjustments)
B	• Limited resp reserve, dec chest wall compliance - ventilation challenges may arise • Worse outcomes with rib fractures
C	• Vital sign threshold changes • Look for evidence of tissue hypoperfusion – shock difficult to identify in older pts • Identify and reverse anticoagulants
D	• Greater use of CT imaging to identify cerebral/spinal injuries • Underlying cognitive impairment or delirium confound assessment
E	• Prevent hypothermia • Pad bony prominences • Early removal of spine boards/collars



GERIATRIC TRAUMA VITAL SIGNS

HR > 90

SBP < 110

Correlate with increased mortality

Age adjusted shock index = age x HR/SBP
> 50 = suspect shock or occult shock





INJURY PATTERNS IN OLDER PATIENTS



Head trauma

Spine trauma

Thoracic injuries

Intra-abdominal trauma

MSK

HEAD TRAUMA

Incidence of intracranial bleeding in seniors presenting to the emergency department after a fall: A systematic review

Kerstin de Wit^{a,*}, Zahra Merali^a, Yoan K. Kagoma^b, Éric Mercier^c

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^c Centre de recherche sur les soins et services de première ligne de l'Université Laval (CERSSPL-UL), Quebec, Quebec, Canada

- 5.2% pooled incidence of ICH
- 11 studies
- N = 11,102 older adults



CANADIAN CT HEAD RULE

INSTRUCTIONS

Only apply to patients with Glasgow Coma Scale (GCS) 13-15 and at least one of the following:

- Loss of consciousness.
- Amnesia to the head injury event.
- Witnessed disorientation.

Exclusion criteria:

- Age <16 years.
- Blood thinners.
- Seizure after injury.

≥65 ≠ CT head automatically

High Risk Criteria: Rules out need for neurosurgical intervention

GCS <15 at 2 hours post-injury

No 0

Yes +1

Suspected open or depressed skull fracture

No 0

Yes +1

Any sign of basilar skull fracture?

Hemotympanum, raccoon eyes, Battle's Sign, CSF
oto-/rhinorrhea

No 0

Yes +1

≥2 episodes of vomiting

No 0

Yes +1

Age ≥65 years

No 0

Yes +1

Medium Risk Criteria: In addition to above, rules out "clinically important" brain injury (positive CT's that normally require admission)

Retrograde amnesia to the event ≥ 30 minutes

No 0

Yes +1

"Dangerous" mechanism?

Pedestrian struck by motor vehicle, occupant
ejected from motor vehicle, or fall from >3 feet
or >5 stairs.

No 0

Yes +1

Intracranial hemorrhage after head injury among older patients on anticoagulation seen in the emergency department: a population-based cohort study

Keerat Grewal MD MSc, Clare L. Atzema MD MSc, Peter C. Austin, PhD, Kerstin de Wit MD MSc, Sunjay Sharma MD MSc, Nicole Mittmann PhD, Bjug Borgundvaag PhD MD, Shelley L. McLeod MSc PhD

■ Cite as: *CMAJ* 2021 October 12;193:E1561-7. doi: 10.1503/cmaj.210811

- Patients on warfarin have increased risk ICH compared to DOACs (RR 1.43, 95% CI 1.20–1.69) and no AC (RR 1.36, 95% CI 1.15–1.61).
- No difference in ICH between DOACs and no AC

HEAD INJURY & ANTI-COAGULATION



Original Research | [Published: 15 October 2022](#)

Delayed intracranial hemorrhage after head injury among elderly patients on anticoagulation seen in the emergency department

[Sharon Liu](#), [Shelley L. McLeod](#), [Clare L. Atzema](#), [Peter C. Austin](#), [Kerstin de Wit](#), [Sunjay Sharma](#), [Nicole Mittmann](#), [Bjug Borgundvaag](#) & [Keerat Grewal](#) 

[Canadian Journal of Emergency Medicine](#) **24**, 853–861 (2022) | [Cite this article](#)

- Delayed bleeds?
 - 1% of all patients found to have delayed ICH
 - Increased odds of delayed ICH with warfarin compared to no AC (OR 1.5, 95% CI 1.1–2.1)
 - No association between delayed ICH and DOAC use compared to no AC (OR 0.9, 95% CI 0.6–1.1)

HEAD INJURY & DELAYED BLEEDING



SPINE TRAUMA

- Degenerative disease of spine = increased risk of fractures and SCI
- Risk of complications (pressure injuries, delirium) with immobility on spine boards and in collars
- 1/5 of older patients (55+) with C-spine fractures have no pain on initial presentation and no midline tenderness, and no neurological deficit.



SPINE INJURIES IN OLDER ADULTS

Most common spine injuries in older adults:

- Odontoid fractures (type II most common)
- SCI (central cord syndrome)
- Injuries associated with spondylosis and ossification of the posterior longitudinal ligament

SPINE TRAUMA



The American Journal of Emergency Medicine

Volume 67, May 2023, Pages 144-155



Cervical spine injuries in adults ≥ 65 years after low-level falls – A systematic review and meta-analysis

- In 21 studies, including 17,192 adults 65+, the prevalence of C-spine injury from a low-level fall was 3.8%
- Despite decreased/altered LOC being reported as risk factor for c-spine injuries, this review could not correlate injury with GCS level due to the quality of the data available.
- **Bottom line:** Clinical decision rule is needed to help risk stratify older adults who do and do not require C-spine imaging after low level falls



SPINE IMAGING CLINICAL RULES

Geriatric clinical screening tool for cervical spine injury after ground-level falls

Jacklyn Engelbart ¹, Peige Zhou,¹ Jenna Johnson,² Michele Lilienthal,¹ Yunshu Zhou ³, Patrick Ten-Eyck,³ Colette Galet ¹, Dionne Skeete¹

Predictors of C-spine injury:

- midline tenderness (OR = 22.961 (15.178–34.737); $p < 0.001$)
- focal neurologic deficit (OR = 2.601 (1.340–5.049); $p = 0.005$)
- signs of trauma to the head/face (OR = 2.601 (1.340–5.049); $p = 0.005$)

But the overall model only had 86.6% SN

NEXUS Criteria for C-Spine Imaging

Clears patients from cervical spine fracture clinically, without imaging.

When to Use ▾	Pearls/Pitfalls ▾	Why Use ▾
Focal neurologic deficit present	No 0	Yes +1
Midline spinal tenderness present	No 0	Yes +1
Altered level of consciousness present	No 0	Yes +1
Intoxication present	No 0	Yes +1
Distracting injury present	No 0	Yes +1

NEXUS criteria 66-100% SN among older adults based on systematic review of 7 studies

Modified NEXUS:

- ALOC → “change from baseline MS rather than GCS <15”
- Distracting injury → signs of head trauma
- Sensitivity improved to 100% (**not validated*)



WHO TO IMAGE?

Current recommendations or lack thereof:

- ATLS and ACS Geriatric Trauma Management Guidelines suggests liberal use of CT imaging to identify spine injuries
- EAST trauma guidelines do not make specific recommendations for imaging in older patients
- Some studies suggest trauma team activation patients should undergo screening C-spine CT (Duane et al., 2016)



SO....WHO TO IMAGE?

My thoughts:

- High risk trauma mechanisms (fall >3ft, MVC, ped-MVC, etc)
- Patients with midline tenderness and/or neurological deficit
- Patients with obvious head/face/neck trauma and in who you are ordering a CT head
- Obtunded/ALOC patients



- Increased risk of rib fractures due to loss of bone density and chest wall changes
- Up to 50% of older persons have rib fractures after falling from standing height
- 34% older adults with rib fractures will develop pneumonia
- Risk factors for mortality in blunt chest wall trauma:
 - Age 65+ (OR 1.98 (1.86-2.11, 95% CI))
 - 3+ rib fractures (OR 2.02 (1.89-2.15, 95% CI))
 - Presence of pre-existing disease (OR 2.43 (1.03-5.72, 95% CI))
- Increased mortality with each successive rib fracture (5.8% 1 rib, 10% 5 ribs, 15% 7 ribs, 34.4% 8 ribs)

THORACIC TRAUMA



MANAGEMENT OF THORACIC TRAUMA

Management

- CT imaging as x-rays miss rib fractures
- Analgesia to allow adequate respiration, prevent atelectasis, allow effective coughing to clear secretions
 - Tylenol, NSAIDs, opioids
 - Regional anesthesia
- Incentive spirometry
- Early mobilization and physiotherapy

Admission

- Hospital admission if ≥ 3 rib fractures
- ICU if > 6 rib fractures
- Consider transfer to trauma centre



INTRA-ABDOMINAL TRAUMA

- Difficult and unreliable physical exam:
 - Altered pain perception (fewer peripheral sensory nerve cells in peritoneum)
 - Thinner abdo muscles → less ability to produce guarding or react to rebound
- High index of suspicion in patients with pelvic injuries or rib fractures





MSK INJURIES

Hip Fractures

- 1 year mortality 20-25%
- If x-ray negative, but patient cannot walk, get a CT
- Analgesia
 - US guided nerve block (femoral nerve block, fascia iliaca block, PENG block)
- Early OR

SUMMARY

- Have high index of suspicion for injuries
- Consider alternative vital sign thresholds
- Warfarin has significant increased risk of ICH and delayed ICH; no difference between DOACs and no anticoagulation
- Liberal use of CT c-spine imaging, although currently no consensus on who to image
- Significant mortality with rib fractures



QUESTIONS?

Want more info on Geri Trauma?

- **EM CASES Geriatric Trauma**
 - Episode 159: Part 1
 - Episode 160: Part 2



Defintion

Risk factors

Clues on history and physical

Screening criteria

Required reporting

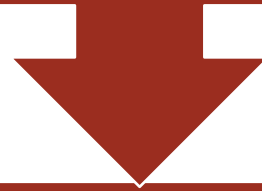
Management



ELDER MISTREATMENT

DEFINITION OF ELDER MISTREATMENT

Mistreatment of an older adult by a person in a position with an expectation of trust OR when an older adult is targeted based on frailty or disability



Types of Elder Mistreatment

Physical
abuse

Neglect

Sexual abuse

Psychological
abuse

Financial
exploitation



EPIDEMIOLOGY

- Elder mistreatment experienced by 10% community dwelling older adults each year and >20% of nursing home residents
- Victims have increased risk of:
 - Nursing home placement
 - Hospitalization
 - Depression
 - Anxiety
 - Death



Potential Risk Factors for Elder Abuse

FOR BECOMING A VICTIM

- Functional dependence or disability
- Poor physical health
- Cognitive impairment/dementia
- Poor mental health
- Low income/socioeconomic status
- Social isolation/low social support
- Previous history of family violence
- Previous traumatic event exposure
- Substance abuse

FOR BECOMING A PERPETRATOR

- Mental illness
- Substance abuse
- Caregiver stress
- Previous history of family violence
- Financial dependence on older adult

RISK FACTORS



CLINICAL CLUES

BOX 186.3

Indicators From the Medical History of Possible Elder Mistreatment

- Poor living conditions according to paramedics or others
- Unexplained injuries
- Past history of frequent injuries
- Delay between onset of medical illness or injury and seeking of medical attention
- Recurrent visits to the ED for similar injuries
- Using multiple physicians and EDs for care rather than one primary care physician ("doctor hopping or shopping")
- Noncompliance with medications, appointments, or physician directions
- Patient or caregiver reluctant to answer questions
- Strained patient/caregiver interaction
- Inconsistent history of injury mechanism between the patient and caregiver
- Elderly patient referred to as "accident prone"
- Caregiver not able to give details of the patient's medical history or routine medications
- Caregiver answers the questions regarding the patient
- Abandonment of the patient in the ED by the caregiver

ED, Emergency department.



CLINICAL CLUES

BOX 186.3

Indicators From the Medical History of Possible Elder Mistreatment

Poor living conditions according to paramedics or others
Unexplained injuries
Past history of frequent injuries
Delay between onset of medical illness or injury and seeking of medical attention
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Noncompliance with medications, appointments, or physician directions
Patient or caregiver reluctant to answer questions
Strained patient/caregiver interaction
Inconsistent history of injury mechanism between the patient and caregiver
Elderly patient referred to as "accident prone"
Caregiver not able to give details of the patient's medical history or routine medications
Caregiver answers the questions regarding the patient
Abandonment of the patient in the ED by the caregiver

ED, Emergency department.

Injury history/pattern:

- Unexplained injuries
- History frequent injuries
- Recurrent ED visits for injuries
- Inconsistent history with injury pattern
- Delay in seeking attention from injury onset

Caregiver interactions:

- Strained patient/caregiver interaction
- Patient referred to "accident prone"
- Caregiver answering for patient
- Abandonment of the patient in the ED by caregiver
- Caregiver unable to give patient medical history details/routine meds
- Reluctant to answer questions

Other

- Noncompliance with meds, appointments
- Using multiple physicians and ED
- Poor living conditions noted by EMS



BOX 186.5

Physical Signs Suspicious for Potential Elder Abuse or Neglect

PHYSICAL ABUSE

Bruising in atypical locations (not over bony prominences/on lateral arms, back, face, ears, or neck) (see Fig. 186.1)

Patterned injuries (bite marks or injury consistent with the shape of a belt buckle, fingertip, or other object) (see Fig. 186.2)

Wrist or ankle lesions or scars (suggesting inappropriate restraint) (see Fig. 186.3)

Burns (particularly stocking/glove pattern suggesting forced immersion or cigarette pattern) (see Fig. 186.4)

Multiple fractures or bruises of different ages (see Fig. 186.5)

Traumatic alopecia or scalp hematomas

Subconjunctival, vitreous, or retinal ophthalmic hemorrhages

Intraoral soft tissue injuries

SEXUAL ABUSE

Genital, rectal, or oral trauma (including erythema, bruising, lacerations) (see Figs. 186.6 and 186.7)

Evidence of sexually-transmitted disease

NEGLECT

Cachexia/malnutrition

Dehydration

Pressure sores/decubitus ulcers (see Figs. 186.8 to 186.10)

Poor body hygiene, unchanged diaper

Dirty, severely worn clothing

Elongated toenails (see Fig. 186.10)

Poor oral hygiene (see Fig. 186.11)

Gibbs LM: Understanding the medical markers of elder abuse and neglect: physical examination findings. Clin Geriatr Med 30:687–712, 2014; Palmer M, Brodell RT,



Fig. 186.3. Pattern bruising on lower leg from a ligature. (From Gibbs LM: Understanding the medical markers of elder abuse and neglect: physical examination findings. Clin Geriatr Med 30:687–712, 2014.)



Fig. 186.1. Atypical bruising of the chest in a case of substantiated abuse. (From Gibbs LM: Understanding the medical markers of elder abuse and neglect: physical examination findings. Clin Geriatr Med 30:687–712, 2014.)



Fig. 186.4. Burn injuries on the back and buttocks from scalding water. (From Gibbs LM: Understanding the medical markers of elder abuse and neglect: physical examination findings. Clin Geriatr Med 30:687–712, 2014.)



Fig. 186.8. Case of elder neglect showing moisture-associated skin damage (MASD) and ulcers in the sacrum, buttocks, and thighs. (From Gibbs LM: Understanding the medical markers of elder abuse and neglect: physical examination findings. Clin Geriatr Med 30:687–712, 2014.)



Fig. 186.2. Pattern bruise on the left buttock from unknown object. (From Gibbs LM: Understanding the medical markers of elder abuse and neglect: physical examination findings. Clin Geriatr Med 30:687–712, 2014.)



Fig. 186.5. A 70-year-old man was brought from his caregiver's home to the emergency department (ED) by police after his daughter found him severely bruised. He had multiple contusions at varying stages of healing on his chest and arms, as well as a linear patterned injury across his left anterior chest. The central and bilateral locations of the contusions, varying colors, and linear pattern of the bruise on the left side of his chest are highly suggestive of physical abuse. (Courtesy Dr. D.C.)



Bruising on ear in abused older woman



SCREENING TOOLS

- ED Senior AID (ED Senior Abuse Identification Tool)
 - only tool validated in ED (SN 94%, SP 84%)
 - 6-8 questions, observations
 - More time intensive
- EM-SART (Elder Mistreatment Screening and Reporting Tool)
 - 3 questions, followed by full screen with ED Senior AID if positive
 - Validation studies ongoing
- EASI (Elder Abuse Suspicion Index)
 - 5 questions + observations
 - Validated in primary care but excluded pts with cognitive impairment (SN 47%, SP 75%)
- EAI (Elder Assessment Instrument)
 - 41 observations
 - Time consuming



EM-SART

- 3 questions and observe for red flags:
 - Has anyone close to you harmed you?
 - Has anyone close to you failed to give you the care that you need?
 - Has anyone tried to force you to sign papers or use your money against your will?



HOW TO MANAGE IN ED

Patient perspective:

- Respect the patients wishes/values
- Support decision-making autonomy
- Respect confidentiality
- Seek consent before taking action

...but ensure patient has capacity!

Factors to consider:

- Consider the medicolegal reporting duties in your jurisdiction
- Place of residence (community or facility)
- Who was the perpetrator (family or HCP)
- What patient wants
- Need for support or assistance



REQUIREMENTS TO REPORT - ALBERTA

- No duty to report elder abuse in the community
 - Patient may contact the Family Violence Info Line at 310-1818 for information (24/7 line)
- **Protection of Persons in Care Act**
- **Duty to report elder abuse in care facilities**
 - Safeguards for Vulnerable Adults Information Reporting Line 1-888-357-9339
 - Includes patients in supportive living/LTC, receiving publicly funded care, or actions of guardian/trustee



QUESTIONS?

