A Review of Accidental Deaths

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Goals of presentation

- Discuss investigation of accidental deaths
- Remind of reporting requirements
- Discuss examples of accidental deaths
  - Drug overdose
  - Blunt force trauma
  - Asphyxial deaths
  - Burns

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Definition of Accidental Manner

- Non-intentional injury
- When an injury or poisoning causes death and there is little or no evidence they occurred with intent to harm or cause death.

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CDCP: Leading Causes of Death by Age
United States: 2021

Table 4. Five leading causes of death, by age group, based on age-adjusted deaths per 100,000 population, 2021

Age	#1	#2	#3	#4	#5
<5 years	Perinatal event (53.2)	Congenital abnormality (24.4)	Unintentional injury (14.1)	Homicide (3.1)	Heart disease (2.1)
5-24 years	Unintentional injury (20.1)	Suicide (8.2)	Homicide (8.1)	Cancer (2.5)	COVID-19 (1.8)
25-44 years	Unintentional injury (80.2)	COVID-19 (26.3)	Heart disease (20.2)	Suicide (18.7)	Cancer (17.1)
45-64 years	Cancer (149.2)	Heart disease (133.5)	COVID-19 (122.7)	Unintentional injury (77.6)	Liver disease (31.9)
≥65 years	Heart disease (1,088.6)	Cancer (849.1)	COVID-19 (541.9)	Stroke (277.8)	Chronic lung disease (234.0)

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System - Mortality, 2018-2021, Single Race. Accessed on CDC WONDER Online Database, released in 2023.

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Unintentional Injuries - Accidents

- Reflects many different causes.
- 90%
  - Overdoses/poisonings (43.6 %)
  - Falls
  - Motor vehicle accidents

CDCP: Leading Causes of Death by Age; United States: 2021

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Send for Autopsy

- Body bag
- Bag hands
- Chain of custody

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Reporting Requirements

Inquests Deskbook

Revised November 2023. This deskbook covers procedure and resources for conducting inquests, including ordering autopsies and formal inquest hearings.

https://www.tjctc.org/tjctc-resources/deskbooks.html

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Texas EMS & Trauma Registry

- Injury.web@dshs.Texas.gov

- Must report within 90 days of death.
- Best to report monthly
  - Submersion injuries (drowning)
  - Traumatic brain injuries
    - Includes suffocation, drowning, blunt force trauma
  - Spinal Cord injuries

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Cause of Death

- Actual disease process or injury that causes death
  - Gunshot wound to the chest
  - Injury to the brain
  - Pneumonia
  - Cancer
  - Blunt force trauma

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Cause of death

- Proximal cause of death
  - condition or injury that starts the chain reaction to death
- Immediate cause of death
  - condition that directly leads to death

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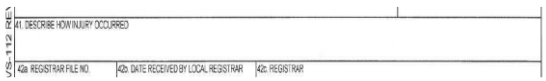
Death Certification

- Concise narrative of how injury occurred – can write full sentences.
- Place injury occurred
- Work-related?
- Information needed for public health



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Death Certification

- Documentation of injuries by JPs and medical examiners vital for injury prevention.
- Examples
  - Bicycle helmet laws and campaigns for kids
  - Ordinances for fencing swimming pools

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Specific Types of Accidental Deaths

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Drugs to be Discussed

Ethanol
Cocaine/Methamphetamine
Opiates
Fentanyl
Marijuana
Synthetic Cannabinoids
Kratom

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Assessing Possible Drug Overdoses

- Did a single drug cause death?
  - One drug in a high amount
- Metabolism?
  - Amount may be low
  - History is important

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More on Possible Drug Overdoses

- Did multiple drugs together cause the death?
  - Same mechanism of action
    - e.g. Central nervous system depressants
  - May not be in very high amounts

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Ethanol

- Produces euphoria
- Tolerance
- Physical dependence
- Effects every organ system
  - Skin, GI, liver, cardiovascular, pancreas
  - CNS - depressant

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Ethanol Effects

- Effects on task performance
- Slurred speech
- Vestibular functioning

- Driving drunk 0.08 g/dl
- Impairment at 0.03 g/dl

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Ethanol Deaths

- ~ 80% of single vehicle deaths involve alcohol
- Often seen in combination with other drugs
- Can also have acute alcohol intoxication
  - College students/fraternities/sororities

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Manner of death - Ethanol

- Acute ethanol intoxication or combined with other drugs
- Manner - Accident

- Effects of chronic ethanol abuse cirrhosis, Gastrointestinal bleed
- Manner - Natural

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Meth Labs

- Raids discussed in the news
- Methamphetamine synthesized from ephedrine

- Also used diphenhydramine, chlorpheniramine, dextromethorphan, etc.

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Methods of Administration

- Oral
- Injected
- Smoked
- Snorted

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Cooking Cocaine "Crack"

- Crack cocaine - introduced around 1986
- Made by combining cocaine and bicarbonate (or other)
- Add sterile water
- Boil
- As it cools, forms 'rocks'

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Effects of Cocaine and Methamphetamine

- Stimulant, decreased fatigue
- "High" Euphoria, sense of well being

- Hypertension
- Hyperthermia

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Physical Effects

- Euphoria
- Loss of appetite
- Inc. blood pressure - vasoconstriction
- Aggressiveness
- Convulsions
- Stroke – intracerebral hemorrhage
- Any dose can cause death

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Cocaethylene

- Cocaine and ethanol simultaneously
- Metabolic product in body – more toxic
- More pleasant, longer high
- Modified 'coming down'

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Cocaine Metabolites

- Benzoylecognine (BE)
- Ecogoninie methyl ester (EME)

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Toxic Dose - Death

- Any dose of cocaine or methamphetamine can be cause of death
- Hypertension
- Make any hypertension disease worse.
  - Stroke, heart attack
  - Aneurysm

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Cerebral Infarcts

- Strokes in non-drug users – Usually infarcts
  - Arterial thrombus
  - Embolism
  - Vascular compromise
- Infarcts in cocaine or meth users
  - Hemorrhagic or infarcts
  - With 3 hours or morning after binge
  - Vascular spasm
  - Vasculitis.

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Opioid Epidemic - Data from DEA Jan 2023

- In 2020 > 56,000 deaths in US
- Increase of 56% from 2019
- 18x higher than it was in 2013
- Fentanyl largely dominated the category.

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Opioids

- Heroin
- Hydromorphone (Dilaudid)
- Oxycodone (Percocet)
- Hydrocodone (Vicodin)
- Meperidine (Demerol)
- Methadone
- Fentanyl (Duragesic)

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Routes of Administration

- Intravenous
- Subcutaneous (skin popping)
- Oral
- Patch
- Pills

- Varies with type

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Methadone

- Synthetic
- Introduced in 1965 as maintenance drug for heroin addicts
- Increasingly used for intractable pain
- Can also be cause for overdose

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Fentanyl

- Potent synthetic opioid
- 100 times more potent than morphine
- Also more potent than heroin
- Rapid onset and short duration of effects.

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Fentanyl – Types of Administration

- Open patches and chew and inject
- Fentanyl pills labeled OxyCodone – DEA fact sheet

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Fentanyl Certification Guidelines

HB 6– Fentanyl & Death Certificates

HSC § 193.005; Applies only to a death that occurs on/after 9/1/23, or that occurs before that date but is discovered on/after 9/1/23

- Death certificate must include "fentanyl poisoning" or "fentanyl toxicity" if:
  - a toxicology examination reveals a controlled substance listed in Penalty Group 1-B present in the body in an amount/concentration that is considered to be lethal by generally accepted scientific standards; and
  - the results of an autopsy are consistent with an opioid overdose as the cause of death.
- Penalty Group 1-B is found in HSC§ 481.1022, and currently includes fentanyl, alphamethylfentanyl and any other derivative of fentanyl.

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Physical Effects - opiates

- Euphoria
- Nausea
- Constricted pupils
- Constipation
- Sedation
- Decreased heart & respiratory rate

- Death by central nervous system and respiratory depression.

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Marijuana

- Well-being
- Sedation
- Depersonalization
- Altered perception of time and space
- Hallucinations
- Paranoid ideation

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Marijuana Effects

- Psychomotor and cognitive performance impairment

- Direct cardiovascular effects
  - Tachycardia
  - Blood pressure

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Marijuana Active Ingredients

- Active ingredient Δ^9 tetrahydrocannabinol
- Δ^9 THC

- Lipophilic
- Extremely long half life – 28-56 hours

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Synthetic Cannabinoids

- K2/ Spice
- Opposite effects to Δ^9 THC (!!!)

- Stimulant/ psychoactive substances
- May use with THC or vape

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Kratom

- Not a scheduled drug
- Readily available to buy
- Stimulant effects
  - Tachycardia
  - Vomiting
  - Seizures
  - Delusions

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Blunt Force Injuries

- Contusions
- Abrasions
- Lacerations
- Fractures

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Blunt Force Trauma

- Falls
- Motor vehicle accidents
- Traumatic blow

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Contusions

Hemorrhage into the soft tissue due to rupture of blood vessels

45

Contusion Symptoms

- May be larger than the impacting object
- Significant blows may not produce contusions
- May be difficult to see in dark-skinned persons
- May be easier to see if there is a longer interval between death and autopsy

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Contusion Color Changes

- In an adult (children heal faster):

Red	Immediate
Blue-Purple	1-4 hours
Green	4-7 days
Yellow	7-10 days
Normal	14-21 days

**depends on size, extent, depth, local circulation*

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What do Contusions Look Like?

- May be patterned
- May not develop immediately
- May be observed more readily over prominent parts of the body

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Abrasions

- Scraping/removal of superficial layers of skin
  - Graze—bullet
  - Scratch—fingernail, sharp edge
  - Brush burn—frictional force (dragging on ground)
  - Binding—handcuffs/rope
- May be patterned

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Lacerations

- Blow from blunt objects or falls
  - Bridging of connective tissue within depths of wound
  - Appearance may not reflect object causing injury

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Fractures

- Long bones
- Skull
- Facial bones
- Ribs

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Subgaleal Hematoma

- AKA Subscalpular hematoma
- Blunt force trauma
- Fall or hit
- Size does not necessarily reflect impacting object

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Cephalohematoma – birth trauma

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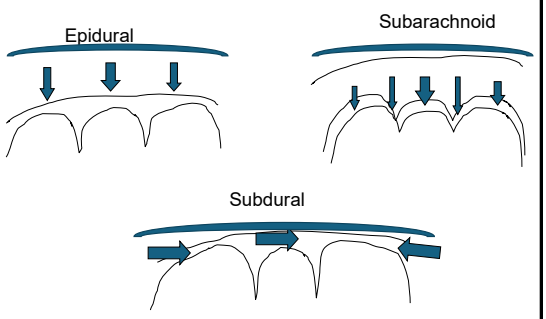
Types of Brain Bleeding - Traumatic



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Epidural Hemorrhage

- Impact injuries
- Rarely seen in infants and children
- Usually 90% associated with a skull fracture
- Classic association - hit in head with bat
- Can be seen in fire deaths – not traumatic

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Subarachnoid Hemorrhage

- Most common sequela of head trauma
- Can be due to natural causes – aneurysm
- Collections of subarachnoid blood at base of brain can be due to lacerations of basal or vertebral arteries – traumatic (hyperextension).

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Subdural Hemorrhage

- Most common lethal injury in head trauma
- Due to falls or impacts with objects
- Not usually associated with skull fractures
- Associated with diffuse axonal injury

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Brain Contusion

- The brain parenchyma has a bruise or injury

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Diffuse Axonal Injury

- Due to effects of head motion on the brain
- Angular acceleration/deceleration
- Spheroids are seen microscopically
- Beta-amyloid precursor protein positive;
  - not specific--occur in other forms of axonal injury (for example: cerebral infarct, encephalitis, anoxia

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Diffuse Axonal Injury

- Concussion – minor DAI, with or without loss of consciousness
- Second impact syndrome – minor head injury followed by a second injury before the first resolves.
  - Seen in sports
  - Mortality 50%

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Elderly Injury Example

- 85-year-old female died in nursing home.
- History of dementia, Hypertension, emphysema.
- Nursing home doctor signs DC - as natural death

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Elderly Injury

- Family ordered a private autopsy.
- Finding – subdural hematoma and history hip fracture 3 months prior
- Accidental manner of death.

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Oh no, now what?

- Open an inquest.
- Death certificate needs to be changed.
  - Decertify the death certificate
  - Physicians cannot sign accident, suicide, homicide and undetermined.

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Elderly Injury Case

- 83-year-old lady
- Resident of nursing home
- Fell while being transferred from toilet

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Elderly Injury Case 2

- Fractured arm
- Died within days of the fracture.

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Fractures in Elderly

- Hip, ribs, arms etc.
- Considered independent risk factors for death
- At least within the year
- Especially if they don't return to their "baseline"
- Manner - Accident

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Motor Vehicle Accident Deaths

- Know cause of death is Blunt force trauma
- What exactly caused the death?
- How quick was the death?
- Was there “conscious pain and suffering?
- Need autopsy to get closer to answering

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Vehicle Accident Case Example

- 35-year-old Male
- Drove off bridge into water
- Expect Blunt Force trauma

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Blunt Force Trauma

- Vertebral column fracture
- Arm fracture
- Rib fractures

- But…. Suprise!

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Another Case

- 35 male
- MVA with family member
- Blunt force trauma
- Descendant was trapped
- Car about to explode

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What I didn't tell you yet

- While trapped, he asked for a gun.
- Shot himself
- Heard on 911 call
- Then explosion happened.
- **Investigation – is important!!!**

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Describing Fatal MVA on death certificate

- Person injured
  - Driver, passenger, pedestrian, cyclist?
- Type of vehicle
  - Car, truck, bus, motorcycle, four-wheeler?
- Object vehicle collided with
- Did accident occur on a public road?
- Was safety gear being used?

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Describing Fatal MVA on Death Certificate

- What was person doing when injury occurred?
  - Engaged in organized sports
  - Engaged in leisure activity
  - Working for income

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TxDot Report

- Report MVA or bridge collapse
- Information includes Name, pedestrian, passenger, County
- Where autopsy is being performed.
- Toxicology results.
- By the 11th of the month.
- https://www.txdot.gov/government/enforcement/crash-records.html

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Work Related Deaths - 2022

- A person died every 96 minutes
- 5500 for the year 2022
- OSHA investigates 25-35%
- Others were due to lack of resources or jurisdictional issues.
- 91% male
- Most were transportation and material moving

Data from Census of Occupational Injuries 2022

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Work Related Deaths

- Send for autopsy and toxicology
- Document injuries
- Document natural disease
- Document drug use
- Insurance/civil lawsuits involved

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OSHA
JP not required to report – but helpful

https://www.osha.gov/report

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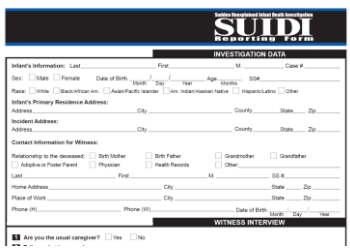
Child Deaths

- Scene investigation important – even if child taken to hospital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Reporting Form
INVESTIGATION DATA
WITNESS INTERVIEW

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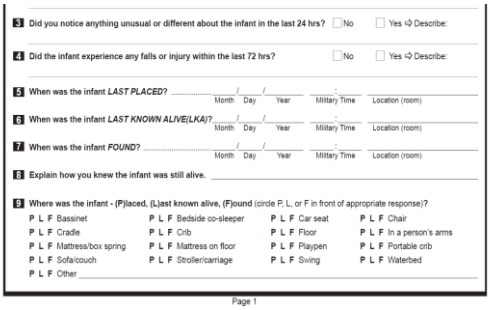

3 Did you notice anything unusual or different about the infant in the last 24 hrs? ☐ No ☐ Yes ⇨ Describe:

4 Did the infant experience any falls or injury within the last 72 hrs? ☐ No ☐ Yes ⇨ Describe:

5 When was the infant *LAST PLACED*? ..... ___/___/___ ___:___ ___
Month Day Year Military Time Location (room)

6 When was the infant *LAST KNOWN ALIVE(LKA)*? ___/___/___ ___:___ ___
Month Day Year Military Time Location (room)

7 When was the infant *FOUND*? ..... ___/___/___ ___:___ ___
Month Day Year Military Time Location (room)

8 Explain how you knew the infant was still alive. ___

9 Where was the infant - (P)laced, (L)ast known alive, (F)ound (circle P, L, or F in front of appropriate response)?

P L F Bassinet	P L F Bedside co-sleeper	P L F Car seat	P L F Chair
P L F Cradle	P L F Crib	P L F Floor	P L F In a person's arms
P L F Mattress/box spring	P L F Mattress on floor	P L F Playpen	P L F Portable crib
P L F Sofa/couch	P L F Stroller/carriage	P L F Swing	P L F Waterbed

P L F Other ___

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Evaluating Child Injury Deaths

- History and circumstances are important
- Many injuries can be accidental or non-accidental
- Isolated head injuries can be difficult to evaluate
- Natural disease may play a role in severity of injury

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Unsafe Sleep

- 70% new parents bedshare
- 47% report sleeping with babies
- 13% usually share an adult bed at night

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Bed-Sharing: Possible Overlay

- Exact Positioning: who is lying where?
  - Heights and weights of those sharing bed
  - Bedding: type, thickness, pillows, brands
  - Infant position when put down
  - Infant position when found: were the nose & mouth covered?
- Medications/Drugs?

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Overlay

- 3-week-old
- Mom, Dad and Baby on the futon
- Mom wakes up and sees Dad's arm over baby's face

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Entrapment

- Kids are small and have limited motor skills
  - Placed in cribs, playpens, bouncy seats
  - Limited supervision
- Investigation:
  - Accident or Homicide
    - Establish position of child when found
    - Document equipment: take into evidence
    - Document time left unsupervised

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Infant Died after Fall from Walker

- 11-month-old old
- Placed in walker by aunt
- Heard thump
- Child found in walker under a chair

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Asphyxia

- Anything that interferes with oxygen uptake or utilization
  - Suffocation
  - Strangulation
  - Drowning
  - Chemical asphyxia
  - Mechanical asphyxia

  Plastic bag, overlaying, too much bedding, entrapment

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Suffocation

- Choking
  - Aspiration of food
  - Foreign objects

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Brain Edema

- Can occur with hemorrhages and lack of oxygen
- If severe, herniation or midline shift
- Can produce secondary brain stem hemorrhage

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Take Home Points – Asphyxia Deaths

- Petechiae are not diagnostic, just suggestive
- Often no diagnostic signs at autopsy
- Does story match the injuries?

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Drowning

- No physical findings at autopsy
- Diagnosis relies on scene investigation
- May have water in stomach
- No such thing as “water in lungs”
- Immersion changes to hands and feet

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Drowning – Do an Autopsy!

- Blunt force trauma – neck fracture?
- Drug overdose
- Carbon monoxide – if around boats
- Other contributory causes – heart disease

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Burns

- Categories
  - Radiant heat - sunburn
  - Flame
  - Contact
  - Scalding
  - Chemical

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Burn Injuries

- Degree of injury
  - 1st degree—confined to epidermis
    - Skin red without blistering
  - 2nd degree—destroys epidermis, spares dermis
    - blistering
  - 3rd degree—destruction of dermis
    - Skin surface brown or black
  - 4th degree—destruction of subcutaneous structures (e.g. muscle)

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Burn Deaths

- Clothing can be initially protective
- Death
  - Immediate—smoke inhalation
  - Delayed—sepsis from burns

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Burns and Fires

- 75% of fire-related deaths are due to inhalation of toxic smoke
  - Carbon monoxide (lethal level 50-60%)
    - Children/small animals reach fatal level quicker due to higher metabolic rate
  - Hydrogen cyanide (lethal level 5 mg/ml)

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Carbon Monoxide Levels

- Tissues and blood “pink hue”

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Burns

- Weight and height altered
- Feet and hands may be lost
- Body of an adult rarely destroyed by house or car fire
  - House fire temp—1200 to 1600 F
  - Crematorium temp—1800 to 2000 F
- Children may be consumed by fire

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Electrocution

- Electrocution
  - Ohm's law—V=IR (volts = current x resistance)
  - Household current 110 volts (alternating)
  - Resistance of skin
    - Dry—100,000 ohms (1.1 mamp)
    - Wet—1,000 ohms (110 mamp)

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Electrocution – Currents vs. Injury

Current	Physiologic effect
1 mamp	Slight tingle
16 mamp	Release wire due to shock
20 mamp	Muscular paralysis
100 mamp	Ventricular fibrillation
2000 mamp (2 amp)	Ventricular standstill
5 amp	Electrical burn
20 amp	Blows common household fuse

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Electrocution Deaths

- Low voltage
  - Burns may be present at entry/exit sites
    - Caveat—current entering over broad surface, e.g. bathtub electrocution
  - Death due to ventricular fibrillation
- High voltage
  - Electrical burns—chalky white with cratering
  - Charring
  - Death due to ventricular standstill or paralysis of respiratory center

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Electrocution - Lightning

- Lightning
  - Direct strike
  - Side flash
  - Conduction
- Death from high-voltage direct current
  - Usually due to burns and injury to respiratory center of brain

101

Time and Temperature – (adults!)

- Hot Water Causes Third Degree Burns…
  …in 1 second at 156º
  …in 2 seconds at 149º
  …in 5 seconds at 140º
  …in 15 seconds at 133º.
- Household tap – 118-140º

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Consider in Investigation

- What is the story?
- Does the story match the injuries?
- Does the story change?
- What is the temperature of the water?
- What is the source of the water – stove, bathtub?
- Delayed presentation?

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TMORT

- Active group
- Meet monthly via Zoom
- We have a GroupME for immediate communication
- Actively engaging contracted partners for all the regions of Texas

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Jurisdiction

- Jurisdiction remains with you – the JP
- TMORT will help with the resources.
- Resources will be determined by the type of mass fatality event.
- Webinar - Available for more info

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Access TMORT

- County Office of Emergency Management via STAR request
- https://star.tdem.texas.gov/
- When the county can't fill it, they'll pass to the state

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Allergic Reactions

- Generally considered natural
- Drugs, bee stings, food allergies etc.

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Anaphylactic Deaths

Most common food allergies – peanuts and shellfish

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Anaphylactic Death Causes

- Antibiotics
  - Penicillin
- Iodine contrast agents
- Chemotherapy agents

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Anaphylactic Deaths - Stings

Second most common cause of fatal anaphylaxis in United States.

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Another Case Example

- Deceased came to hospital 1 week ago.
- ICU admission
- Died with “anoxic encephalopathy”
- Now what?

111

Anoxic Encephalopathy

- State of brain disfunction because of lack of oxygen to the brain.
- This is an **immediate** case of death.
- Big Question – what is the **proximal** cause?

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Anoxic Encephalopathy – Why?

- Cardiovascular disease? Lung disease?
- Drug overdose?
- Infection? – from the hospital or before?
- Asphyxia – hanging, choking, strangulation?

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Anoxic Encephalopathy - Investigation

- Need to open inquest.
- Investigate events
- Get admission blood for testing
  - Hospitals usually use urine.
  - Test for substances and get true level

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Get Admission Blood

Toxicology

This decedent had a positive ethanol test at the hospital

She was given 2 units of blood and 1 liter of saline

Admission specimens from the hospital should be requested to be sent with the body


NMS

NMS Labs

CONFIDENTIAL

Toxicology Report

Report Issued: 07/02/2024 22:02

Patient Name: [redacted]
Patient ID:
Chart:
DOB:
Sex: Female
Workorder: 24059771

To: 16311
Forensic Forensics, LLC
Attn: Dr. Amy Gruszynski
2452 US Highway 80 East
Mesquite, TX 75149

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Positive Findings:

None Detected

See Detailed Findings section for additional information

Testing Requested:

Test	Test Name
82078	Postmortem, Basic w/Vitreous Alcohol Confirmation, Blood (Forensic)

Specimens Received:

ID	Tube/Container	Volume/ Mass	Collection Date/Time	Matrix Source	Labeled As
001	Gray Stopper Glass Tube	5 mL	06/25/2024 11:30	Femoral Blood	AF24-0497
002	Gray Stopper Glass Tube	5 mL	06/25/2024 11:30	Femoral Blood	AF24-0497
003	Blue Cap Plastic Tube	5 mL	06/25/2024 11:30	Vitreous Fluid	AF24-0497
004	White Cap Plastic Container	25 mL	06/25/2024 11:30	Urine	AF24-0497

All sample volumes/weights are approximations.
Specimens received on 06/26/2024.

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Therapeutic Misadventure

- Something "went wrong" during treatment
- Or a procedure or surgery
- Or a medication.

- Generally considered Natural.

- Does not mean is not malpractice.

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Delayed Accidental Deaths

- Drug overdose ⇒ anoxic encephalopathy days later
- Rib fractures from a fall ⇒ pneumonia ⇒ sepsis

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More Delayed Accidental Deaths

- MVA ⇒ repair of aortic laceration ⇒ aneurysm at site 10 years later
- Blunt force injury of head ⇒ altered mental function ⇒ bedridden ⇒ pulmonary embolism

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Manner on Death Certificate

If anything listed in either the Part 1 or the Part 2 is anything other than natural, the manner changes with it.

For example, Hip fracture in the elderly 3 months before death – Manner becomes Accident.

Hemorrhagic stroke due to hypertension – but cocaine positive – manner becomes Accident.

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Red Flags – Something Other than Accident??

- History provided
- Body locations of injuries
- Other Patterned injuries, burns
- Fractures
- Old injuries

- Thorough investigation is important

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Opportunities for Intervention

- Drug and ethanol abuse/use education
  - Will also impact MVA occurrences
- Education for safe sleeping for infants
  - Not in adult beds with adults
- Safe environments

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Opportunities for Intervention Continued

- Advances in MVA safety features have accounted for 44% of the life expectancy gains.
- Detailed reporting on death certificates and other surveys helps.

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Thank you!

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