Know your equipment!
Ambulance Standards

- KKK standards
  - Foundation for “star of life” ambulance uniformity
  - Three basic ambulance designs
    - Type I, type II, and type III
  - Created by the US General Services Administration
  - Rewritten every five years
Ambulance standards

- Other standards
  - ASTM International F2020-02a standards
  - In Europe, standards published by European Committee for Standardization (CEN)
  - NFPA 1917

- In late 2013, KKK will expire and NFPA may become the new standard...
Basic Ambulance Designs: —Type II

Ambulance Inspections

- In Wisconsin, governed by Administrative Code Trans 309
- Inspections are under the jurisdiction of DOT and inspected by WSP
# Ambulance Inspections

![Ambulance Inspection Report](image)

The document contains detailed information about ambulance inspections, including various items that need to be checked during an inspection. The report is structured in a table format, listing different items, their codes, and checkboxes to indicate whether each item is present or not. The inspection report includes sections for remarks, explanations, and other details relevant to the inspection process. The report is used by the Wisconsin Department of Transportation to ensure that ambulances meet safety and operational standards.
Responding to calls
Operating with Lights and Sirens

- In Wisconsin, governed by DOT 346.03
  - Emergency response vehicles may, while responding
    - Stop, stand or park, regardless of other restrictions
    - Proceed past a red or stop signal or stop sign, but only after slowing down as may be necessary for safe operation
    - Exceed the speed limit
    - Disregard regulations governing direction of movement or turning in specified directions

- Exemptions apply ONLY when operating a flashing red light AND an audible signal
Due Regard

“The exemptions granted the operator of an authorized emergency vehicle by this section do not relieve such operator from the duty to drive or ride with due regard under the circumstances for the safety of all persons nor do they protect such operator from the consequences of his or her reckless disregard for the safety of others.”

Tested in the court case *Wisconsin v. Polenska*
This is not due regard...
The “Two-Second” Rule

- Used to gauge distance
  - Look at object by road that will soon be passed by vehicle ahead
  - Count “one thousand and one, one thousand and two”
  - If you reach object before one thousand and two, you are traveling too close to vehicle in front of you

- If bad road and weather conditions
  - Increase following distance to a 4- or 5-sec count
Braking Distance

Based on:

- Average reaction time
- Average vehicle weight
- Average road conditions
- Average brakes
Braking Distance

- Adversely affected by:
  - Wet roadways
  - Poor brakes
  - Poor tires
  - Heavy vehicle weight
  - Poor reaction time
Crashes happen…

Or even worse….
Ambulances are not invincible...
Close to Home
Characteristics of Fatal Ambulance Crashes

- Kahn, Pirrallo & Kuhn
- US NHTSA FARS
- 1987-1997
- 339 Ambulance crashes
- 405 fatalities & 838 other injuries
- Emergency Mode of Travel (RL&S)
  - 60% (202/339) of all crashes
  - 58% (233/405) of all fatalities

*Prehospital Emergency Care* 2001; 5:261-269
Characteristics of Fatal Ambulance Crashes

- Kahn, Pirrallo & Kuhn
- In most fatal ambulance crashes:
  - Traveling in the “emergency mode” (RL&S)
  - The ambulance is the striking vehicle
  - The crash occurs at an intersection
  - Occupants of other vehicles are more likely to die or suffer serious injury than occupants of the ambulance
  - Rear compartment occupants are more likely to be injured or die than front compartment occupants
  - The ambulance drivers have poor driving histories

_Prehospital Emergency Care_ 2001; 5:261-269
Characteristics of Fatal Ambulance Crashes

- Kahn, Pirrallo & Kuhn
- Most RL&S fatal crashes occurred:
  - At intersections
  - At an angle
  - With another vehicle
- Most fatal RL&S crashes involved:
  - One fatality (84%)
  - People who were not in the ambulance (78%)
    - Mostly in other vehicles
    - 9% were pedestrians or bicyclists

*Prehospital Emergency Care 2001; 5:261-269*
Characteristics of Fatal Ambulance Crashes

- Kahn, Pirrallo & Kuhn
- Ambulance occupant deaths
  - Rear compartment > front compartment
    - OR 2.7
  - Unrestrained/improperly restrained occupants
    - OR 2.5 (compared to properly restrained)
    - OR 2.8 (rear vs. front occupants)

*Prehospital Emergency Care* 2001; 5:261-269
Ambulance Crash Injuries Among US EMS Workers 1991-2002

- Based on NHTSA FARS data
- 300 Fatal Ambulance Crashes
- 82 deaths in the ambulances
  - 27 EMS workers
  - Most EMS worker deaths in front compartment
  - Lack of restraint use cited in many of the EMS worker deaths
- 275 deaths of others (in vehicles or pedestrians)

*MMWR* 2003; 58:154-156
Occupational Fatalities in EMS: A Hidden Crisis

- Maguire & Hunting, *et al*
- Death rate among EMS workers 12.7 per 100,000 workers
  - More than twice the National Average (5.0)
  - 14.2 per 100,000 for Police
  - 16.5 per 100,000 for Firefighters
- Highest risk occurs in transportation related incidents
  - 9.6 per 100,000 EMS workers

Occupational Fatalities in EMS

- Of 114 EMS related deaths from 1992-1997:
  - 67 from ground transportation accidents (59%)
  - 19 from air transportation accidents (17%)
  - 13 from cardiovascular issues (11%)
  - 10 from homicides (mostly shootings) (9%)
  - 5 from other causes (needlestick, electrocution, drowning)
On scene
Scene size-up
Scene size up
Scene size-up
Scene size-up
Scene size-up
Scene size-up
Parking at an Emergency Scene

- Make sure vehicle’s location allows for traffic flow around area

- If law enforcement and fire service have secured scene, ambulance should:
  - Park about 100 ft past scene
    - Same side of road
  - Uphill (about 2 feet) and upwind if hazardous materials suspected

- If scene is not secured, ambulance should:
  - Park about 50 ft before scene in “fend-off” position
Never safe…
Fend-Off Position

Your unit is the first emergency vehicle on the scene.
Best positioning

Allow fire and police vehicles to create a buffer zone and area of protection.
Positioning at other calls

- For standard medical calls:
  - consider exit strategy
  - access for personnel and cot

- For other types of rescues (fire, hazmat, etc):
  - position out of the way of necessary apparatus
  - position upwind, uphill
  - position close enough to be able to get victims or injured personnel quickly
  - position with an exit strategy
Patient transport
Code 3 vs. Code 2 Studies

- **Hunt & Brown, et al**
  - Small Urban Setting – Transport Phase
  - RL&S transport time savings average 43.5 sec vs. without RL&S (N=50)
  - RL&S transport not warranted, except in rare circumstances

- **Brown & Whitney, et al**
  - Medium Size Urban Setting – Response Phase
  - *Prehospital Emergency Care* 2000;4:70-74
  - RL&S Response time savings average 1 min 46 sec
  - Statistically significant
  - Clinically relevant in very few circumstances
Code 3 vs. Code 2 Studies

- **Ho & Casey**
  - Major Urban Setting – Response Phase (N=64)
  - Average time savings 3.02 minutes (38.5%)
  - Statistically significant

- **Ho & Lindquist**
  - Rural Setting – Response Phase (N=67)
  - *Prehospital Emergency Care* 2001;5:159–162
  - Average time savings 3.63 min (30.9%)
  - Statistically significant
The Effectiveness of Lights and Sirens During Paramedic Transport

- O’Brien, Price & Adams
- Prospective case-control observational
  - Simultaneous Code 3 ambulance transport vs. Non-Code 3 observer vehicle (OV)
  - Convenience sample of 75 runs
- Do RL&S save time?
- Does the time savings result in clinically significant interventions at the destination hospital?

Prehospital Emergency Care 1999; 3:127-130
The Effectiveness of Lights and Sirens During Paramedic Transport

- O’Brien, Price & Adams
- Ambulance vs. OV
  - Mean Ambulance transit time 666 sec (11:6)
    - SD 203 sec
  - Mean OV transit time 896 sec (14:56)
    - SD 269 sec
  - Mean Difference 230 sec (3:50)
    - SD 126 sec (Range 23 sec to 13 min, 3 sec)
    - Statistically significant (p<0.0005)

*Prehospital Emergency Care* 1999; 3:127-130
The Effectiveness of Lights and Sirens During Paramedic Transport

- O’Brien, Price & Adams
- Ambulance vs. OV
  - Average distance traveled was 8.8 miles
  - Statistically significant correlations between the transit time difference and:
    - Number of stop lights
    - Traffic intensity
    - Distance traveled
  - No differences based on the time of day

*Prehospital Emergency Care 1999; 3:127-130*
The Effectiveness of Lights and Sirens During Paramedic Transport

- O’Brien, Price & Adams
- Hospital Interventions
  - 81% (61/75) received none
  - 5% (4/14) received critical interventions that could not be accomplished by the paramedics before hospital arrival
    - Re-intubation
    - One being prepped for intubation
    - IV + D50 for a hypoglycemic after failed IV in the field
    - Diazepam for child in status epilepticus - difficult to start IV
  - Remaining interventions felt to be non-critical

*Prehospital Emergency Care* 1999; 3:127-130
The Effectiveness of Lights and Sirens During Paramedic Transport

- O’Brien, Price & Adams
- Conclusions
  - There was a statistically significant time savings with RL&S transport
  - The use of RL&S added little to the care of those patients who received successful interventions by paramedics in the field
  - Few clinically relevant interventions were accomplished at the hospital during the time saved by RL&S transport
  - Paramedic ALS interventions significantly reduce the need for RL&S transport

*Prehospital Emergency Care* 1999; 3:127-130
NAEMSP Position Statement

- Few published data on effectiveness of RL&S in reducing response [or transport] times
- RL&S should be reserved for situations in which patient welfare is at stake
- RL&S during response and transport should be based on situational and patient problem assessments and the Medical Director should participate in the development of related policies
- Crashes should be evaluated by EMS system managers and medical directors

*Prehospital and Disaster Medicine, April-June 1994*
EMS dispatch should use a priority reference system to identify which calls warrant RL&S

Except for suspected life-threatening, time-critical cases or cases involving multiple patients, RL&S response by more than one EMV usually is unnecessary

The utilization of emergency RL&S should be limited to emergency response and emergency transport situations only
NAEMSP Position Statement

- All agencies should institute and maintain emergency vehicle operation education programs for vehicle operators
- Scientific studies evaluating the effectiveness of RL&S under specific situations should be conducted and validated
- Laws and statutes should take into account prudent safety practices by both EMS providers and the monitoring public

*Prehospital and Disaster Medicine, April-June 1994*
Surviving an Ambulance Crash

- Restrain your equipment!
  - A 5 pound oxygen tank has 150 pounds of force during a 30 MPH crash.
- Restrain your patient!
  - The crash force experienced during a 40 MPH crash is equivalent to falling off a 50 foot cliff.
- Restrain yourself!
Don’t be the dummy...
Restraining pediatric patients

- Whenever possible, do NOT transport children in the ambulance
- For sick but stable kids, they are best in a carseat or other kid designed device in the captain’s chair
- If necessary, you can attach carseat to the cot
Restraining pediatric patients

- Injured, critical children can be transported on the cot but need at least three points of contact with straps (padding may help) and shoulder harness if possible.

- Injured trauma patients can be secured to board and then secured on cot with three points of contact.

- NEVER transport in the parent’s arms or lap.
Air ambulances
Fixed-Wing Aircraft
Rotary-Wing Aircraft
Use of Aeromedical Services

- Consider air transportation when:
  - Ground transport time to appropriate facility poses a threat to patient's survival
  - Weather, road, or traffic conditions would seriously delay patient care
  - Critical care personnel and specialized equipment are needed
Use of Aeromedical Services

  - More air transported victims died (as expected)
  - Controlling for known variables, there was an increase in survival for air transport:
    - 15% increase for those going to level I trauma centers
    - 16% increase for those going to level II trauma centers

- Several other studies have consistently found similar results...

  *JAMA.* 2012;307:1602-1610
Use of Aeromedical Services

- Diaz et al. looked at transport times between air and ground transport
  - Ground ambulances had shorter transit times when less than 10 miles from hospital
  - Simultaneously dispatched helicopters had shorter transit times than ground at distances greater than 10 miles
  - Non-simultaneously dispatched helicopters were faster than ground at a range of 45 miles

Example of response times
Possible appropriate uses for aeromedical transport

- Prolonged extrication
- Severity of injury requiring critical care intervention
- Vehicular intrusion
- Ejection
- Unrestrained occupant, rollover
- Motorcycle accident
- Significant vehicle damage
- Fall from greater than 15 ft
- Penetrating injury to head, neck, torso
- Amputation or near amputation

- Scalping or de-gloving injury
- Severe blood loss
- Hypotension
- Severe burns, especially to face/airway involvement
- GCS less than 13
- Unstable or potentially unstable airway
- Multisystem trauma
- STEMI, post-cardiac arrest
- Access to scene prohibits safe ground transport
- Farm, industrial, PTO, animal attack
Landing zone requirements

- 150’ x 150’ preferred minimum area (100’ x 100’ minimum)
  - Firm, flat, level surface <= 5° slope
  - Free of overhead obstructions, personnel, vehicles, wires, and loose debris
  - Avoid locating in low lying area
  - Free from…
    - Rocks, tree stumps, fence posts, brush, large rocks, etc.
    - Loose debris
    - Loose sand / gravel / snow
    - Hazardous Materials
Landing zone setup
Safe Approach Zones
Occupational risks of air ambulances

- Air ambulances have the worst fatal crash record in U.S. aviation
- From 1972 to 2009, there were 264 people killed in air ambulance incidents
- From 2007 to 2009, nine fatal crashes claimed 35 lives, including three of our own
Occupational risks of air ambulances

- And continuing close to home:
  - REACT out of Rockford, IL     December 10, 2012
    - Flight Nurse Jim Dillow
    - Flight Nurse Karen Hollis
    - Pilot Andy Olesen
  - Mercy Airmed out of Mason City, IA     January 2, 2013
    - Pilot Gene Grell
    - Flight Nurse Shelly Lair-Langenbau
    - Flight Paramedic Russell Piehl