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Centers capable of treating hyperbaric emergencies in California

Walter Chin, C.H.T, R.N
Kevin Yang
Nisha Talati
R.B. "Gus" Gustavson, RN

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Objectives

1. Address the requirements a center must meet in order to treat a critically ill patient

2. Address the health risk and monetary cost of having to transport patients to a suitable facility

3. Address what centers in California do and do not treat these types of patients and why

4. Address the need for more involvement from other centers in the treatment of these types of cases

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The critical care patient

- Patients admitted to the ICU often have multisystem disease, have traumatic injuries, or are under intensive treatment regimens to avoid or manage end-organ failure or dysfunction .

- Critical care patients that require hyperbaric oxygen therapy:
  - Gas Embolisms
  - Carbon Monoxide
  - Necrotizing soft tissue infection
  - DCS

Requirements for treating critical patients

- Equipment
  - IV Pumps
  - Invasive pressure monitoring
  - EKG
  - Pulse Oximeter
  - Ventilator
- Approved FDA Equipment
  - **Plum A+™ Hyperbaric Infusion System**
  - **510K Vent**
- Guidelines for device approval
  - Hospital clinical engineering
  - In house inspection
  - Risk Management
  - Manufacturing Company

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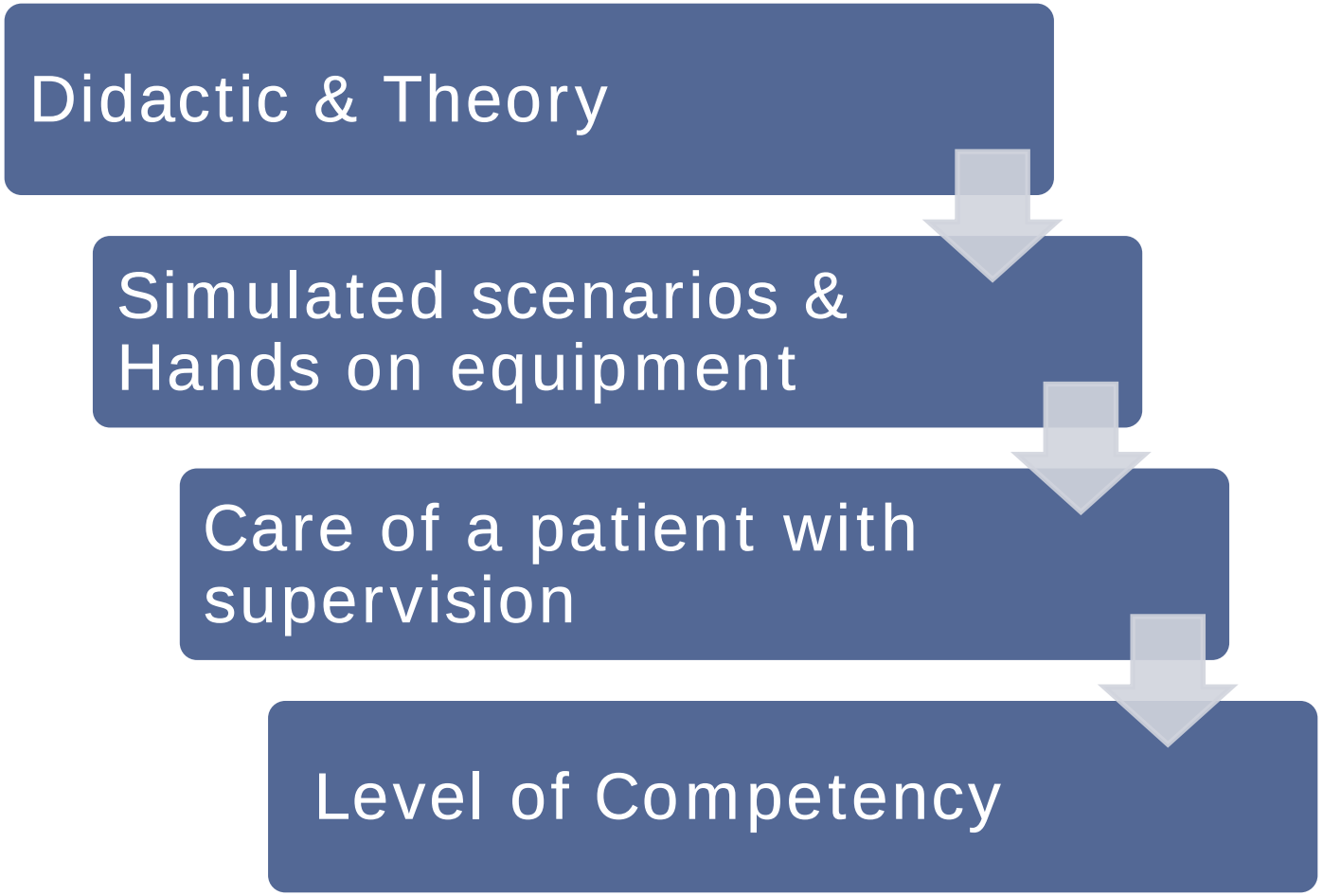
Requirements for treating critical patients

Requirements for treating critical patients

- Training
  - 4 phases



Requirements for treating critical patients

- Emergency policies and Procedures
  - Cardiac Arrest
  - Respiratory Distress
- Treatment protocols
- Through put
  - Field to hospital
  - Hospital to Hospital
  - Department to Center
- Transporting requirements
  - Staff
  - Meds
  - Equipment
- Educations-EMS, MAC

Cost for Ground Transport

Procedure	Cost
Response to call with equipment and personnel at (ALS) level	$ 825.75
Code 3 used during response or transport per incident	$ 96.00
Mileage Rate. Each mile or fraction thereof Minimum 30 miles	$ 412.50
Nurse critical care transport - per hour	$ 171.50
Infusion Pump - per line (minimum 3 lines)	$ 195.00
Total cost with minimum of 30 miles 3 infusion pumps and with 1 hour of Nurse critical care transport and Respiratory therapist	**~$2120**
Helicopter Transport	**$~11,000**

Ground $~11,000.00 vs. Air ~$2120

County of Los Angeles General Public ambulance rates: 07/01/2005

Hospital Cost & Average Length of stay

Patient Type	Hospital days average	Cost average per day
Critical Care	22.4 days	$11,690.00
Telemetry	2.8 days	$ 2,780.00

- Average cost of 5 critical care cases
- Average hospitalization

- Average cost of 5 telemetry cases
- Average length of hospitalization

Patients treated at UCLA from 2008-2010

Risk of Helicopter Transport

- **Hypoxia at altitude**
  - Drop in partial pressure of oxygen at higher altitude leads to decrease in oxygen saturation of the blood
  - Decrease in oxygen saturation causes increase in cardiac output

    Decrease ischemic threshold

    Atrial arrhythmais, PVC

- **Expansion of Gases at Altitude**
  - Gas trapped in closed space will expand by approximately 35% when going from sea level to 8,000 feet of altitude.

Essebag V, Halabi AR, Churchill-Smith M, Lutchmedial S. Air medical transport of cardiac patients. [2] Chest. 2003 Nov;124(5):1937-45.

Risk of Helicopter Transport

- **Anxiety**
  - Nervousness about flight may provoke cardiac ischemia

- **Complication of moving patients**
  - Physical movement of patient can casue complications ranging from pulling out an IV line to pulling out an endotracheal tube
  - Risk of transport increases with amount of instrumentation patient is using

    Critical care patients are therefore at greatest risk of a complication during transfer.

Risk of Helicopter Transport

- Crashing
  - 182 crashes between January 1, 1983 and April 30, 2005 (22.3 years)
    - 39% were fatal
  - 184 occupants died
    - 45% were patients
    - 32% were crewmembers
  - Risk increases with conditions of darkness, bad weather, low visibility

Helicopter Medical transport Crashes in California from 2000-2010

Amount	Fatal	Serious
11	14	3

Baker SP, Grabowski JG, Dodd RS, Shanahan DF, Lamb MW, Li GH. EMS helicopter crashes: what influences fatal outcome? Ann Emerg Med. 2006 Apr;47(4):351-6. Epub 2006 Jan 19.

Risk of Delayed Treatment

- Gas Embolisms
  - Initially reversible damage may become permanent
  - After a delay of 24 hours or more, treatment may become ineffective and symptoms may not respond to treatment
  - Death

- 86 patients admitted to Salvator University Hospital of Mareille, France for Iatrogenic Cerebral Air Embolism
  - Patients treated with HBOT less than 6 hours after AGE was found had better prognosis than those treated in 6 hours or later

    Treatment in <6hr: 68% recovery

    Treatment in ≥6hr: 40% recovery

Dr. E.D. Thalmann, DAN Assistant Medical Director. Diving Medicine Articles. *Decompression Illness: What Is It and What Is The Treatment?* March/April 2004. <http://www.diversalertnetwork.org/medical/articles/article.asp?articleid=65>

Survey

- Methods:
  - Contacted 34 California centers by phone. Centers were located via UHMS chamber directory
  - Questions:
    1. Do you treat ICU cases?
    2. Do you treat ventilator-dependent patients or intubated patients?
    3. If yes, how many, what types, per year?
    4. If no, are there centers in the area that do?
    5. Does your center have a emergency on call schedule.
    6. Mono/Multiplace?
    7. What are your hours of operation?

Results

- Amount of hyperbaric centers in California 42
- Received information from 34 centers (including UCLA).

Answers	n
Amount of multiplace centers in California	8
Amount of monoplace centers in California	26
Centers that responded yes to being able to treat ICU cases	18
Amount of monoplace centers that responded yes to being able to treat ICU Cases	13
Multiplace centers that treat ICU cases	5
Monoplace center that stated yes to being able to treat ICU cases but stated that they don't have IV Pumps or Ventilators and rarely see ICU cases	7
Multiplace centers that stated yes to being able to treat ICU cases but stated that they don't have IV pumps or Ventilators and rarely see ICU cases	1

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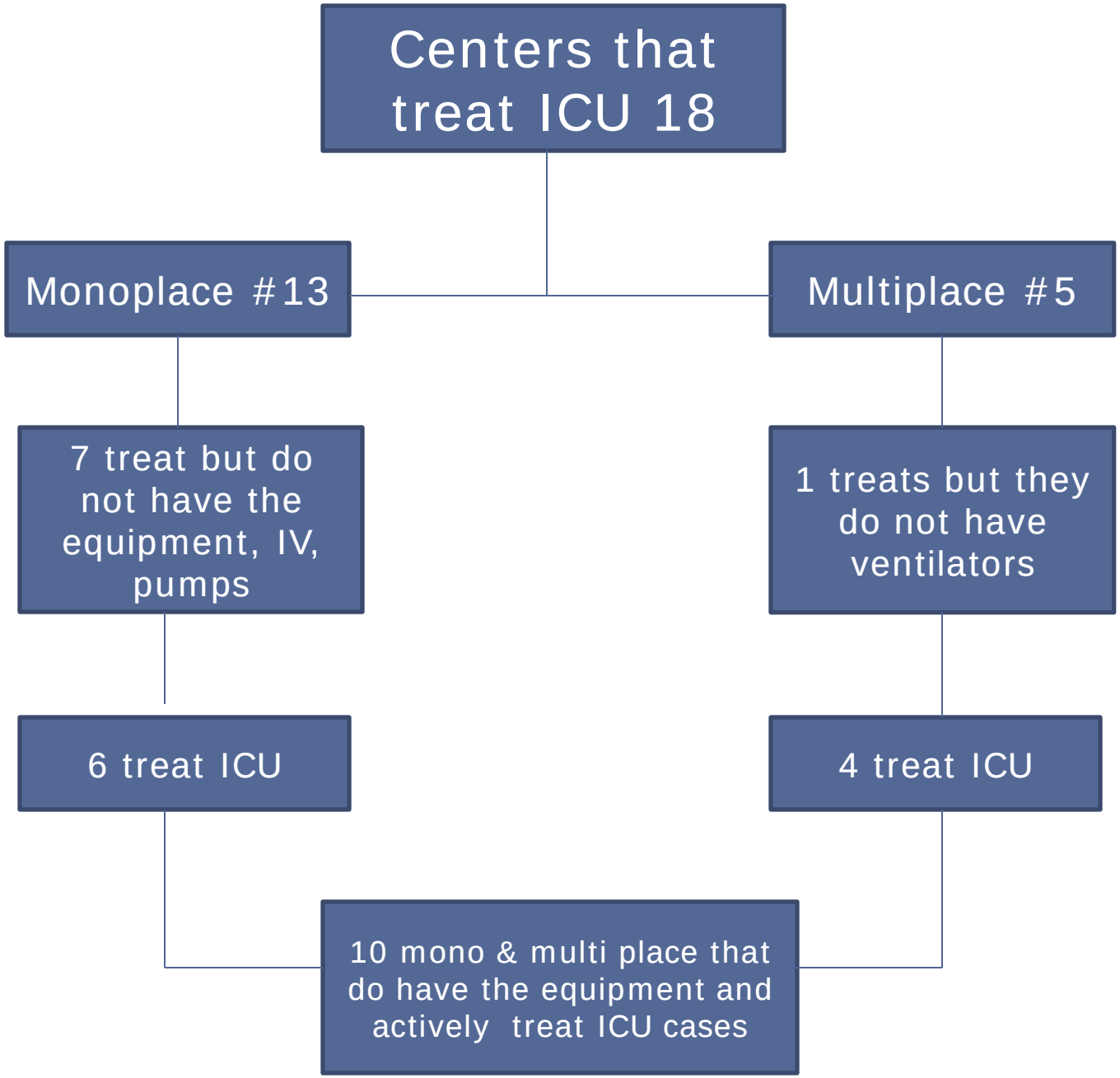
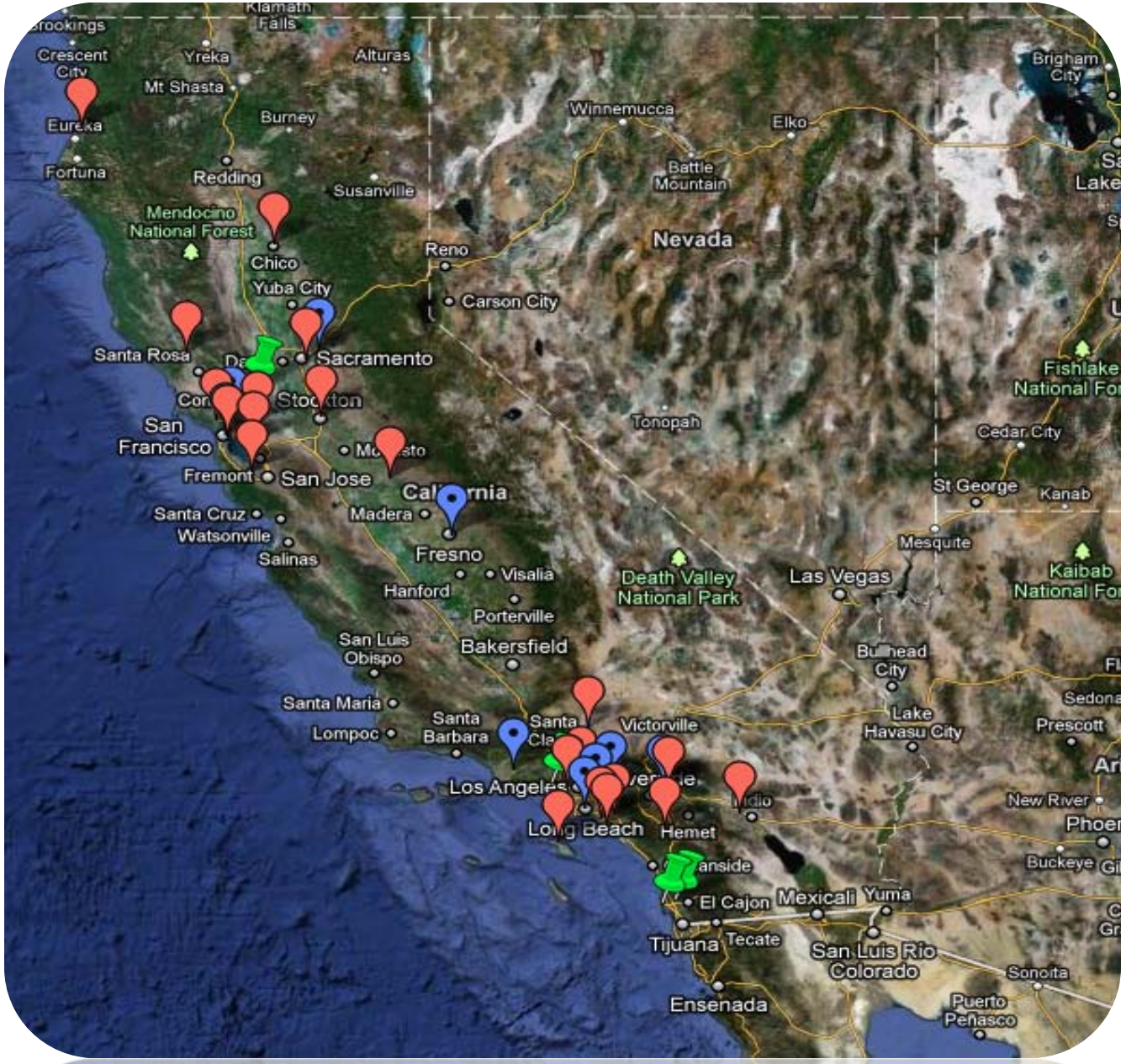

Centers that treat ICU 18
Monoplace #13
Multiplace #5
7 treat but do not have the equipment, IV, pumps
1 treats but they do not have ventilators
6 treat ICU
4 treat ICU
10 mono & multi place that do have the equipment and actively treat ICU cases

Centers in CA treat ICU patients



- No ICU
- Multiplace ICU ventilator capable
- Monoplace center ICU Ventilator capable

Where do we send this patient?

- From Yosemite, 73 miles to the nearest monoplace, or 150 miles to the nearest multiplace.

- From Arroyo Grande 129 mile trip to the nearest monoplace center and 163 miles to the nearest multiplace center

Conclusion

- Proliferation of HBOT centers across the country
- Disproportion of centers that are treating ICU cases vs those that are not
- We need to consider when to treat and when not to treat
  - Consider the risk of flying vs delaying tx
- Consider different monetary payment structure