Virtual PICU Models: Projecting to the Community

James Marcin
Pediatric Critical Care - UC Davis Children’s Hospital
Sacramento, CA
I have no financial relationships or conflicts of interest to disclose
Why Telemedicine?

Regionalization improves efficiency and quality

Telemedicine allows our expertise to be everywhere
16 million (23%) of children live >60 minutes from Children’s Hospital (CHA)

41 million (57%) of children live >30 minutes from Pediatric Trauma Center (ACS)
Applications of Telehealth

- Outpatient telemedicine
- ED telemedicine
- Inpatient telemedicine
- Education – Multidisciplinary
Applications of Telehealth

- eReferral – eConsultation
- Daycare-School telehealth
- Virtual Visits – DTC
- Remote Patient Monitoring
Applications for PCCCM

- Transport medicine
- Education and simulation
- Remote Emergency Department consultations
- Remote Inpatient & ICU consultations
- Rapid Response Teams
- Home monitoring (CSHCN)
  - Interstage home monitoring
  - Home ventilation
- Palliative care & Hospice
- International medicine
EMS-C & Transport

- First responder
- Interfacility transport
  - Tablet, Gurney, Wearable

**Pediatrics Overall (0-18 years)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Time (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg EMS Response Time in Minutes</td>
<td>9.2</td>
</tr>
<tr>
<td>Avg EMS Scene Time in Minutes</td>
<td>12.6</td>
</tr>
<tr>
<td>Avg EMS Transport Time in Minutes</td>
<td>11.7</td>
</tr>
<tr>
<td>TOTAL COUNT OF EVENTS (N)</td>
<td>1,200,111</td>
</tr>
</tbody>
</table>
Education and Simulation

- Mock codes
- Teams – CRM
- Medical rounds
Pediatric Tele-Emergency

- **Feasibility**

- **Diagnostic concordance**

- **Reviews**
ED Telemedicine
Impact of critical care telemedicine consultations on children in rural emergency departments,
Impact of Telemedicine Consultations

- Quality of Care
- Medication Errors


Prospective Randomized Trial

15 crossover cluster randomized control trial
- Two-year enrollment
- Randomized to 6-month blocks
  - 3 telemedicine : 1 telephone
- Adherence encouraged but ultimately at physicians discretion

Study Population
- Request for consultation from a critical care physician
- ≤14 years old
- Non-trauma
Randomized
N=696

- Telemedicine
  - 527 (75.7%)
  - Telemedicine
    - 229 (43.5%)
  - Telephone
    - 298 (56.6%)
- Telephone
  - 169 (24.3%)
  - Telemedicine
    - 24 (14.2%)
  - Telephone
    - 145 (85.8%)
## Results-Intention to Treat

<table>
<thead>
<tr>
<th>Patient factor</th>
<th>Assigned Telephone, N (%)</th>
<th>Assigned Telemedicine, N (%)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (SD)</td>
<td>3.86 (4.5)</td>
<td>4.34 (4.7)</td>
<td>0.29</td>
</tr>
<tr>
<td>Gender Female</td>
<td>76 (45.0%)</td>
<td>228 (43.3%)</td>
<td>0.70</td>
</tr>
<tr>
<td>Medicaid Insurance</td>
<td>129 (76.3%)</td>
<td>423 (80.3%)</td>
<td>0.27</td>
</tr>
<tr>
<td>ED arrival by EMS</td>
<td>136 (80.5%)</td>
<td>396 (75.1%)</td>
<td>0.16</td>
</tr>
<tr>
<td>Mean RePEAT Score</td>
<td>1.59 (0.6)</td>
<td>1.57 (0.6)</td>
<td>0.63</td>
</tr>
</tbody>
</table>
## Results-Intention to Treat

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Assigned Telephone, N (%)</th>
<th>Assigned Telemedicine, N (%)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>169 (24.3%)</td>
<td>527 (75.7%)</td>
<td></td>
</tr>
<tr>
<td>Transfer Status</td>
<td></td>
<td></td>
<td>0.02</td>
</tr>
<tr>
<td>Discharged or Admitted</td>
<td>10 (6.0%)</td>
<td>67 (12.7%)</td>
<td></td>
</tr>
<tr>
<td>Transferred</td>
<td>157 (94.0%)</td>
<td>458 (87.2%)</td>
<td></td>
</tr>
<tr>
<td>Deceased</td>
<td>2 (1.2%)</td>
<td>2 (0.04%)</td>
<td></td>
</tr>
</tbody>
</table>
### Results - Intention to Treat

#### Multivariable odds of transfer from ED (random intercepts)

<table>
<thead>
<tr>
<th>Predictor</th>
<th>OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consult Modality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>REF</td>
<td></td>
</tr>
<tr>
<td>Telemedicine</td>
<td>0.42 (0.20-0.89)</td>
<td>0.02</td>
</tr>
<tr>
<td>Encounter age in years</td>
<td>1.10 (1.02-1.18)</td>
<td>0.01</td>
</tr>
<tr>
<td>RePEAT score</td>
<td>3.75 (2.22-6.34)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Estimate (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Needed to Treat</td>
<td>12.7 (7.1-59.8)</td>
<td>0.01</td>
</tr>
<tr>
<td>Risk ratio</td>
<td>0.91 (0.85-0.98)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
NICU Telemedicine
Virtual Pediatric Trauma Center

- Potentially Avoidable Transfers
  - Range from 20% - 40%

- Difficult... but not impossible...
  - More access points
  - Mobile technologies
  - Inclusion of image sharing
International Telemedicine

- Collaboration between PICUs
  - Within country and Between countries
- Specialty ICUs – Education – Rounds
Telemedicine PCC: Conclusions

- Transport medicine
- Education and simulation
- Remote Emergency Department consultations
- Remote Inpatient & ICU consultations
- Rapid Response Teams
- Home monitoring (CSHCN)
- Palliative care & Hospice
- International medicine
Washington Nationals
World Series Champions!!
Start California dreaming!
Join us in sunny
Sacramento, California
October 23 - 25, 2020
Details and registration information to follow soon!

PCCCG 2020
THANK YOU

Jim Marcin
916-524-3368
jpmarcin@ucdavis.edu