How can we protect Children from Adverse Drug Events?
Two “Little” Patients

- CYL: 17 month old male infant who presents to the A&E with severe respiratory distress

- LYC: 17 month old male infant with severe drowsiness
Risk factors for Adverse Drug Events Among Pediatric Patients in Hong Kong

- Higher/Larger Doses
- Δ Elimination/Metabolism
- Extreme of age
- Complex disease states - Inc # meds medications
- Genetic Polymorphisms

- Individualized dosing
- Ontogeny related pharmacokinetic changes
- Absence/Insufficiency information
- Lack of appropriate formulations

- Use of TCM
- Doctor Shopping
- No SPD (Community)
- “Hong Kong Practice”
"Hong Kong Practice"

Definition:

1. **Noun**
   
   1. A way or standard of practice in medicine *unique to the region of Hong Kong* largely influenced by a set way of prescribing medications

2. **Adjective**
   
   – Interesting yet unexplainable ways of practice with no obvious or evidence based rationale (other than $$)
Case #1

CYL is a 17 month old male infant admitted due to severe respiratory distress & croup

- Nasal Pharyngeal aspirate shows positive Influenza A
- Developed respiratory distress requiring intubation
- The patient developed sepsis and decompensated further into shock
- One week after admission he was diagnosed with Hospital Acquired Pneumonia

List of Medications During Hospital Stay:

- Rocuronium
- ½ NS + D5W + 14.9% KCl + 5.85% NaCl
- Fentanyl
- Midazolam
- Dopamine
- Noradrenaline
- Amoxicillin + Clavulanate
- Vancomycin
- Piperacillin + Tazobactam
- Paracetamol
Danger #1: Unlabeled Uses
Ontogeny Related Differences and Unlabeled Uses

• More medications are considered high-alert in pediatrics

• Of the 248 different medications used in a pediatric ICU\textsuperscript{1}:
  – 24.2\% were not FDA approved for \textit{any} pediatric age group
  – Only 33.1\% were FDA approved for all pediatric age groups

Ex. of Medications not FDA approved for any pediatric age\textsuperscript{1}:
  \begin{itemize}
    \item Captopril
    \item Dexmedetomidine
    \item Dopamine
    \item Oxycodone
    \item Enoxaparin
    \item Fosphenytoin
    \item Labetalol
    \item Methadone
    \item Pantoprazole
    \item Polyethylene glycol
    \item Sildenafil
    \item Spironolactone
    \item Thiopental
    \item Ursodiol
  \end{itemize}

Danger #2: Medication Errors
Medication Errors

• Potential for medication errors in the pediatric population is 3X higher compared to adults

• Most of the errors (up to 79%) were prescribing errors largely due to incorrect dosing

• Prescribing errors involved intravenous medications (54%) and anti-infectives (28%)

Occurrence of Prescribing Errors in a PICU in Hong Kong

• **Primary Objective:**
  – To determine the occurrence of prescribing errors in a pediatric intensive and high dependency unit (PICU) in Hong Kong

• **Secondary objective:**
  – To determine the clinical significance, the type of error, and nature of medication involved

• **Method:**
  – Prospective Observational Chart review among PICU patients to detect for any prescribing errors over a 3 month period
Occurrence of Prescribing Errors in a PICU in Hong Kong

• Results:
  – 131 prescribing errors or pADE identified during the study period
  – Of the 43 patients admitted to the study site, 19 (46.3%) of patients had at least one pADE
    • 6.9 errors per patient affected; 3.2 errors per patient admitted to the PICU
  – Most common type of prescribing error was incorrect dose calculation (48.1%)
Results:

- Medications associated with an error were:
  - Intravenous fluids (42.4%)
  - Cardiovascular agents (15.3%)
  - Anti-infectives (12.7%)

- More than 77% of the pADEs were considered to cause clinically serious or significant patient harm
  - 2 pADEs were considered lethal
Case #1

During the patient’s stay in the PICU (9 days):

- **11 prescribing errors** were due to either a **wrong rate of infusion** or **wrong dose**
- **6** of the errors involved IV fluids
- **5** were thought to cause significant harm if unintercepted
- **1** potentially lethal
  - Fentanyl mL/min rather than mL/hr

**List of Medications During Hospital Stay:**

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- Midazolam
- Dopamine
- Noradrenaline
- Amoxicillin + Clavulanate
- Vancomycin
- Piperacillin + Tazobactam
- Paracetamol
Danger #3: Polypharmacy or Polytherapy
Case #2

• LYC is a 17 month old male infant develops running nose and cough with phlegm.

• His parents brings him to a general practitioner in a private clinic

• The patient is otherwise healthy with no prior medical history.
Case #2

Question: How many medications do you think the GP prescribed?

a. None (bed rest and fluids)
b. 3
c. 5
d. 8
e. 10
Case #2

Question: How many medications do you think the GP prescribed?

- Ketotifen
- Actifed Compound
- Cocilliana DM
- Piriton
- Cephalexin
- Acetylcysteine Lozenges

Directions: 1 teaspoonful (5mL) orally four times a day
Case #2: Part 2

• Three days later, the patient’s symptoms persist. His mom brings him to another general practitioner.

• Question: How many medications do you think the GP prescribed?

  a. None (bed rest)
  b. 3
  c. 5
  d. 8
  e. >10
Case #2: Part 2

- Take 5mL PO Four times a day

10 mL of Piriton
15 mL of Polaramine
15 mL of Actifed

20 mL of Cocillana Codeine
20 mL of Cocillana DM
2 crushed tablets of Bromhexine

Take 5mL PO Four times a day
## Polypharmacy

<table>
<thead>
<tr>
<th>Bottle A</th>
<th>Active Ingredient</th>
<th>Amount per 5mL Dose</th>
<th>Total Amount per Day</th>
<th>Recommended Maximum Daily Dose in ≥2 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piriton (10mL)</strong></td>
<td>Chlorpheniramine</td>
<td>2.5mg</td>
<td>10mg</td>
<td>6-8mg</td>
</tr>
<tr>
<td><strong>Polaramine (15mL)</strong></td>
<td>Dexchlorpheniramine</td>
<td>3mg</td>
<td>12mg</td>
<td>3mg</td>
</tr>
<tr>
<td></td>
<td>Guaifenesin</td>
<td>37.5mg</td>
<td>150mg</td>
<td>600mg</td>
</tr>
<tr>
<td></td>
<td>Pseudoephedrine</td>
<td>7.5mg</td>
<td>30mg</td>
<td>Max 15mg per dose (patient is taking 18.75mg per dose)</td>
</tr>
<tr>
<td><strong>Actifed Compound (15mL)</strong></td>
<td>Codeine</td>
<td>3.75mg</td>
<td>15mg</td>
<td>No strong recommendation. Max 15mg per dose</td>
</tr>
<tr>
<td></td>
<td>Pseudoephedrine</td>
<td>11.25mg</td>
<td>45mg</td>
<td>Max 15mg per dose (see above)</td>
</tr>
<tr>
<td></td>
<td>Triprolidine</td>
<td>0.468mg</td>
<td>1.87mg</td>
<td>2.5mg</td>
</tr>
</tbody>
</table>
## Polypharmacy

<table>
<thead>
<tr>
<th>Bottle B</th>
<th>Active Ingredient</th>
<th>Amount per 5mL Dose</th>
<th>Total Amount per Day</th>
<th>Recommended Maximum Daily Dose ≥2 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocillana Codeine (20mL)</td>
<td>Cocilliana</td>
<td>0.04mL</td>
<td>0.16mL</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Euphorbia</td>
<td>0.1mL</td>
<td>0.4mL</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Scillae</td>
<td>0.01mL</td>
<td>0.04mL</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Senega</td>
<td>0.01mL</td>
<td>0.04mL</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Codeine</td>
<td>4.5mg</td>
<td>18mg</td>
<td>Same as above (No strong recommendation. Max 15mg per dose)</td>
</tr>
<tr>
<td>Cocillana DM (20mL)</td>
<td>Cocilliana</td>
<td>0.04mL</td>
<td>0.16mL</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Euphorbia</td>
<td>0.1mL</td>
<td>0.4mL</td>
<td>-</td>
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<tr>
<td></td>
<td>Scillae</td>
<td>0.01mL</td>
<td>0.04mL</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Senega</td>
<td>0.01mL</td>
<td>0.04mL</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Dextromethorphan</td>
<td>7.5mg</td>
<td>30mg</td>
<td>30mg</td>
</tr>
</tbody>
</table>
Case #2: Part 2

- Three days later, the patient’s symptoms persist. His mom brings him to another general practitioner.

- Question: How many medications do you think the GP prescribed?

  a. None
  b. 3
  c. 5
  d. 8
  e. >10
Key Points:

• The pediatric population is exposed to multiple risk factors for adverse drug events
  – These risk factors are often present concurrently and synergistically increase risk for harm

• Hidden Dangers exist in throughout our healthcare system; some of which are preventable while some are inevitable

• Recognizing these factors can lead to interventions to prevent or reduce their occurrence
Danger #4: Not doing anything

I have a lot of work to do.

...oh well.
What can we do?

- We know what works:
  - Interventions known to reduce medication errors
  - Clinical Pharmacists
  - Computerized Physician Order Entry
  - Standardization of Intravenous Systems
  - Education
  - Set Protocols and Guidelines
What can we do?

- What we don’t know yet:
  - What other dangers to children are out there?
  - What is the extent of the problem?
  - How do we adopt interventions into our local practice?
  - Is the information applicable to local population? Is there even any information at all?
  - How can we elevate the standards in the community?
Definition:

1. **Noun**

A way or **standard of practice in medicine** which adopts **Innovative** strategies to provide **Excellent** care for patients
ALONE, WE CAN DO SO LITTLE. TOGETHER, WE CAN DO SO MUCH.