Drowning Update

Daniel Brody MD, FRCPC, FAAP
Pediatric Emergency Medicine
Trauma Rounds
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Disclosure statement

I have no known financial or commercial interest connected with this presentation
Objectives

• Overall burden of drowning
• Epidemiology
• Quebec drowning “epidemic”
• Outcome in survivors
• Prevention
Injury mortality-North America: 0-18y

www.cdc.gov/injury/2010
Morbidity of injury

Injury mortality worldwide

WHO childhood injury report. 2008
Drowning definition

• 33 definitions of drowning
  – Near drowning
  – Dry vs. wet drowning
  – Active vs. passive
  – Secondary

a process resulting in primary respiratory impairment from submersion in a liquid medium

Papa et al., Resuscitation. 2005
World congress on drowning. Amsterdam, 2002
Drowning definition

Drowning
The process of experiencing respiratory impairment from submersion/immersion in a liquid.

Dead
Alive

No Morbidity
Good Cerebral Performance

Moderately Disabled
Severely Disabled
Vegetative State/Coma
Brain Death

Morbidity

World congress on drowning. Amsterdam 2002
Epidemiology: worldwide

WHO injury report. 2008
Epidemiology: southeast Asia

WHO. Childhood injury report. 2008
Epidemiology: USA

cdc.gov/injury/drowning
## Epidemiology: Canada

<table>
<thead>
<tr>
<th>Province/Municipality</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>22</td>
<td>23</td>
<td>31</td>
</tr>
<tr>
<td>British Columbia</td>
<td>62</td>
<td>66</td>
<td>54</td>
</tr>
<tr>
<td>Manitoba</td>
<td>15</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>12</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>38</td>
<td>23</td>
<td>12</td>
</tr>
<tr>
<td>Northwest Territories</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>13</td>
<td>19</td>
<td>9</td>
</tr>
<tr>
<td>Nunavut</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Ontario</td>
<td>121</td>
<td>132</td>
<td>97</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Quebec</td>
<td>68</td>
<td>79</td>
<td>83</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>9</td>
<td>26</td>
<td>21</td>
</tr>
<tr>
<td>Yukon</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>368</strong></td>
<td><strong>409</strong></td>
<td><strong>347</strong></td>
</tr>
</tbody>
</table>

Canadian drowning report. Lifesaving Society 2012
Epidemiology: Canada (incidence)

- Atlantic: 2.46 drownings/100,000 persons/year (n=525)
- Québec: 1.40 drownings/100,000 persons/year (n=908)
- Ontario: 1.23 drownings/100,000 persons/year (n=1,233)
- Prairies: 1.57 drownings/100,000 persons/year (n=696)
- B.C.: 2.44 drownings/100,000 persons/year (n=826)
- Territories: 13.17 drownings/100,000 persons/year (n=114)
- Canada: 1.63 drownings/100,000 persons/year (n=4,314)

Epidemiology: Québec
Drowning: age + body of water

Canadian Red Cross. 2003-2008 drowning report
Epidemiology: death rates

[Graph showing total drownings by age group from 2000-2009 and 2000-2008]

CHIRPP database. PHAC. 2008
Body of water: Canada

- Lake (n=298): 40%
- River (n=253): 34%
- Other pool (n=69): 9%
- Residential pool (n=54): 4%
- Other/unknown (n=46): 6%
- Ocean (n=27): 7%

CHIRPP database. PHAC. 2008
Rapport. 2009
Residential pool drownings

Canadian Red Cross. 2003-2008 drowning report
Woman in wedding dress drowns in Quebec river

Police say Maria Pantazopoulos' dress got too heavy for her to lift


Stay Connected with CBC News
5-year-old stable but unconscious

BY BRENDA BRANSWELL, THE GAZETTE    JULY 19, 2012
Toddler drowns in Kirkland pool

Rash of drownings prompt new water safety warnings

Toddler drowns in Laval backyard pool

Resuscitation efforts fail to save 2-year-old in suburban Montreal

CBC News  Posted: Jul 8, 2012 7:04 PM ET  |  Last Updated: Jul 8, 2012 8:43 PM ET
Girl, 2, drowns in Quebec backyard pool

CBC News  Posted: Jul 12, 2012 2:50 PM ET  |  Last Updated: Jul 12, 2012 8:16 PM ET

The girl, 2, drowned in this pool. (Radio-Canada)
“Drowning Epidemic”

1 toddler drowning every 2.1 days

July 9: St. Ephrem DeBeauce – 18mo

June 26: lac des lièvres – 4y
Drowning deaths in Quebec

<table>
<thead>
<tr>
<th>Year</th>
<th>Quebec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>68</td>
</tr>
<tr>
<td>2010</td>
<td>79</td>
</tr>
<tr>
<td>2011</td>
<td>83</td>
</tr>
</tbody>
</table>

2012 ~72-74

Toddler drownings ↑↑↑↑

Residential pool drownings ↑↑↑↑

Google images – summertime in Montreal
<table>
<thead>
<tr>
<th>Rank</th>
<th>Location</th>
<th>People per Pool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Florida</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>Quebec</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>California</td>
<td>31</td>
</tr>
</tbody>
</table>

[cdc.gov/homeandrecreational_safety/water_injuries](https://www.cdc.gov/homeandrecreationalsafety/waterinjuries)
> 300,000 pools in Quebec
### Residential pool drownings

#### POOL DEATHS (June 26-July 12, 2012)

<table>
<thead>
<tr>
<th>Date</th>
<th>Age/Gender</th>
<th>Location</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 12</td>
<td>2-year-old boy</td>
<td>St-Anne-des-Plaines</td>
<td>Walking along pool, adults talking</td>
</tr>
<tr>
<td>July 12</td>
<td>2-year-old girl</td>
<td>St-Remi</td>
<td>Broken patio lock, unfenced pool</td>
</tr>
<tr>
<td>July 10</td>
<td>75-year-old man</td>
<td>Repentigny</td>
<td>Fell into pool approx 12 secs</td>
</tr>
<tr>
<td>July 8</td>
<td>18 month old girl</td>
<td>Laval</td>
<td>Ran outside, unfenced pool</td>
</tr>
<tr>
<td>July 4</td>
<td>16 month old girl</td>
<td>Kirkland</td>
<td>Parent went in to answer phone</td>
</tr>
<tr>
<td>June 27</td>
<td>3-year-old boy</td>
<td>Sainte-Martine</td>
<td>Ran outside, died in ICU 2 days later</td>
</tr>
<tr>
<td>June 26</td>
<td>23 month-old girl</td>
<td>Terrebonne</td>
<td></td>
</tr>
</tbody>
</table>
Residential pool drownings

Canadian Red Cross. 2003-2008 drowning report

- Swimming: 25% (n=24)
- Playing or wading in the pool: 15% (n=14)
- Other †: 4% (n=4)
- Cleaning the pool: 3% (n=3)

* Walking or playing near the pool: 53% (n=51)
Pool supervision

- Drink alcohol: 3%
- Close eyes and relax: 4%
- Talk on phone: 11%
- Eat: 17%
- Read: 18%
- Supervise another child: 28%
- Talk to someone: 38%

Pathophysiology

Accidental Submersion

Panic Reaction

Laryngospasm

Sustained Laryngospasm

Glottic Relaxation

Dry Drowning (10%)

Wet Drowning (90%) (100%)

Szpilman et al., NEJM. 2012
Management

• ATLS/PALS
• C-spine
• Hypothermia
• Salt vs freshwater
• Antibiotics
• Steroids
• ICU care
5-year-old stable but unconscious

BY BRENDA BRANSWELL, THE GAZETTE  JULY 19, 2012
Outcome

- Severity of initial ischemic brain insult
- Effectiveness of "on-scene" resuscitation
- Transfer to ED or ED care
- Post-resuscitation management

Suominen. JTREM. 2012
Prognosis

• Determinants
  – Duration of submersion
    • > 5 minutes
  – Need for CPR
  – Duration of CPR
  – Spont. breathing + circulation restored in the ED
  – Time to regain consciousness

• Assessment
  – Serial PICU neuro evaluation
  – MRI

Quan et al. Pediatrics. 1990
Long-term outcome

• Large methodological heterogeneity
• No studies > 5 year follow-up
• No two studies use same neuropsychologic tools
• Neuro exam at discharge not predictive of long-term outcome
  – May not manifest until school age
  – Similar pattern seen in studies of other hypoxic events in young children

Suominen et al., JTREM. 2012
QOL post drowning

Suominen et al., Resuscitation. 2011
Prevention

• Swimming lessons *
• Fencing *
• More specific
  – Supervision *
  – Alcohol
  – Boating safety
  – Ice safety
  – Epilepsy
Girl, 2, drowns in Quebec backyard pool

CBC News  Posted: Jul 12, 2012 2:50 PM ET  |  Last Updated: Jul 12, 2012 8:16 PM ET

The girl, 2, drowned in this pool. (Radio-Canada)
“The spike in drownings prompted Jean Charest's government to announce it would implement a "swim to survive" program piloted in several schools two years ago. The program would target children in Grade 3 and promote basic swimming skills to survive a fall in deep water."
Swimming lessons

• > 5y.o. – can prevent drowning
  – float on back > 30 seconds
  – Stand in 2 ft of water
• < 5y.o – controversial!

• AAP: Swimming for toddlers recommended but not as a drowning prevention strategy

Weiss et al; Pediatrics. 2010
Canadian red cross. 2010
AAP:Policy statement-drowning.2010
Supervision

- Minimum swimming level
- Lifeguards
- Chaperones (1 for every 4-5 kids)
- Buddy system

Boy, 5, found unconscious in water at Parc Jean-Drapeau

Pelletier et al., InjPrev. 2011
Fencing

• Australia: mandatory fencing 1994
• Retrospective review: 2000
  – 32 toddler drownings
  – 28/32: one or both parents home
  – 6/32: considered “good swimmers”
  – Fencing
    • 3 complete fences
    • 18 incomplete fences
    • 11 no fence

Blum et al., Resuscitation. 2000
Fencing

- Do pool fences prevent death from drowning?

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Fencing</th>
<th>No fencing</th>
<th>Odds Ratio</th>
<th>Weight</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>M-H,Fixed,95% CI</td>
<td></td>
<td>M-H,Fixed,95% CI</td>
</tr>
<tr>
<td>Pitt 1991</td>
<td>25/72</td>
<td>136/204</td>
<td>0.27 [ 0.15, 0.47 ]</td>
<td>100.0 %</td>
<td>0.27 [ 0.15, 0.47 ]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>72</td>
<td>204</td>
<td>100.0 %</td>
<td></td>
<td>0.27 [ 0.15, 0.47 ]</td>
</tr>
</tbody>
</table>

Total events: 25 (Fencing), 136 (No fencing)
Heterogeneity: not applicable
Test for overall effect: Z = 4.59 (P < 0.00001)
Fencing

• 4 sided fence
• All pools
• High enough/not climbable
• Locked gate
• Enforced legislation
  – Fines
  – Regular inspections
• Media campaigns

Thompson et al., Cochrane review. 2010
Fencing: Quebec law

- In-ground, above ground + inflatable pools > .6m deep
- 4 sided fence
- Minimum ht = 1.22m
- “style” that inhibits climbing
- Self closing/latching gate
- Penalty: $500-700 (repeat offences: $700-1000)
  - Municipal enforcement
- Municipal permits
- Applicable to pools installed after Oct 31, 2010

Residential swimming pool safety act. chapter S-3.1.02, r. 1cx
Child drownings: 'Nobody is going to judge these parents more than themselves'

BY MONIQUE MUISE, THE GAZETTE

JULY 18, 2012

MORE ON THIS STORY

- Residents complain to municipalities about neighbours' lack of protective fencing around backyard pools
- Quebec schools to start 'Swim to Survive' program
- Drownings in numbers
Prevention: coroner.gouv.qc.ca

- 2008: diving board report
- 2011: St-Sauveur water park report
- 2012: swim to survive program
Resources

• Review articles
  – Szpilman et al., Drowning. NEJM. 2012. 366;22
  – mels.gouv.qc.ca/loisirsport/pdf/FaitsSaillantsNoyadeAnglais.pdf
  – Lifesaving.ca/contect/english/pdf/CLS%20Drowning%202012E_WEB.pdf
  – cdc.gov (injury– water safety)

• Long-term outcome
  – Suominen et al., JTREM. 2012. 20;55

• Prevention
  – Weiss et al., Pediatrics. 2010. 126;e253
  – Mapiscinesécuritaire.com