Child Safety – Button or Coin Batteries

Ingestion risks and preventative measures

Paul W Robinson, Australia
1. About button cells and batteries
2. Hazards, harm and risk principles
3. Child behaviour, and ingestion risks
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1. About button cells and batteries
Cells and batteries terms

- A **cell** is the basic device that converts chemical energy into electrical energy\(^1\).

- A **battery** consists of one or more component cells connected together, possibly including protective devices, in a form that is ready for use\(^1\).

- Where there is only one cell, often the above terms are used interchangeably\(^1\).

- **Primary** batteries are not intended to be recharged\(^1\). These are the most common button batteries available.

- **Secondary** batteries are intended to be recharged.

- **Button or coin cell or battery** is a cell or battery which is round, and where the diameter is greater than the height\(^1\).
Button or coin batteries

- Many standard sizes available, with diameters ranging from less than 5 mm to more than 40 mm.

- Many different cell chemistries available, but mostly divided into Voltage Range 1 (1.4V range) and Voltage Range 2 (3.2 V range - lithium). [1]
Where to find coin/button cells

Any household device requiring a small & portable electrical power source. Some examples:

- Remote controls (TV/audio)
- Garage door openers
- Bathroom scales
- Toys
- Cameras
- Watches
- Calculators
- Hearing aids
- Electronic greeting cards
- Digital thermometers, clocks
- Talking books
- Handheld electronic games
- Flash lights and pen lights
- Flashing shoes, balls, scooter wheels
- Wireless keyboards & mice
- Keychain devices
- Kitchen scales
- Car keys
- Clothing or fashion novelties
- Birthday candles
- Novelty drink glasses
- Pet tech items
All these use lithium CR2032 cells

Decoding “CR2032”: C=lithium negative electrode with organic electrolyte, R=round shape, 20=diameter in mm, 32=thickness in tenths of a mm[1]

Diabetes glucose meters

Portable weighing scales

Activity tracker

Dog glitter collars
2. Hazards, harm and risk principles
Hazard, harm and risk principles

- **Harm** is an injury or damage to health of people, or damage to property or the environment \(^5\)
- **Hazard** is a potential source of harm \(^5\)
- **Risk** is the combination of the probability of occurrence of harm and the severity of that harm \(^5\)
- **Safety** is freedom from risk that is not tolerable (in a given context based on the values of society) \(^5\)

- **To prevent harm**, risk assessment and risk reduction measures must be applied to identify and eliminate the hazards, or control the hazards to a “tolerable” level of residual risk \(^5\)

- **Objective of this paper**: to better understand the risks and to prevent harm to children from button batteries

3/20/2015
3. Child behaviour and battery risks
Object ingestion and insertion risk

- Younger children have an instinctive behaviour to put non-food items into the mouth.
- We need to determine whether this could cause injury, how serious, how frequently, and of what nature.
- Sometimes objects are inserted into other places: the nose or ears, for example, and these have caused injuries too.[31]
- Not just batteries are inserted or ingested, but any object the child can grasp by hand or mouth.
Ingestion/swallowing risks

- Batteries 32 mm and larger won’t pass through the Toy Standard small parts cylinder \(^2\) (31.7 mm dia.), so children are unlikely to swallow them.

- If the battery is greater than 12 mm, it may become stuck in the child’s oesophagus \(^13\).

- If the battery passes through the oesophagus, it rarely needs to be retrieved, unless there are signs of GI tract injury, or a larger battery has not passed from the stomach to the intestine \(^6\).

- If the battery is smaller, it usually passes through and usually this does not cause injury \(^25\).
How children get coin batteries

- USA National Battery Ingestion Hotline (NBIH) shows:
  - 61.8% of ingested batteries were obtained directly from the product by the child
  - 29.8% were loose
  - 8.2% were obtained from battery packaging

- Products from which 20 mm lithium batteries were obtained:
  - Remote control devices = 36.2% of cases
  - Games & toys = 13.1%
  - Watches & Stopwatches = 8.5%
  - Flameless candles = 7.7%
  - Bathroom & kitchen scales = 3.8%
  - Key fobs = 3.1%
  - Other products = remainder 27.6%
Injury mechanisms

Four possible injury mechanisms include:

– The moist adjacent tissue completes a circuit for the battery to produce current, creating hydroxide at the negative pole. This is the most significant injury mechanism\(^{25}\)

– Leakage of electrolyte may occur (but the electrolyte in lithium cells is only a mildly irritating organic electrolyte, thus not a source of injuries for lithium cells\(^{25}\))

– Direct pressure may cause ischemic necrosis (not a major injury source\(^{25}\))

– Choking and aspiration hazard (but usually with specific symptoms)

The above conditions can block breathing and/or burn and damage soft human tissue, which worsens if the battery remains stationary
Cell type % of Ingestions[^4]
Nearly all severe-injury ingestion cases involve lithium batteries\[25\]
  - The few exceptions involved children < 1 year\[25\]

66\% of button battery ingestions are in children < 6 years\[25\]

All fatalities are in children < 4 years\[25\]

12.6\% of child ingestions of 20 mm batteries in children younger than 6 years experienced a major effect\[25\]

Significant nasal and ear injuries from alkaline batteries have also been presented to surgeries\[31\]
4. Medical triage challenges
Triage challenges

- Children might not be willing or able to say they swallowed a battery or gave one to a sibling.
- Delays in treatment may lead to serious complications & death.
- Serious oesophageal burns can occur in a relatively short period (2 h) when a lithium coin cell is lodged there\(^{[12][31]}\), thus there are frequent recommendations to remove the battery within that 2 h window.
- Perforation has been reported to occur as rapidly as 5 hours after ingestion\(^{[31]}\).
- 3V lithium batteries generate more current than other types, which produces hydroxide 1,000 times more rapidly than 1.5 V cells\(^{[26]}\). Depleted lithium cells are still a risk.
- Injury can continue after endoscopic battery removal for days to weeks due to residual alkali or weakened tissues\(^{[25]}\).
Rapid medical response is essential, but diagnosis is a challenge\textsuperscript{[25]}:

- Button battery ingestions are not witnessed in
  - 92\% of fatal outcomes, and
  - 56\% of major complications
- 36\% of patients with oesophageal batteries have no symptoms
- If symptoms do occur, they are non-specific
- 12.6\% of children under 6 years who swallow a 20 mm lithium battery suffer severe or fatal injuries

NBIH Button Battery Ingestion Triage and Treatment Guideline\textsuperscript{[13]}

- See next slide (from http://www.poison.org/battery/guideline.asp)
Suspect a battery ingestion in these situations

"Coin" ingested.
Check AP x-ray for battery's double-dim or halo-effect and lateral view for step off.

Battery ingestion known or suspected

NPO until esophageal position ruled out by x-ray.1
Take up to 5 minutes to determine imprint code (or diameter) of companion or replacement battery.
Consult National Battery Ingestion Hotline at 202-625-3333 for identification and treatment.

TIPS, PITFALLS & CAVEATS

- 3 “N”s: Negative – Narrow – Necrotic. The negative battery pole, identified as the narrowest side on lateral x-ray, causes the most severe, necrotic injury. The negative pole is the side opposite the and without the imprint.
- 20 mm lithium coin cell is most frequently involved in esophageal injuries; smaller cells lodge less frequently but may also cause serious injury or death.
- Definitive determination of the battery diameter prior to passage is unlikely in at least 40% of ingestions.
- Assume hearing aid batteries are < 12 mm.
- Manages ingestion of a hearing aid containing a battery as an ingestion of a small (≤ 12 mm) battery.
- Do not induce vomiting or give cathartics. Both are ineffective.
- Assays of blood or urine for mercury or other battery ingredients are unnecessary.

NOTES:

1 NPO. Anesthesia may be required for removal.
2 X-ray abdomen, esophagus and neck. Batteries above the range of the x-ray have been missed. If battery in esophagus, obtain AP and lateral to determine orientation of negative pole. If ingestion suspected and no battery visualized on x-rays, check ears and nose.
3 If battery diameter is unknown, estimate it from the x-ray, factoring out magnification (which tends to overestimate diameter).

Symptomatic patient, no ingestion history, Consider battery ingestion if:
- Airway obstruction or wheezing
- Drooling
- Vomiting
- Chest discomfort
- Difficulty swallowing, decreased appetite, refusal to eat
- Coughing, choking or gagging with eating or drinking

X-ray immediately to locate battery. Batteries lodged in esophagus may cause serious burns in 2 hours. Batteries in the esophagus may be asymptomatic initially. Do not wait for symptoms.

Battery in Esophagus?

NO

Was a magnet co-ingested?

NO

Do not wait for symptoms. Remove endoscopically if possible; surgically if not.

Are related signs or symptoms present?

YES

≥ 15 mm cell ingested by child < 6 years.2

NO

X-ray 4 days post ingestion (or sooner if symptoms develop). If still in stomach, remove endoscopically (even if asymptomatic).

If symptoms develop later, promptly re-evaluate.

If battery in stomach, remove endoscopically even if symptoms appear minor. If battery beyond reach of endoscope, surgical removal reserved for unusual patients with occult or visible bleeding, persistent or severe abdominal pain, vomiting, signs of acute abdomen and/or fever, or profoundly decreased appetite (unless symptoms unrelated to battery).

Anticipate specific complications based on injury location, battery position and orientation (negative pole). Determine length of observation, duration of esophageal rest, need for serial imaging or endoscopy/bronchoscopy based on severity and location of injury. Monitor patients at risk of perforation into vessels as inpatients with serial imaging and serial auscultation. Intervene early to prevent fatality. Monitor for respiratory symptoms, especially those associated with swallowing, to diagnose TE fistulas early. Expect perforations and fistulas to be delayed up to 28 days after battery removal and esophageal strictures, delayed weeks to months.
Other medical notes

- Do not induce vomiting for patients with a battery in the stomach
  - it could cause the battery to become lodged in the oesophagus by retrograde movement\(^5\)

- Batteries which pass to the stomach usually pass through the remainder of the GI tract without incident\(^{25}\)
  - Confirm battery passage by inspecting stools (4 to 10 days) and consider repeat x-rays if not observed\(^{13}\)
X-Ray: battery in the oesophagus

Battery lodged in child’s esophagus
Battery in the stomach of an 18 months old [6]
5. Worldwide frequency and extent
# Frequency of occurrence (OECD[7])

<table>
<thead>
<tr>
<th>Country</th>
<th>Numbers</th>
<th>Period</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>3500 ingestions</td>
<td>Per year</td>
<td>Numbers increasing: from 1900 in 2008 to 4800 in 2010[12] Most were treated &amp; released without treatment; approx. 10% required hospitalization</td>
</tr>
<tr>
<td></td>
<td>35 deaths</td>
<td>Not stated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3,366 ingestions, 2.6144% moderate-major injury or death</td>
<td>2013</td>
<td>Children &lt;6 years = 66% of ingestions, 6 to 9 years = 15% of ingestions</td>
</tr>
<tr>
<td>Canada</td>
<td>65 emergency room visits</td>
<td>Per year</td>
<td>70% ingestion, 16% ear/nose insertion. 70% &lt; 4 y old</td>
</tr>
<tr>
<td>France</td>
<td>248 accidents in 10 hospitals</td>
<td>2005-2012</td>
<td>Extrapolated globally to 1240 accidents/yr</td>
</tr>
<tr>
<td>Korea</td>
<td>254 ingestions (&gt;half &lt; 1 y old)</td>
<td>The last 4 years</td>
<td>= 64 per year</td>
</tr>
<tr>
<td>Japan</td>
<td>93 confirmed or possible ingestions</td>
<td>Not stated</td>
<td>Most often for 1-4 year age group</td>
</tr>
<tr>
<td>New Zealand</td>
<td>175 calls to poisons centre</td>
<td>2011-2013</td>
<td>= 58 per year</td>
</tr>
<tr>
<td>Country</td>
<td>Numbers</td>
<td>Period</td>
<td>Comment</td>
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</tr>
<tr>
<td>Australia</td>
<td>5/week treated</td>
<td>Not stated</td>
<td>= 270 per year</td>
</tr>
<tr>
<td></td>
<td>One death</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Croatia</td>
<td>25 hospitalisations children &lt; 7 y old and 1 adult</td>
<td>2011-2013</td>
<td>= 8 per year</td>
</tr>
<tr>
<td>Austria</td>
<td>14 reported hospitalisations</td>
<td>2005-2011</td>
<td>= 2 per year</td>
</tr>
<tr>
<td>Brazil</td>
<td>4 media reports</td>
<td>Not stated</td>
<td>No further info</td>
</tr>
<tr>
<td>Latvia</td>
<td>1 death 1 y old</td>
<td>Not stated</td>
<td>No further info</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1 death (13 months old)</td>
<td>2013</td>
<td>No further info</td>
</tr>
<tr>
<td></td>
<td>1 severe case</td>
<td>2014</td>
<td></td>
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6. Risk controls
Risk control overview

- **Keep batteries away from children**, but it’s not always so simple in today’s distracting world, where consumers assume products are intrinsically safe.

- **Engineering solutions** exist to reduce the likelihood of child-access to batteries inside products, e.g. child-resistant closures for lithium button batteries.

- **Hazard warning instructions** can be applied to equipment, the packaging, and user instructions to advise adults of the risks of ingestions.

- **Retail packaging for spare lithium batteries** can be dimensioned to prevent ingestion, made child-resistant, have relevant warnings, and be kept out of reach of children.

- **Regulatory oversight**: to enforce standards compliance, mandate incident reports of significant harm or death, conduct recalls for potentially hazardous products.

- **Consumer safety information** and education campaigns.
International Standards

- **IEC 62368-1 Ed. 2, 2014** covers A/V & ICT equipment containing lithium button batteries; where accessible to children and has lithium coin/button cells below 32 mm dia.
  - **Instructional safeguards** (safety labelling and instructions)
  - **A tool, or two hand movements** independent & simultaneous, used to open battery compartment door or cover
  - **Stress relief tests** (heat plastics to at least 70 Deg C)
  - **Battery replacement test** (repeated opening and closing)
  - **Drop test** (3 drops of 1 m or 10 drops for remote controls)
  - **Impact test** (2 Joules impact force perpendicular to cover)
  - **Crush test** (hand held remote control devices at 330 N)
  - **Test hook test** (20 N) for button battery cover or door

- No battery cover fastener retention (per IEC 60086-1)

- Revisions under consideration

29 3/20/2015
Opening with tool examples
Primary batteries, covering size, electrical, classifications, marking, packaging and general safety instructions etc[1]:

- **IEC 60086-1** Primary batteries Part 1 General
  - IEC 60086-1 (draft) says cautions for “swallowable batteries” shall be given. There are recommendations in Annex B for equipment designs. These are similar to requirements in IEC 62368-1 (plus battery enclosure fastener retention)

- **IEC 60086-2** Primary batteries Part 2 Physical and electrical specifications (under revision)

- **IEC 60086-4** Primary batteries Part 4 Safety of lithium batteries, has equipment recommendations including:
  - Battery compartments should be designed so they cannot be opened by children
  - Precautions for proper handling of batteries should be given

Does not contain recommendations for child-resistant packaging, or ear and nose insertion prevention/warnings
The Safety of Toys standard, ISO 8124-1:2014\textsuperscript{[2]}

- Specifies requirements for toys intended for use by children in various age groups
- Covers toys designed for children, not other products
- For coin batteries, it’s concerned with a potential choking or aspiration risk, as it treats coin batteries as “small parts” to be assessed by the small parts cylinder that’s designed to assess ingestion or inhalation risks
- Has a drop test, torque test, tension test, & compression test, but inconsistent with IEC 62368-1. Does not seem to have battery door cycling test, stress relief test, impact test & test hook test of IEC 62368-1, or the captive fasteners of IEC 60086-1
International Standards (cont ...)

- **IEC 60065**[^9] Audio, video and similar electronic apparatus—Safety requirements
  - Contains battery compartment design requirements for lithium button batteries, safety marking, and instructions similar to IEC 62368-1

- **IEC 60950-1**[^10] Safety of information technology equipment
  - does not cover button battery ingestion

- **IEC 62368-1** is intended to replace the above standards
The USA CPSC sets safety standards for toys\cite{12}:

- **Consumer Product Safety Improvement Act 2008**
  Section 106 as follows:
  - ASTM F963-11\cite{18} requires batteries to be inaccessible
    - Toys for children <3 years (secure compartments with screws)
    - Toys for <12 year olds where batteries fit the ingestion gauge
  - ASTM F2923-14\cite{19} for children’s *jewellery* to prevent button battery access by children

- **Other legislation:** Button Battery Safety Act of 2011\cite{14}, was under consideration by Congress, but not enacted

- ANSI C18.1M Part 2\cite{23} and C18.3M Part 2\cite{24} contain information about battery compartment protection
UL 60065 Ed. 7\textsuperscript{[16]} has lithium cell child-access safety requirements for equipment (Annex I). Effective 2014-01-02

- includes safety instructions, conditioning (mold stress relief and door/cover cycling) and mechanical abuse tests (drop, impact and crush) with an assessment of battery compartment door/cover functionality and battery accessibility after testing

UL 4200A\textsuperscript{[22]} Standard for Safety for Products Incorporating Button or Coin Cell Batteries of Lithium Technologies (Feb 10, 2015: UL is now in the final stages of adoption)

- Very similar technical requirements to IEC 62368-1
- Extends the lithium cell requirements of UL 60065 to other products

- Includes lithium button/coin cell batteries $\leq$ 32 mm diameter based on limits in the Toy Safety specification, ASTM F963, for ingestion of small parts.
- Excludes professional or commercial use products not intended to be used where children will be present
The USA CPSC recommends the following steps to prevent unintentional battery ingestion\(^{15}\):

– Do not allow children to play with or be in contact with coin cell batteries
– Caution hearing aid users to keep hearing aids and batteries out of the reach of children
– Never put batteries in your mouth for any reason because they are easily swallowed accidentally
– Always check medications before ingesting them. Adults have swallowed button batteries mistaking them for pills or tablets
– Keep remotes and other electronics out of your child's reach if the battery compartments do not have a screw to secure them. Use tape to help secure the battery compartment
– If a button battery is ingested, seek medical attention immediately. The National Battery Ingestion and Poison Help Hotlines are available 24 hours a day
– Discard button batteries carefully
The Australian Competition and Consumer Commission (ACCC) is consulting with industry on requirements
- ACCC has also published consumer and supplier facts

Standards Australia has published draft button battery safety requirements for its national adoptions of IEC 60065 and IEC 60950-1, based on IEC 62368-1 with national differences to cover\(^\text{[11]}\):
- all button batteries below 32 mm diameter, not just lithium, and
- small tubular batteries designated R1 in IEC 60086-2 (10.9 to 12.0 mm dia. x 30.2 mm long), as these fit in the small parts cylinder

Published as DR AS/NZS 60065:2012 Amd 1:2014, and DR AS/NZS 60950-1:2014\(^\text{[11]}\)
- DR AS/NZS 60065:2012 is based on an older version of IEC 60065
- Was open for public comment until 5 Feb 2015
The Australian Consumer Law (ACL) requires suppliers to report safety incidents involving products to the ACCC where it involves hospitalization or death relating to product use:

“Suppliers must notify the Commonwealth minister within 48 hours of becoming aware that a person suffered serious injury, illness or death associated with a consumer good or product-related service they supplied – either in Australia or overseas. This applies even if the consumer goods or product-related services were misused” [20]

The ACCC may request a voluntary recall of unsafe products, or may impose mandatory recalls if it believes necessary.

Having requirements in Australian standards will allow the ACCC to reference those technical requirements in regulations as it sees necessary.

Electrical regulators can also reference the safety standards for product compliance approvals.
Adopted ISO 8124-1:2012 (Toy standard) [29] as voluntary, but now ISO 8124-1:2014 [2] is current internationally, however:

- Australia’s Mandatory Standard for toys [27] (for children up to 36 months) calls up AS/NZS 8124:2002 [30], an Australian modified version of ISO 8124:2000 – now 14 years out of date, AND

- The Mandatory Standard for toys [27] further modifies AS/NZS 8124:2002 including the following:
  - Deletes the sentence in Annex A.2.3 that restricts access to batteries
  - Excludes balloons (battery-powered illuminated balloons do exist)
  - Does not include “goods supplied wholly or partially unassembled for assembly by an adult after supply, provided that, when assembled in accordance with instructions supplied in writing with the goods, the goods comply with the specified standards” [27]

- So: if a button battery is not supplied inside the toy but an adult has to install/assemble it, these may not be covered by the Mandatory Standard. No mention of childproof battery packaging.

- Note: even if toys are labelled and/or marketed for older children, the Mandatory Standard may apply if the toys are commonly recognised as being intended or suitable for children under 36 months of age [28]
Special cases

- Packaging and labelling of spare button batteries for replacement use

- Hearing aid batteries
  - for children’s hearing aids\(^{[21]}\)
    - Special battery safety measures are required for hearing aids for children less than three years of age
    - Battery safety features can also be requested if the child wearing an aid has a sibling less than three years of age
  - for aged people and other “diverse users”\(^{[32]}\)
    - For example button cells may be mistaken for medical pills

- Button battery equipment only used where children are unlikely to access them are not subject to requirements

- **Diverse users** are individuals with differing characteristics or user accessibility needs
  - Includes age, gender, size, health condition, impairment, training and experience

- **Impairments** are problems in body function or structure relating to a significant deviation or loss
  - May be temporary or permanent, static or intermittent

- The user accessibility needs of some users might conflict with the user accessibility needs of other users

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It is important to ensure that the user accessibility needs of diverse users are accommodated in diverse ways

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- Some of the human ability impairments to consider:
  - Vision
  - Touch
  - Fine hand use abilities
  - Voice & speech
  - Hearing
  - Taste
  - Muscle power & endurance
  - Cognitive abilities
Special Cases (cont…)

- Button batteries used in greeting cards...
  
  - Often aimed at very young children, but are not toys
  - Children can tear the cards to access the electronic module for curiosity and play
  - Some of the modules may fit in the small parts cylinder, complete with batteries and electronics
    - Ensure the module can’t be fully enclosed by the small parts cylinder of the safety of toys standard
    - Ensure the battery cannot be separated from the module (e.g. by permanently fixing in a holder or by using an enclosure
Special Cases (cont…)

- Two alkaline cells in series = 3 V in modules

- Need to check for module ingestion risk if accessible
Birthday candle: Multi-cell lithium battery = 6 V

- Check if this module or 6 V multi-cell coin battery is child-accessible and ingestible (in this case a tool was needed)
- Other tests: crush, impact, stress relief, test hook etc.?
- This is not a toy, and not A/V or ICT\(^8\). It needs to be covered by a generic standard but none published yet
Store presentation issues

Price sticker covers warnings

Are the warnings prominent & legible?

Store displays: Non-childproof packaged button cells displayed at 1+years-old child-accessible height – these kids are learning to walk, and grab anything shiny/colourful
Special Cases (cont...)

- Is it a toy or not?
  - Never let a child play with this!

- Light-up party balloons containing batteries
7. Conclusions & recommendations
Conclusions & Recommendations

<table>
<thead>
<tr>
<th>Conclusion</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>1. Child ingestion and insertion risks and harm from button cells below 32 mm are very significant</td>
<td>1. Protection of children via good product design must be improved for button battery products</td>
</tr>
<tr>
<td>2. Child incidents are common, widespread &amp; on the rise, with the growing availability of smaller, cheaper products</td>
<td>2. Raise community awareness via product safety instructions, advertising, social media, regulators and other channels</td>
</tr>
<tr>
<td>3. Adverse child health events can be quick &amp; serious, including major injuries and death</td>
<td>3. Educate community to urgently seek medical help for child button cell ingestion or insertion events</td>
</tr>
<tr>
<td>4. Lithium button batteries below 32 mm have by far the greatest harm outcomes</td>
<td>4. Limit access to lithium cells by childproof compartments and packaging, &amp; user instructions</td>
</tr>
<tr>
<td>5. Solutions exist to reduce and prevent injuries, but not applied consistently or across all lithium button battery-using products</td>
<td>5. Better coordination and consistency of requirements needed in a multi-disciplinary end-user application environment</td>
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</tbody>
</table>
### Conclusions & Recommendations...

<table>
<thead>
<tr>
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<th>Recommendation</th>
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<tbody>
<tr>
<td>6. For multi-cell batteries or child-accessible modules with multiple</td>
<td>6. Check the whole module for child accessibility, then check with the</td>
</tr>
<tr>
<td>batteries, the voltage is additive, increasing the risk</td>
<td>small parts cylinder, and also check multi-cell button batteries</td>
</tr>
<tr>
<td>7. Risks are not entirely limited to lithium cells, as there are injury</td>
<td>7. Provide prominent child ingestion &amp; insertion warnings with non-lithium</td>
</tr>
<tr>
<td>reports from other button cell types</td>
<td>button cell products</td>
</tr>
<tr>
<td>8. Adopting child-protection requirements for all coin cell types may</td>
<td>8. Consider button cell access issues for diverse users with differing</td>
</tr>
<tr>
<td>cause other concerns with diverse users</td>
<td>accessibility needs</td>
</tr>
<tr>
<td>9. Global incident reporting data is fragmentary, inconsistent and</td>
<td>9. Incident reporting needs to be more pervasive and granular, so the true</td>
</tr>
<tr>
<td>incomplete</td>
<td>scope can be analysed. Consider NPDS data system as a model[^33^], plus</td>
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<tr>
<td></td>
<td>battery type info</td>
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[^33^]: Consider NPDS data system as a model
## Conclusions & Recommendations

<table>
<thead>
<tr>
<th>Conclusion</th>
<th>Recommendation</th>
</tr>
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<tbody>
<tr>
<td>10. Treatment response must be urgent and assume ingestion of a lithium button battery</td>
<td>10. Medical facilities should triage patients similarly to US National Battery Ingestion Hotline guides</td>
</tr>
<tr>
<td>11. Public awareness of the risk is not pervasive, leading to poor and child-risky handling of products</td>
<td>11. Involve manufacturers, suppliers, regulators and medical teams in raising public awareness</td>
</tr>
<tr>
<td>12. Store display systems increase the risk of child access to lithium button battery spares during shopping excursions</td>
<td>12. Lithium button batteries in retail displays should be in childproof packaging, or kept out of reach of children</td>
</tr>
<tr>
<td>13. Store labelling can cover hazard warnings</td>
<td>13. Educate stores not to cover product safety warnings</td>
</tr>
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## Conclusions & Recommendations

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<tr>
<td>14. Some products with button cells that are not toys are attractive for children’s play (e.g. pet products, jewellery, hand held device with button cells)</td>
<td>14. If it contains a button battery and it’s readily accessible to children, it must be safe for children, taking into account diverse users needs</td>
</tr>
<tr>
<td>15. Current standards and regulations are mostly product based, dealing with niche lithium button battery applications</td>
<td>15. Supplement standards and regulations with an issues based approach, similar to the UL 4200A model[22] and consider how to include non-lithium batteries</td>
</tr>
<tr>
<td>16. Some older standards are being retrofitted with modified button battery requirements, and some regulations refer to old and modified requirements as well</td>
<td>16. Use the newest version of the international safety standards, as these contain the most up to date child protections, and other new safety requirements as well</td>
</tr>
</tbody>
</table>
Question time

Thanks for your attention
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