Global meeting on WASH in health care facilities: from resolution to revolution
9-11 September 2019, David Livingstone Lodge, Livingstone, Zambia

Climate Smart
Health Care Waste Solutions

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Health Care Without Harm works to transform health care worldwide so that it reduces its environmental footprint, becomes a community anchor for sustainability and a leader in the global movement for environmental health and justice.

www.noharm.org
www.greenhospitals.net
The Global Green and Healthy Hospitals community has more than 1,200 members in 60 countries who represent the interests of over 36,000 hospitals and health centers.

https://www.greenhospitals.net/members/
Climate-Smart Health Care

- **Mitigation** – Reducing health care’s own carbon footprint and deploying low carbon strategies.
- **Resilience** – Preparing for the impacts of extreme weather and the shifting burden of disease.
- **Leadership** – Educating staff and the public while promoting policies to protect public health from climate change.

Health Care Climate Challenge
[https://www.greenhospitals.net/about-challenge/](https://www.greenhospitals.net/about-challenge/)
Mitigation through the Waste Hierarchy

Most preferable

Prevent
Reduce
Reuse
Recycle
Recover
Treat
Dispose

Least preferable
Carbon footprint of the UK National Health Service

- Pharmaceuticals: 34.5%
- Business services: 14.0%
- Medical Instruments/equipment: 12.7%
- Paper products: 5.8%
- NHS Freight transport: 5.7%
- Food and catering: 5.4%
- Other manufactured products: 5.2%
- Manufactured fuels, chemicals and gases: 4.9%
- Construction: 2.3%
- Water and sanitation: 2.2%
- Waste products and recycling: 2.1%
- Information and communication technologies: 1.7%
- Other procurement: 3.6%

Reduce waste

• Pharmaceuticals
  – Largest fraction of healthcare carbon footprint
• Plastics/packaging
  – 1 million plastic bottles produced every minute
  – Provide drinking water for staff and patients
• Sharps
  – 70-90% of injections may be unnecessary in some countries
• Products that are non-reusable, non-recyclable, or must be incinerated by national law
$180bn investment in plastic factories feeds global packaging binge

Colossal funding in manufacturing plants by fossil fuel companies will increase plastic production by 40%, risking permanent pollution of the earth
Plastics

4% of the world’s oil is used to make plastics and another 4% is used to power the factories that make it.

Around half HCW is plastic

Up to 2015, approx 6300 Mt of plastic waste was generated — 9% recycled, 12% incinerated, 79% accumulated in land-fills or the natural environment.

Waste burning is the most expensive and polluting method of energy production.

[https://drive.google.com/file/d/1JBmaiqjhPT_4AgFH0uWpwaD4nzLDDElY/view](https://drive.google.com/file/d/1JBmaiqjhPT_4AgFH0uWpwaD4nzLDDElY/view)
Reuse

- Eliminate single use
  - Foodware
  - Surgical gowns and drapes
- Single use diapers
  - Non-recyclable, huge disposal problem
- Many other items can be reused or repurposed
- Staff can come up with creative ideas
Recycle

– Expect to start with limited waste streams, but more will be possible in the future
– Segregation must be excellent- mixed or dirty waste will be worthless
– Create space to store enough waste for it to be profitable for a recycler to collect
– Negotiate motivating uses of income, eg offset the cost of waste management, bonuses for staff
75-90% of healthcare waste is general municipal waste
70% of general waste is recyclable
Even syringes can be recycled if needles are cut and they are disinfected
## Value of recyclables from vaccination waste

<table>
<thead>
<tr>
<th>Material</th>
<th>Syringe plastic</th>
<th>Plastic packaging</th>
<th>Cardboard packaging</th>
<th>Paper packaging</th>
<th>Vials and ampoules</th>
<th>Aluminum vial caps</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value/kg ($), n/a</td>
<td>$0.33</td>
<td>$0.23</td>
<td>$0.07</td>
<td>$0.06</td>
<td>$0.003</td>
<td>$1.29</td>
<td>n/a</td>
</tr>
<tr>
<td>Value/100,000 vaccinations ($)</td>
<td>$81.68</td>
<td>$7.88</td>
<td>$9.47</td>
<td>$2.19</td>
<td>$0.07</td>
<td>$2.94</td>
<td>$102.03</td>
</tr>
</tbody>
</table>

Data from Nepal, 2014. All components except cut syringe needles could be sold once disinfected.

Funded by a grant from the Bill and Melinda Gates Foundation through the Grand Challenges Initiative
Treatment and disposal

• Non-burn waste treatment
  – Lower emissions than burning, avoids toxic/POPs pollution, saves recyclables

• Biodigestion
  – Applicable to most organic waste streams, including pathological waste/placenta
  – Biogas is mostly methane, burning it reduces carbon footprint
Autoclaving immunisation waste

Needles and hubs were cut from syringes at the point of use. Syringes were collected, transported in locally made, lockable, aluminium high capacity sharps bins. Cutting needles and using these bins allowed 3x more syringes to be treated than using standard sharps boxes.
Carbon footprint - burn vs autoclaving

Note - Nepal mostly generates its power from hydroelectric sources, so the carbon footprint of grid electricity is very low in comparison to most countries. Zimbabwe is more typical for a low income country.

Funded by a grant from the Bill and Melinda Gates Foundation through the Grand Challenges Initiative
Autoclaving is cheaper than incineration

Funded by a grant from the Bill and Melinda Gates Foundation through the Grand Challenges Initiative
NEPAL

- Biodigesters at major hospitals including KMC and TUTH
- 2-chamber design to maximise retention time (>90 days for placenta)
- Gas value of over 2 US cents per kg of waste treated
- Digestate goes to sewer without further handling
- Potential lifetime 20+ years
Mwanayamala hospital, Tanzania

- 250 bed hospital
- 60 deliveries per day
- Placentas input directly from maternity unit
- Food input via hatch outdoors
- Construction ~$10,000
- ~25kg placenta + ~25kg food = 2.5m³ gas every day
- Biogas is 65% methane, 35% CO₂. Methane is 25-40 x more potent greenhouse gas than CO₂, burning it reduces carbon footprint
Will biodigestion work for you?

• Capable designers/construction companies
• Capacity for basic maintenance (eg piping, burners)
• Minimum 10-12kg of waste/day to generate significate useful amounts of biogas
  – Can also be adapted for smaller situations eg healthpost toilets and organic wastes
• Space that will not be built on (or cars parked)
  – Ideally close to waste sources
• Source of water to keep digester contents flowing
  – Min 1litre water/kg waste. Too much reduces retention time
• Connection to sewer or septic tank for digestate
• Location for use of gas
  – As close as possible to digester
  – Acceptance by users
Resilience/Disaster preparedness
Resilience/
Disaster preparedness

• Climate-related emergencies are already increasing
• Good HCWM will reduce risk of disease spread during emergencies
• Very hard to put in new practices during an emergency
• Train and vaccinate staff so they can work safely even in extreme situations
• Waste management needs to be included in disaster planning and training
The Gorkha Earthquake 2015

Occurred just before noon on Saturday 25\textsuperscript{th} April, 2015

Over 8,000 fatalities and 22,000 injured

1,000 healthcare facilities damaged or completely destroyed

HCWH was collaborating with local NGO HECAF to help Nepali hospitals manage healthcare waste

How did our hospitals fare and what lessons can be learned about resilience against disaster?
Partner hospitals waste management-segregation, autoclaving, recycling
Government hospital/Trauma centre

25 April 2015, earthquake 7.8 magnitude

Peak waste management approx. 3x normal

12 May 2015, earthquake 7.3 magnitude

Kg of waste autoclaved per day
HCWM lessons from the Gorkha Earthquake

• Extra waste volume
  – NOT a problem, the systems could take extra waste
  – Well trained, dedicated HCWM staff continued work

• Segregation systems faltered
  – Pressurised staff did not regard it as a priority
  – Volunteers did know the system
  – Hospital wards were moved
  – Waste bins and needle cutters were left behind

• Waste management needs to be included in emergency planning and training
  – Needle cutting especially important if segregation fails
  – Site HCWM away from flood areas, protect power supply
  – Field hospitals have no healthcare waste management
THANK YOU!