Conference paper
What works in preventing water-related diseases: Infrastructure solutions?

Duncan Mara, University of Leeds, UK
From our programme:

“Infrastructure solutions have a mixed record. What have we learned? How can it be improved?”
What do we KNOW?

- Waterborne diseases
- Water-washed diseases
- Water-based diseases
- Water-related insect vector diseases
But we also know:

Water, Sanitation, and Hygiene
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Water, Sanitation, and Hygiene

But, really to improve health, it’s

Hygiene, Sanitation and Water
But we also know:

Water, Sanitation, and Hygiene

But, really to improve health, it’s
Hygiene, Sanitation and Water

Water supply improvements on their own (i.e., no sanitation, no hygiene education) do NOT improve health
**Diarrhoeal disease (DD) incidence per person per year by region and age in 2000**

<table>
<thead>
<tr>
<th>Region</th>
<th>DD incidence in all ages</th>
<th>DD incidence in 0–4 year olds</th>
<th>DD incidence in 5–80+ year olds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrialized countries</td>
<td>0.2</td>
<td>0.2–1.7</td>
<td>0.1–0.2</td>
</tr>
<tr>
<td>Developing countries</td>
<td>0.8–1.3</td>
<td>2.4–5.2</td>
<td>0.4–0.6</td>
</tr>
<tr>
<td>Global average</td>
<td>0.7</td>
<td>3.7</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Source: WHO
No decline in the number of infectious-disease deaths
What’s our World becoming?
A water-short world
World population (billions):

- 1995: 0.46 billion
- 2025: 2.8 billion
- 2050: 4 billion

Population in water-scarce & water-stressed countries (billions):

- 1995: 0.46 billion
- 2025: 2.8 billion
- 2050: 4 billion
and also ...

an urban world
Source: World Urbanization Prospects: The 2007 Revision
Actually a **poor** urban world

Source: *World Urbanization Prospects: The 2007 Revision*
JOHANNESBURG, 13 July 2009 (IRIN):

The number of poor and food-insecure people in developing countries is increasing more quickly in urban areas than in rural areas, and could be dropping off the policy radar, says new research by the USDA.*

*Food Security Assessment 2008-09.
But we need ... a world with better information
The UN-HABITAT Lake Victoria Water and Sanitation Initiative

‘Adequate’ vs. ‘Improved’ Water Supplies
Case study:
Five secondary urban centres in Western Kenya
Access to ‘improved’ water

(JMP definition)

<table>
<thead>
<tr>
<th>Location</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migori</td>
<td>70</td>
</tr>
<tr>
<td>Kisii</td>
<td>71</td>
</tr>
<tr>
<td>Homa Bay</td>
<td>76</td>
</tr>
<tr>
<td>Siaya</td>
<td>68</td>
</tr>
<tr>
<td>Bondo</td>
<td>52</td>
</tr>
</tbody>
</table>

Improved water (source only)
Access to ‘improved’ water decreases dramatically when quantity (<20 l/cd), cost (>10% of income), and the burden of fetching water (>1 hour/day), are considered:

<table>
<thead>
<tr>
<th>Location</th>
<th>Improved water (source only)</th>
<th>Improved water but not sufficient, not affordable and burdensome to fetch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migori</td>
<td>70</td>
<td>18</td>
</tr>
<tr>
<td>Kisii</td>
<td>71</td>
<td>2</td>
</tr>
<tr>
<td>Homa Bay</td>
<td>76</td>
<td>21</td>
</tr>
<tr>
<td>Siaya</td>
<td>68</td>
<td>9</td>
</tr>
<tr>
<td>Bondo</td>
<td>52</td>
<td>9</td>
</tr>
</tbody>
</table>
Access to ‘adequate’ water

- Migori: 70%
- Kisii: 71%
- Homa Bay: 76%
- Siaya: 68%
- Bondo: 52%

Percentages indicate the proportion of the population with access to adequate water.
Rural areas

On-site water

→ handpumps (inc. new “maintenance-free” pumps), boreholes

“Ownership”

Operation & maintenance (VLOMM, local women)

At least 20 liters/person day, preferably more, and conveniently located.
Rural areas

Off-site water

→ gravity schemes
Small towns & Large villages

• Often “quite urban”, but poor technical capacity, so:
• Aggregation (to achieve some economy of scale)
High-density low-income urban areas

- Well known that the poor pay far more per m$^3$ of water than the non-poor connected to urban reticulation system, so:
  - NO CONNECTION FEES!
  - Water supply (and sanitation) cooperatives
  - For the poor & the very poor “standpipe cooperatives” with each member household paying something like 1% of minimum wage
A lesson from sanitation

In high-density low-income urban areas (inc. slums), if individual household systems unaffordable, then use ‘SPARC-style’ community-managed sanitation blocks.
Community-managed sanitation block in Kibera, Nairobi
Biogas generator
Top floor: community meeting room and kitchen (biogas used for cooking)
If communities in high-density low-income urban slum areas can manage their own sanitation, then surely they can also manage their own water supply?
If communities in high-density low-income urban slum areas can manage their own sanitation, then surely they can also manage their own water supply?

In fact they’re already doing so as there’s a water supply to each community-managed sanitation block.
We also need ... a world with better informed professionals
• We have to get knowledge of **all** appropriate water supply technologies to those in Government, but also **and more importantly** to those in **local** government.

• This is a **MAJOR** challenge!

No substitute for knowledge!
An example of ‘forgotten’ knowledge
Does *everyone* know about?

- Waterborne diseases
- Water-washed diseases
- Water-based diseases
- Water-related insect vector diseases
Does *everyone* know about?

- Waterborne diseases
- Water-washed diseases
- Water-based diseases
- Water-related insect vector diseases

**No**
Another example of lost knowledge:
Esrey et al. (1991)* said in fact:

“In the studies reporting a health benefit, the
water supply was piped into or near the home, whereas in those studies reporting no benefit, the improved water supplies were protected wells, tubewells, and standpipes.”

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“In the studies reporting a health benefit, the water supply was piped into or near the home, whereas in those studies reporting no benefit, the improved water supplies were protected wells, tubewells, and standpipes.”

► 49% median reduction in diarrheal disease from 12 studies; 63% from the two better studies – much more than the usually quoted reductions of ~15–20%

“Found” by Cairncross & Valdmanis (DCPP WP #28, 2004)

**Condominial water supplies**

- **Water supply**
  - **One connection per block**
  - **Block residents pay for in-block pipework and fittings**

**Housing block**
Comparative costs (1997 US$) of conventional and condominial water supplies in Parauapebas, Pará, north Brazil

<table>
<thead>
<tr>
<th>Item</th>
<th>Conventional supply*</th>
<th>Condominial supply*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total cost</td>
<td>Cost per connection(^a)</td>
</tr>
<tr>
<td>Excavation</td>
<td>454,000</td>
<td>88</td>
</tr>
<tr>
<td>Pipes</td>
<td>407,000</td>
<td>79</td>
</tr>
<tr>
<td>Total</td>
<td>861,000</td>
<td>167</td>
</tr>
</tbody>
</table>

\(^a\) individual household connections; \(^b\) individual condominium connections.

*Multiple-tap in-house supplies, 250 litres per person per day, 90% connection rate

*Source: Melo (2005).*
Change outdated water supply design codes and local regulations/bye-laws to permit use of pro-poor systems
From our programme:

“Infrastructure solutions have a mixed record. What have we learned? How can it be improved?”
CONCLUSIONS

• Infrastructure works if you do it right!
• Key is to choose the right infrastructure, design it properly, install it correctly, then do regular preventive O&M.
Conclusions, continued

BUT we need to do more on hygiene education (“mass hygiene education”) to help maximize health benefits from improved water supplies.
Conclusions, continued

BUT we need to do more on hygiene education (“mass hygiene education”) and promote/install sanitation to help maximize health benefits from improved water supplies.
Thank you
Grazie