Disinfection Tunnels- preventing SARS-CoV2 transmission?

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Spraying the environment- when is it applicable

High-volume spraying, fogging, or misting is used to advantage where the target is mosquitoes (vector borne transmission) and threatens the health of the local population

- Yellow fever
- Dengue
- Zika
- Malaria

The approaches are two-fold:

- (1) larvicidal application to surface water with a very thin oil to eliminate the development of mosquito larvae, and
- (2) adulticide application, where this type of spraying is used on bushes and grassy areas, or (in the case of the four diseases listed), inside houses where the mosquito is found during the day.

This application was considered environmentally damaging, but mosquito eradication programs were effective.

It has been banned in most countries due to detrimental effect on humans and the environment
SARS-CoV-2 survival in the environment

- Very susceptible to heat, drying and UV (sun light)
- Disinfectants are inactivated by dirt and debris - always need **prior cleaning** of surfaces before application
- Survival on cloth (depending on type of material) up to 24 hours in laboratory conditions (Kamphf, 2020).

- No evidence of transmission from porous surfaces
  - Grass, soil
  - Pavements
  - Roads
  - Park benches
- Spraying or fumigation outdoor spaces (marketplaces) not recommended (WHO)
- Spraying of disinfectants, even outdoors, harmful to human health
In indoor spaces, routine application of disinfectants to environmental surfaces by spraying or fogging (also known as fumigation or misting) is not recommended for COVID-19. One study has shown that spraying as a primary disinfection strategy is ineffective in removing contaminants outside of direct spray zones.\textsuperscript{38} Moreover, spraying disinfectants can result in risks to the eyes, respiratory or skin irritation and the resulting health effects.\textsuperscript{39} Spraying or fogging of certain chemicals, such as formaldehyde, chlorine-based agents or quaternary ammonium compounds, is not recommended due to adverse health effects on workers in facilities where these methods have been utilized.\textsuperscript{40,41}
HEALTH RISKS FROM DERMAL AND INHALATION EXPOSURE TO DISINFECTING AGENTS

<table>
<thead>
<tr>
<th>Product</th>
<th>CAS</th>
<th>Presentation</th>
<th>INDICATION OF USE</th>
<th>HEALTH RISKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone</td>
<td>10028-15-6</td>
<td>Gas</td>
<td>Air and water disinfectant</td>
<td>Inhalation at low concentrations may increase risk to health, accelerate viral or bacterial infections of the respiratory tract or exacerbate pre-existing chronic lung lesions</td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
<td>7722-84-1</td>
<td>Liquid</td>
<td>Disinfectant whitener</td>
<td>Eye, nasal, dermal, throat and respiratory irritation</td>
</tr>
<tr>
<td>Sodium hypochlorite</td>
<td>7681-52-9</td>
<td>Liquid</td>
<td>Disinfectant</td>
<td>Eye irritation and dermal contact irritation. Inflammation and erosion of mucous membranes if swallowed</td>
</tr>
<tr>
<td>Hypochlorous acid</td>
<td>7790-92-3</td>
<td>Liquid</td>
<td>Disinfectant</td>
<td>Potential dermal irritation from direct exposure. Potential respiratory tract irritation and pulmonary edema from vapour inhalation</td>
</tr>
<tr>
<td>Quaternary ammonium</td>
<td>Product mixes</td>
<td>Liquid</td>
<td>Surfactant disinfectant</td>
<td>Dermal irritation, shortness of breath, gastrointestinal injuries in case of ingestion</td>
</tr>
<tr>
<td>Isopropyl alcohol</td>
<td>67-63-0</td>
<td>Liquid</td>
<td>Disinfectant</td>
<td>Eye, nose and throat irritation, second to direct exposure or contact with vapours</td>
</tr>
<tr>
<td>Ultraviolet rays</td>
<td>Light</td>
<td>disinfection of drinking water, air, titanium implants</td>
<td>UV-induced skin erythema and keratoconjunctivitis</td>
<td></td>
</tr>
</tbody>
</table>

Deliberate exposure to chlorine spraying - Ebola

<table>
<thead>
<tr>
<th>Table 2 Chlorine spraying in the three groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
</tr>
<tr>
<td>------------------------------</td>
</tr>
<tr>
<td>Total interviewed</td>
</tr>
<tr>
<td>Not sprayed (excluded)</td>
</tr>
<tr>
<td>Total analysed</td>
</tr>
<tr>
<td>In own house (under quarantine)</td>
</tr>
<tr>
<td>Outside in the community</td>
</tr>
<tr>
<td>Transfer</td>
</tr>
<tr>
<td>Overall</td>
</tr>
<tr>
<td>Leaving ETU</td>
</tr>
<tr>
<td>Red zone</td>
</tr>
<tr>
<td>Spray others</td>
</tr>
<tr>
<td>In room when spraying others</td>
</tr>
<tr>
<td>EVD case house</td>
</tr>
<tr>
<td>EVD suspect house</td>
</tr>
</tbody>
</table>

HCW = healthcare workers; EVD = Ebola virus disease survivors; NEVD = non Ebola cases

<table>
<thead>
<tr>
<th>Table 5 Adverse events in HCW with single and multiple chlorine exposure compared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic</td>
</tr>
<tr>
<td>Eye sight problem before</td>
</tr>
<tr>
<td>Eye sight problem now</td>
</tr>
<tr>
<td>Coughing</td>
</tr>
<tr>
<td>Cough producing sputum</td>
</tr>
<tr>
<td>Difficulty in breathing</td>
</tr>
<tr>
<td>Chest tightness</td>
</tr>
<tr>
<td>Burning throat</td>
</tr>
<tr>
<td>Skin irritation</td>
</tr>
</tbody>
</table>

Mehter et al. Antimicrobial Resistance and Infection Control (2016) 5:45
Effect of chlorine spraying on HCW while wearing PPE

HCW significantly higher chest symptoms than Ebola survivors

<table>
<thead>
<tr>
<th>Condition</th>
<th>HCW</th>
<th>Ebola Survivors</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>45.0%</td>
<td>55.0%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Chest</td>
<td>66.4%</td>
<td>33.6%</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Major respiratory damage in HCW & the population despite wearing PPE
Toxic effects of chlorine

- Chlorine poisoning can occur when you swallow or inhale chlorine.
- It reacts with water inside and outside of the body (such as the water in your digestive tract) to form **hydrochloric acid** and **hydrochlorous acid**. Both of these substances are extremely poisonous.
- Symptoms of this problem can include changes in the acid levels of your blood.
- Chlorine exposure can also cause low blood pressure.
163 staff interviewed; 49 air samples taken

Fig 1. Prevalence of work-related symptoms by disinfectant product use at a hospital, August 2015. Work-related symptoms were defined as symptoms that improved away from the facility, either on days off or on vacation. *Statistically significant differences using χ² test (P < .05). †All symptoms specific to the last 12 months.
Increase exposure amongst cleaners- MMR

FIGURE. Number of daily exposures to cleaners and disinfectants reported to U.S. poison centers — United States, January–March 2018, 2019, and 2020*.

† Increase in exposures to cleaners on January 29, 2020, came from an unintentional exposure to a cleaning agent within a school.
Spraying individuals with disinfectants (such as in a tunnel, cabinet, or chamber) is **not recommended under any circumstances.** This could be physically and psychologically harmful and would not reduce an infected person’s ability to spread the virus through droplets or contact. Moreover, spraying individuals with chlorine and other toxic chemicals could result in eye and skin irritation, bronchospasm due to inhalation, and gastrointestinal effects such as nausea and vomiting.\textsuperscript{40, 45}
Example from S Africa- atomised airborne disinfectant using ERSA.

- Proving popular since the outbreak of Covid-19 in South Africa, Explospot’s indoor turbines, which atomise and distribute disinfectant using powerful fans and high-pressure nozzles, have been successfully used in warehouses and factories to make disinfecting liquid airborne, thereby sanitising vast areas for up to 18 hours per application.

- These turbines create a fine mist, made up of tiny droplets of between 10 µ and 30 µ. “This mist settles on all surfaces, cleaning it of bacteria, viruses and fungi,”

- The spray nozzles create a dry mist and, as a result of the sedimentation speed of the atomised disinfectant, the droplets have the ability to penetrate hidden corners.

- The disinfectant used – ERSA – in Explospot products is water-based and requires dilution with water at a ratio of 0.66% to water, “thereby being efficient”.

Hazardous Substances Act (Act No. 15 of 1973)

- Hazardous Substances Act is probably the most important chemical regulation in South Africa.
- It controls the production, import, use, handling and disposal of hazardous substances.
- Under the Act, **hazardous substances** are defined as substances that are toxic, corrosive, irritant, strongly sensitising, flammable and pressure generating under certain circumstances and may injure, cause ill-health or even death in humans.
- Hazardous substances are classified into 4 groups (see below).
  - Group I: **industrial chemicals** (IA) and pesticides (IB)
  - Group II: 9 classes of **wastes** excluding Class 1: explosives and class 7: radioactive substances
  - Group III: electronic products and group
  - Group IV: radioactive substances
WHEREAS many inhabitants of South Africa live in an environment that is harmful to their health and well-being:

everyone has the right to an environment that is not harmful to his or her health or well-being:
Global movement to stop disinfection tunnels

Chemical spraying of humans not allowed in Europe, UK, USA

Countries & Organisations against disinfection tunnels or spraying of humans
- WHO
- PAHO
- Chinese CDCP
- Salud sin daño (NGO)
- Infection Control Africa Network
- Latin America – 10 countries
- Philippines
- India
- Malaysia

https://www.nomoredisinfectiontunnels.com/news
Disinfection tunnels and spraying of humans

Problem
Disinfectant tunnels at entrances to public transport (Gautrain and Soweto Taxi rank) have been installed. No evidence of spraying chemicals of humans reduces the risk of transmission.

Evidence
- A literature review, including WHO and PAHO recommendations, studies from West Africa during the 2016 Ebola outbreak, and chemical exposure amongst cleaning staff demonstrated toxic effects of chemicals, especially halogen based compounds causing skin, eye and respiratory irritation.
- Chlorine and other chemicals convert to hydrochloric acid (HCL) leading to damage of the airways.
- Respiratory damage can potentially increase the risk of SARS-CoV2 acquisition and may enhance disease.


Recommendations.
1. There is no evidence that spraying of humans prevents transmission.
2. Chemical spraying of humans by any route, including disinfectant tunnels is strongly condemned as it is damaging to eyes, skin and the respiratory tract and increases the risk of acquisition of SARS-CoV2.
References


11. South African laws governing safety of workers (humans) and the environment
   - Hazardous Substance Act (1973);
   - Occupational Health & Safety Act (1993);
   - National Environmental Management Act (1998)

12. MMWR /April 24, 2020/ Vol. 69 /No 16. Cleaning and disinfectant Chemical Exposures and Temporal Association with COVID-19- National Poison Data System, United States, Jan 1 to March 31, 2020