



## EMERGENCY MANAGEMENT USE CASE

<b>Research Title:</b>	<b>Surface sampling for the detection and surveillance of disease outbreaks</b>
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<b>Description:</b>	<p>Recent infectious disease outbreaks, such as the worldwide Covid-19 pandemic, the spread of mpox (formerly Monkey Pox), and recurrent Ebola in West Africa, demonstrate that new and emerging pathogens can cause serious public health emergencies. Detection and surveillance of new outbreaks is crucial to managing and mitigating the human and economic costs of infectious disease.</p> <p>Pathogen detection and surveillance typically relies on clinical cases – infected individuals who are diagnosed after they display symptoms. This reliance on clinical cases has several drawbacks – symptomatic individuals may not go to the doctor, not all individuals may be symptomatic, and testing can be intrusive and expensive. Thus, alternative surveillance strategies are needed to complement human testing.</p> <p>As part of the CUBE consortium (<a href="#">link below</a>), we have developed and validated an approach to respiratory disease surveillance that does not require human testing. When a sick individual coughs, sneezes, or breathes, they expel virus or bacteria in droplets or aerosols, which eventually fall to the floor. We therefore monitor for the presence of a disease in a building by swabbing floors, and testing for viral or bacterial genetic markers from the floor swabs. We have validated this approach extensively for Covid-19, showing that we can often detect outbreaks in hospitals and long-term care homes (LTCHs) several days before human cases escalate. Our approach is easy to implement, non-invasive, and can be readily expanded to other diseases (we are currently developing protocols for RSV and influenza). In the event of a new pandemic, we propose that floor-swab based surveillance could be used to monitor for outbreaks in congregate settings (hospitals, LTCHs, schools, etc...) housing vulnerable populations.</p> <p>As an example of a specific use case, a hospital could be monitored for a new infectious disease. Here, we might be concerned about a new pathogen that has emerged elsewhere in the world (as with Covid-19), and would like to monitor for its arrival in the local community. We would swab floors in key areas of the hospital, where we might expect to find patients, staff, or visitors who carry the new disease – such areas would include intensive care units, the main lobby, and infectious disease wards. Detection of the new disease on floors would then trigger additional measures, such as increased human testing, and/or appropriate public health measures.</p>
<b>When Applied:</b>	This use case would be applied during an infectious disease epidemic. Our approach is well-suited for congregate settings with a defined population, such as hospitals, long-term care homes, or schools.
<b>Who Applies:</b>	TDEM School boards Universities and community colleges Long-term care home providers Hospitals Public health agencies CDC



<b>Disaster Type:</b>	Infectious disease outbreaks
<b>Infrastructure Affected:</b>	Congregate settings
<b>Industry Affected:</b>	Education, healthcare, long-term care
<b>Where Applied:</b>	Worldwide
<b>Agency Affected:</b>	Not targeted to a specific agency
<b>VOAD Affected:</b>	Not targeted to VOAD
<b>Who/What Affected:</b>	Residents or users of congregate settings, for example students or LTC residents.
<b>How Affected:</b>	<p>Detection of a target disease in a congregate setting could be used to trigger appropriate public health measures, such as increased human testing, masking, or localized shutdowns. Such measures would then decrease or halt the spread of the disease in the facility.</p> <p>Importantly, we have shown that floor-swabbing can often predict an outbreak 2-4 days before an increase in human cases is detected. Thus, use of floor-swabbing could provide several days of extra, crucial time in which to implement public health measures.</p>
<b>Timing of Application:</b>	Before and during an outbreak or epidemic
<b>Critical Points:</b>	<ul style="list-style-type: none"> <li>- Floor swabbing is an effective and non-invasive approach for detecting infectious disease in congregate settings</li> <li>- Floor swabbing can detect disease several days before human cases increase</li> <li>- Floor swabbing is easy to implement and cost effective</li> </ul>
<b>What Benefit:</b>	The chief benefit is early detection of an emerging disease in a congregate setting. Early detection allows the implementation of mitigation measures, with the goal of slowing the spread of disease and preventing cases.
<b>Where Used:</b>	<p>As part of the CUBE consortium, we have applied this approach in a number of congregate settings for surveillance of Covid-19. Locations include two Ontario hospitals, 10 long-term care homes throughout the province of Ontario, 6 buildings at the University of Ottawa, and 9 schools and 4 daycares in Ottawa.</p> <p>(Note that I recently moved to Texas A&amp;M AgriLife from Carleton University in Ottawa, Ontario, hence the connection to an Ontario-based project)</p>
<b>Additional Research:</b>	Yes. I would like to work with local authorities to determine which specific locations would be most appropriate for monitoring. This would involve consideration of which populations are most vulnerable, and which facilities might be most receptive.
<b>Additional Information:</b>	The CUBE website describes our use of floor swabbing for Covid-19 monitoring: <a href="https://cube-ontario.github.io">https://cube-ontario.github.io</a>
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<b>Original Research:</b>	<a href="https://www.facetsjournal.com/doi/10.1139/facets-2021-0139">https://www.facetsjournal.com/doi/10.1139/facets-2021-0139</a> <a href="https://www.medrxiv.org/content/10.1101/2022.06.28.22276560v1">https://www.medrxiv.org/content/10.1101/2022.06.28.22276560v1</a>
<b>What Risks:</b>	There are few risks involved. Facility users may express concern that their facility is being swabbed; good communication should mitigate most of these concerns. Additionally, we cannot guarantee that we will catch all outbreaks in a facility, as our ability to detect pathogens will depend on a variety of difficult-to-control factors.
<b>Partner Agencies/Jurisdictions:</b>	Texas Department of State Health Services Facility (LTC/school/hospital) managers CDC or other federal agencies if a federally-operated site is chosen

**Research with a Technology Component Should Respond to the Following Questions**

<b>Research Requested:</b>	No, the proposed technology was not a response to a specific request.
<b>Why Better:</b>	<p>Two alternative approaches are widely applied in the surveillance of infectious disease outbreaks: individual-based testing, and wastewater testing.</p> <p>Compared to individual-based testing, floor swabbing is non-invasive and inexpensive. Compared to wastewater testing, floor sampling provides greater resolution – we can potentially localize an outbreak to a floor, wing, or ward of a congregate setting, whereas wastewater at best applies to entire building.</p>
<b>Reliability:</b>	Our approach uses standard molecular biology infrastructure. In the event of failure of a piece of equipment, a lab facility will typically have backup equipment that can be used.
<b>Support Needed:</b>	A molecular biology laboratory is required for implementation. Academic molecular biology labs, as well as clinical testing labs, will generally have the equipment and expertise required for testing.
<b>Citizen Impact:</b>	Facility users may express concern that their facility is being swabbed; good communication should mitigate most of these concerns.
<b>Training Required:</b>	<p>Floor swabbing is straightforward; we have produced a short training video that effectively teaches the technique, which can be accessed here: <a href="https://youtu.be/3DC76EfIPR8">https://youtu.be/3DC76EfIPR8</a>.</p> <p>The laboratory work can be readily learned by staff trained in molecular biology. Past experience indicates that it takes 1-2 weeks to become comfortable with the lab protocols.</p>
<b>Public Accountability:</b>	<p>Privacy issues are minimal – since we are swabbing floors, positive cases generally cannot be traced back to individuals.</p> <p>Managers may be concerned about publicly sharing data on floor swab positivity for their facilities; data release policies can be determined on a case-by-case basis.</p>