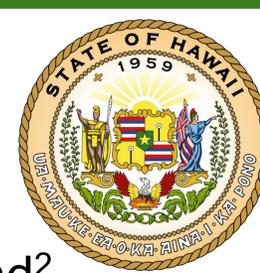




# Framework Design Study of Nursing Care Facility Wastewater Testing of *Candida auris*



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## 1. Introduction

### 1.1 Early capture of *C. auris* outbreak through wastewater

- C. auris* yeast colonizes body sites such as the skin, causes infections, and is transmitted by direct contact.
- Emergence of multidrug-resistant *C. auris* infections.
- Challenges in colonization surveillance and controlling *C. auris* outbreaks in nursing care facilities (CFs).
- Wastewater testing for *C. auris* as an early warning tool.

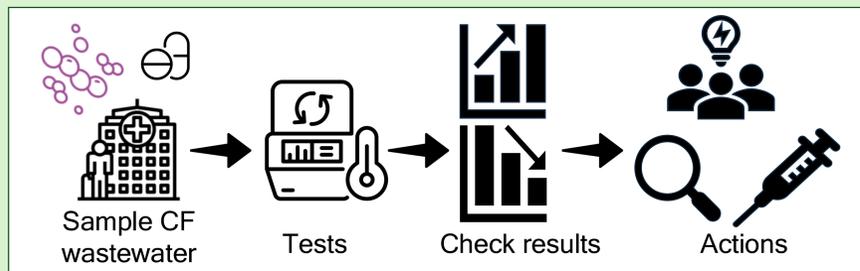


Figure 1: The concept of wastewater testing at CFs to capture emergence of *C. auris* risks and prevent outbreaks. The wastewater samples are routinely collected from the CFs.

1.2 Successful wastewater testing program at Hawai'i State Department of Health - State Laboratories Division (SLD) The testing successfully captured COVID-19 outbreak and triggered timely public health actions (Figure 2).

### 1.3 Potential future outbreak in Hawai'i.

- The introduction of *C. auris* to a major city has been shown to be related to its role as a travel network hub.
- In 2023, there were nearly 10 million visitors to Hawai'i from both domestic and international locations.
- One reported case in Hawai'i in 2022 was travel-related.

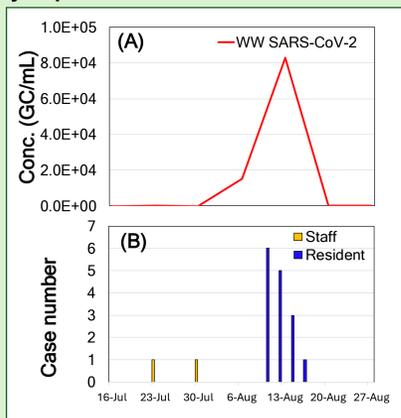
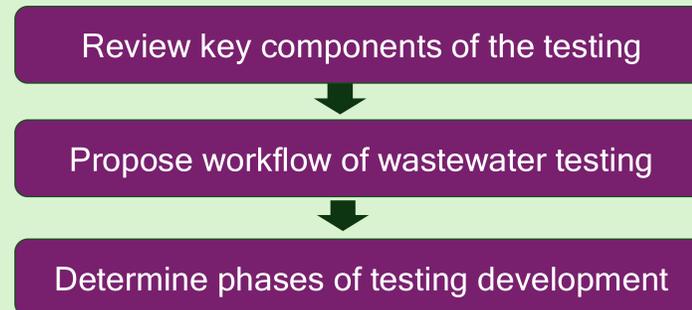


Figure 2: Viral RNA of SARS-CoV-2 was detected in a CF wastewater (A) prior to a spike of reported COVID-19 cases (B) (Unpublished data, O'ahu, Hawai'i, 2024).

## 2. Objective

Propose a framework for building laboratory capacity of *C. auris* testing in CF wastewater to effectively track and control emergence of drug-resistant *C. auris* outbreak.

## 3. Method



## 4. Results and Discussion

### 4.1 Key components of the *C. auris* testing in CF wastewater

#### 4.1.1 Sensitive, Rapid, and Relevant detection assay

Table 1: Summary of *C. auris* detection and antifungal susceptibility testing (AFST) from the literature of wastewater testing

Study location	<i>C. auris</i> detection (Test - LOD - processing time <sup>a</sup> )		AFST	Study
	Genotypic	Phenotypic		
WWTP NV	n/a	SSDB <sup>c</sup> /CHROMagar/MALDI-TOF - ~100 CFU/mL - >9 days	n/a	[1]
WWTP FL	qPCR - n/a - <1 day	CHROMagar - n/a - >4 days	n/a	[2]
WWTP UT <sup>b</sup>	qPCR - C <sub>q</sub> = 33.03 - <1 day	SSDB <sup>c</sup> /CHROMagar - n/a - >9 days	n/a	[3]
WWTP UT	qPCR - C <sub>q</sub> = 33.03 - <1 day	n/a	n/a	[4]
WWTP Nationwide	dPCR - ~1,000 cp/g - <1 day	n/a	n/a	[5]
LTCF Chicago	dPCR - n/a - <1 day	SSDB <sup>d</sup> /CHROMagar/MALDI-TOF - n/a - >9 days	n/a	Unpublished

<sup>a</sup> The processing time was estimated and not from the study. <sup>b</sup> The study involved whole-genome sequencing (genotypic method) of recovered isolates. <sup>c</sup> The Salt Sabouraud Dulcitol Broth (SSDB) enrichment broth was supplemented with fluconazole. <sup>d</sup> SSDB was supplemented with Chloramphenicol and Gentamicin.

### 4.1.2 Antifungal resistance

- Amphotericin B and echinocandin-class drugs are used for the treatment of *C. auris* infections.
- In the USA, around 33% of isolates are likely resistant to amphotericin B, and 1% are resistant to echinocandin.

### 4.2 Proposed workflow for wastewater testing

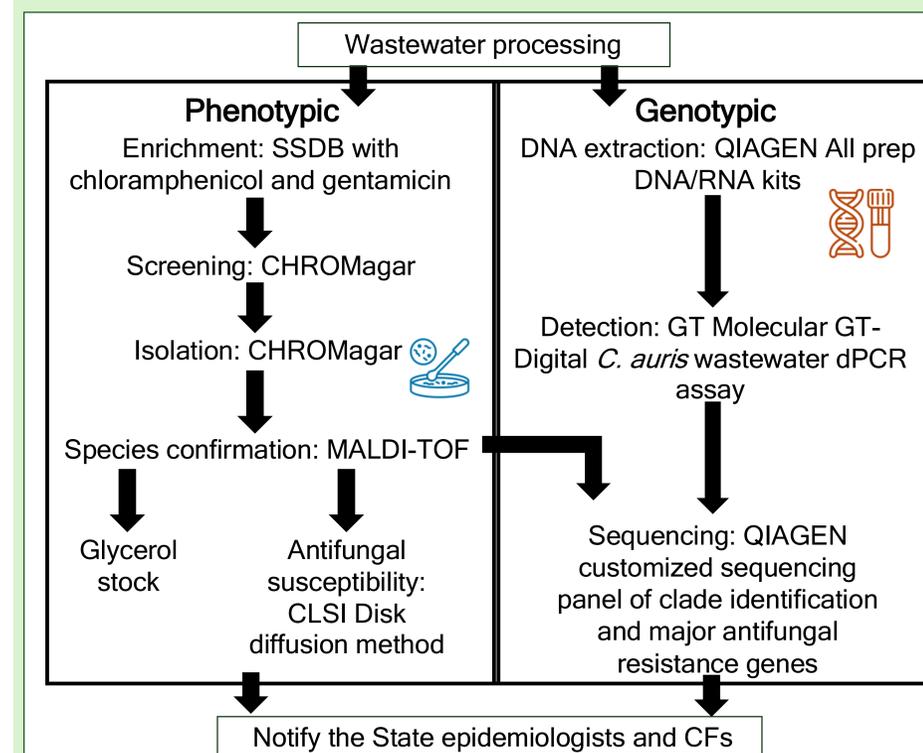


Figure 3: Proposed workflow for *C. auris* testing in CF wastewaters, expanding from the SLD workflow wastewater testing program.

### 4.3 Phases of wastewater testing development

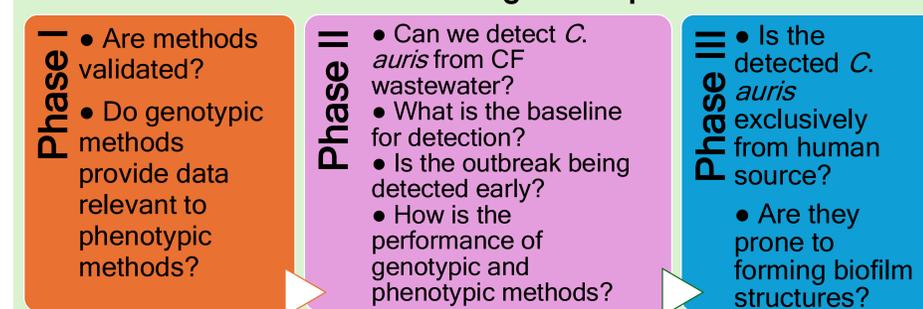


Figure 4: Study questions during study phase I to III.

5. Conclusion A framework for developing effective *C. auris* testing in CF wastewaters should integrate both phenotypic and genotypic methods, and investigate antifungal resistance. The development can be divided into phases to achieve comprehensive testing.

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