

Purpureocillium lilacinum Keratitis Outbreak Associated with an Ophthalmology Clinic — New York City, 2024

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Abstract

In December 2024, a clinical laboratory notified the New York City Health Department of three patients with fungal keratitis caused by an unidentified mold following laser eye surgery at an ophthalmology clinic. All three patients experienced vision loss, and one patient required corneal transplantation. Corneal cultures from two of the patients grew *Purpureocillium lilacinum*, an environmental mold that can cause a range of infections in humans; eye infections have been reported. The clinic paused surgeries. The health department assessed the clinic's infection prevention and control (IPC) practices and identified multiple deficiencies, including incomplete instrument sterilization logs, absence of disinfectants approved for use on work surfaces, use of expired topical ocular medications, and opportunities for exposure to nonsterile water from cool-mist humidifiers in the procedure room. CDC environmental infection control guidelines recommend avoidance of cool-mist humidifiers in health care facilities. All environmental cultures were negative for *P. lilacinum*, but fungal amplicon sequencing detected *P. lilacinum* DNA in the tubing of a surgical device. No further cases were identified after implementation of recommended IPC measures and resumption of surgeries during January 2025. Adherence to published IPC guidance during all procedures in ambulatory settings can reduce the risk for health care-associated infections.

Introduction

In December 2024, a clinical laboratory in New York City (NYC) notified the NYC Health Department of three patients with fungal keratitis caused by an unidentified mold that developed after elective laser eye surgery performed at an ophthalmology clinic for the purpose of reducing or eliminating

the need for corrective lenses. The clinic had suspected infection based on patient reports of eye pain and vision loss and postoperative clinical assessments, and sent corneal specimens to the laboratory, which noted fungal elements on microscopy. Because of the unusual appearance of the organism, the laboratory notified the health department. Corneal cultures from two of the patients grew *Purpureocillium lilacinum* (formerly *Paecilomyces lilacinus*), an environmental mold. Infection with *P. lilacinum* can result in clinical manifestations ranging from superficial mycoses to life-threatening systemic infections (1); eye infections have been reported (2,3). *P. lilacinum* infection is not reportable in NYC.

Investigation and Findings

Initial Clinic Response and Laboratory Report to Health Department

The clinic employed one ophthalmologist and consisted of a single treatment room. Patient A had surgery on day 0 and experienced symptoms 2 days later (Figure 1). Patients B and C had surgery on day 7 and became symptomatic 3 days later, on day 10. After identifying infections in patients A and B (on days 5 and 11, respectively), the clinic paused surgeries. A third infection, in patient C, was identified the next day (day 12). Clinic staff members conducted a round of environmental

INSIDE

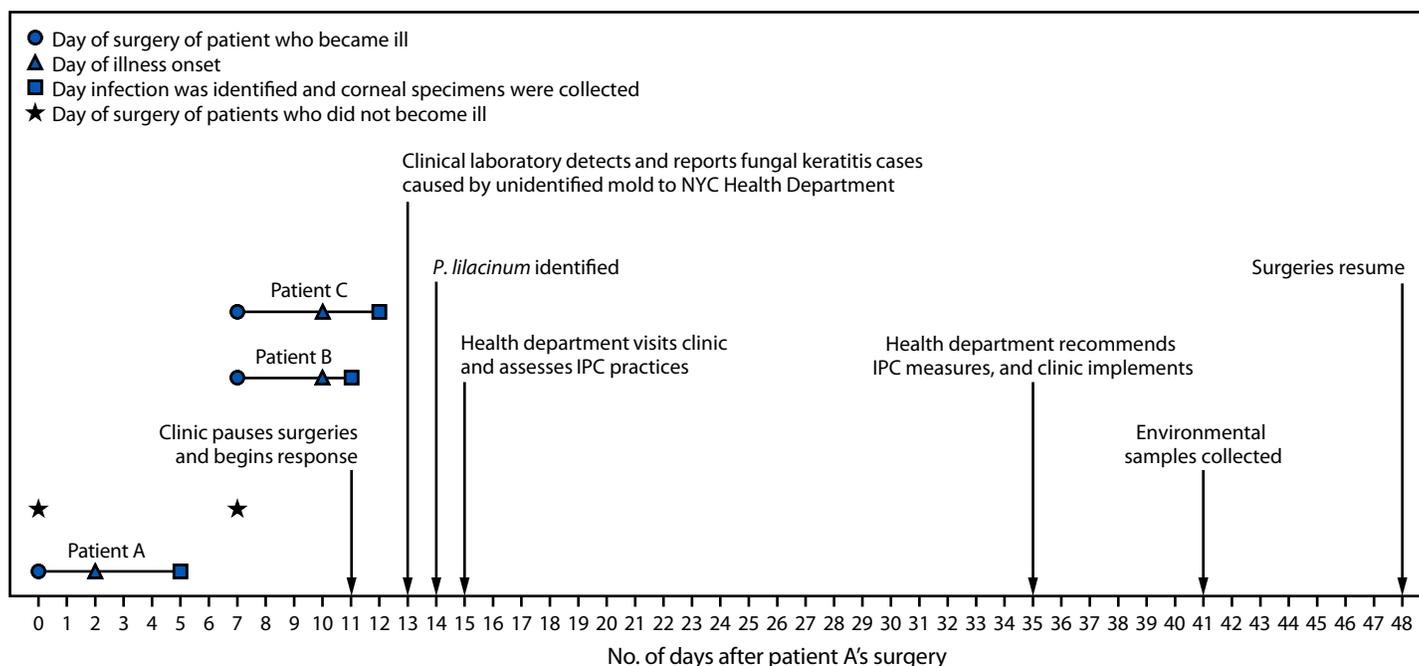
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FIGURE 1. Timeline for *Purpureocillium lilacinum* keratitis outbreak — New York City, December 2024–January 2025*



Abbreviations: IPC = infection prevention and control; NYC = New York City.

* Of the eight patients who did not become ill, two had surgery on day 0, and six had surgery on day 7. The analysis period lasted from days 0–13.

cleaning, discarded or replaced some equipment, and retained other equipment for future environmental testing. Retained items included the procedure room refrigerator, and an epikeratome, a surgical device that uses suction to separate the corneal epithelium from the underlying corneal layers. The

epikeratome consists of the machine that generates suction, suction tubing (Figure 2), and a handheld attachment that touches the eye during surgery which is sterilized after each use. On day 13, the laboratory detected mold in the clinical specimens and notified the health department. The

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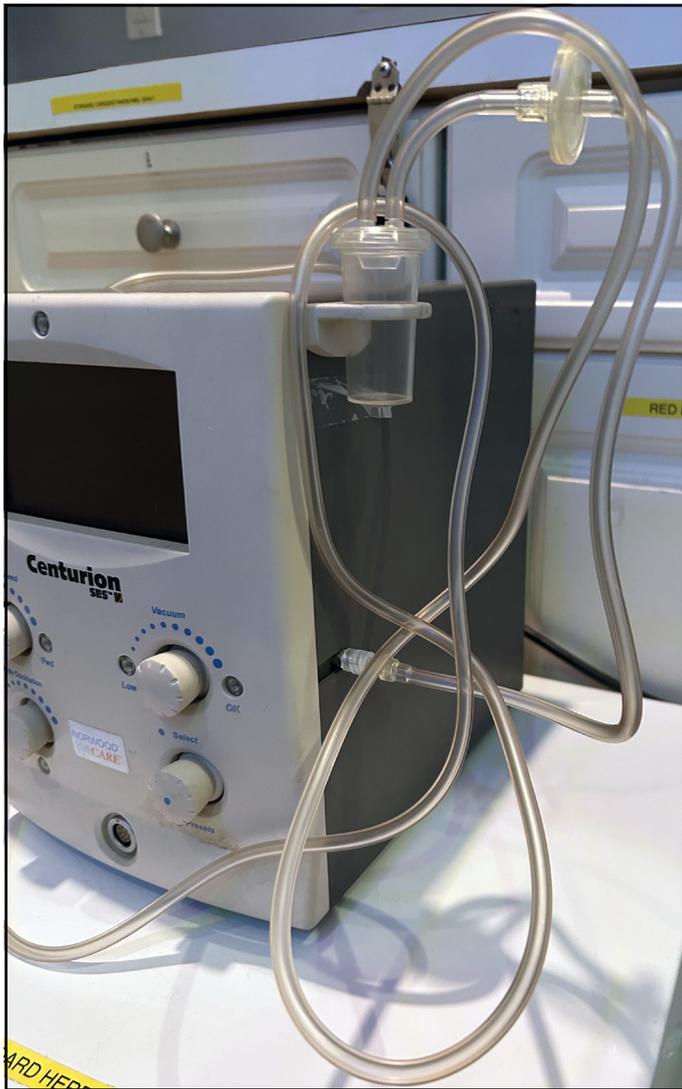
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FIGURE 2. Epikeratome machine and single-use tubing from the ophthalmology clinic — New York City, December 2024*



Photo/Michelle Chang

* An epikeratome is a surgical device that uses suction to separate the corneal epithelium from the underlying corneal layers. The epikeratome consists of the machine that generates suction, suction tubing, and a handheld attachment that touches the eye during surgery and is sterilized after each use. The handheld attachment is not included in the photo.

following day, the mold in patient A's culture was identified as *P. lilacinum*; *P. lilacinum* was detected in a second patient's culture shortly thereafter.

In accordance with standard practice for an outbreak investigation, the NYC Health Department's institutional review board did not review this activity. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.*

* 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

P. lilacinum Keratitis Case Definition and Identification

A case of *P. lilacinum* keratitis was defined by the NYC Health Department as eye pain or vision loss in a patient after laser eye surgery at the clinic on days 0–13[†] and 1) corneal cultures demonstrating *P. lilacinum* or 2) scrapings identifying fungal elements. Cases were identified through medical record review and clinician interviews. Among 11 patients who had laser eye surgery during the analysis period, three patients, who had surgery on day 0 (patient A) and day 7 (patients B and C), experienced illness meeting the case definition 2–3 days after surgery (Figure 1). Two of these three patients received a positive *P. lilacinum* culture result and one patient's corneal scrapings identified fungal elements. All three ill patients experienced vision loss, and one of the two who received a positive *P. lilacinum* culture result required corneal transplantation. After identification of the fungal infection, the ill patients were started on topical voriconazole and natamycin. Eventually, all were transitioned to oral posaconazole. Patients sought care from multiple providers, and information on clinical outcomes is not available.

Clinic Procedures and Patient Characteristics

Based on the limited demographic and clinical information collected by the clinic, the health department reviewed information on the age, sex, and comorbidities of the 11 patients who underwent surgery during the analysis period. Surgeries at the clinic were conducted in a highly protocolized manner. All patients treated during the analysis period were in contact with the same surgical equipment in the same operative environment. The surgical procedures for all three ill patients, and at least four of the eight patients who did not become ill, involved use of the epikeratome. Of the eight patients who did not become ill, two had surgery on day 0 and six had surgery on day 7. Patients received the same perioperative medications, including three types of eye drops (steroid, nonsteroidal anti-inflammatory, and antibiotic). None of the patients was known to be immunocompromised, and no apparent demographic, clinical, or procedural differences were identified between patients who did and did not become ill.

Infection Prevention and Control Assessment and Findings

On day 15, health department staff members visited the clinic to assess infection prevention and control (IPC) practices. The IPC assessment was conducted using CDC's Infection Control Assessment and Response tool (4), which includes modules that can be selected on the basis of facility-specific concerns or applicability to a specific organism. The

[†] No patients were lost to postoperative follow-up during the period when the infections occurred.

assessment focused primarily on the domains of instrument sterilization, environmental cleaning, medication safety, and water exposures.

Multiple IPC deficiencies were identified, including incomplete sterilization logs for surgical instruments, use of a disinfectant that is not approved by the Environmental Protection Agency (EPA) for surface cleaning in the procedure room, intraoperative use of expired topical ocular medications, and opportunities for patient exposure to nonsterile water during surgery. For example, clinic staff members reported that an undated bottle of saline solution was used to provide surgical irrigation for multiple patients over the course of weeks. In addition, among the equipment that clinic staff discarded and replaced as part of their initial response to the infections were multiple cool-mist humidifiers. During the IPC assessment, the new cool-mist humidifiers were present in the procedure room.

Genomic Analysis and Antifungal Susceptibility Testing of *P. lilacinum* Clinical Isolates

Whole genome sequencing analysis of the two *P. lilacinum* clinical isolates demonstrated that they differed by approximately 55 single nucleotide polymorphisms (SNPs) from each other and by approximately 200,000 SNPs from control isolates. This analysis suggested a common infection source. Antifungal susceptibility testing demonstrated good in vitro activity of azoles and supported resistance to amphotericin B.

Environmental Testing

On day 41, health department staff members collected the saline bottle, stored epikeratome tubing, and swabs from five refrigerator locations (gasket, interior door, interior bottom, interior upper, and medication compartment) for fungal cultures and amplicon sequencing.[§] The humidifiers in use when the infections occurred had been discarded before the investigation and were not available for testing.

All environmental cultures were negative for *P. lilacinum*, but fungal amplicon sequencing detected *P. lilacinum* DNA in the epikeratome suction tubing (Figure 2). During surgery, the epikeratome draws air away from the eye through a handheld attachment that touches the eye and is connected to suction tubing that contains a filter to prevent flow of debris into the machine. The handheld attachment is sterilized after each use and was therefore not made available for sampling. The suction tubing is intended for single use and is provided as a sterile product. Clinic staff members reported that tubing was never shared between patients; it is not known whether the set of tubing collected for testing was the one used for any of

the infected patients' procedures. The epikeratome machine is a multiuse item. It was not sent for testing because no clear sampling approach could be identified.

Public Health Response

Whether the *P. lilacinum* DNA in the epikeratome tubing was the source of infection is unclear because of the way the tubing was used and the possibility of environmental contamination. The humidifiers were another possible source. Cool-mist humidifiers were previously implicated in an outbreak of *Mycobacterium chelonae* eye infections at a laser eye surgery clinic (5); however, the humidifiers in use at the time the *P. lilacinum* infections in this outbreak occurred had been replaced and were unavailable for testing. CDC environmental infection control guidelines recommend avoidance of cool-mist humidifiers in health care facilities (6), and current health care engineering guidelines specify that steam humidification should be used (7).

The clinic worked closely with the health department to implement all recommended IPC measures to prevent potential exposures, including exchange of cool-mist humidifiers for steam humidifiers and, out of an abundance of caution, replacement of the epikeratome. No further cases were identified after implementation of IPC measures and resumption of surgeries during January 2025.

Discussion

P. lilacinum caused severe disease in all three infected patients, including one who required corneal transplantation. Most cases of *P. lilacinum* keratitis have been reported in association with soft contact lens use, eye trauma, eye surgery, and immunosuppression (2,3). *P. lilacinum* is considered intrinsically resistant to amphotericin B, and treatment with polyene antifungals including amphotericin B and natamycin has been linked to poorer clinical outcomes (1,3,8). A recent analysis of fungal culture results from a major U.S. commercial laboratory found increasing rates of *P. lilacinum* detection during 2019–2025 (8). Two *P. lilacinum* strains registered with EPA during 2005 and 2021 are used as agricultural bionematicides (biologic agents used to control plant parasites) in the United States (9,10). Agricultural use of *P. lilacinum* might increase its presence in the environment, potentially contributing to clinical infections and culture contamination. Because *P. lilacinum* is known to cause drug-resistant keratitis, and rates of detection are increasing, *P. lilacinum* should be considered as a potential cause of infection after eye surgery, even before definitive culture identification.

[§] Fungal amplicon sequencing used the internal transcribed spacer (ITS) regions ITS1 and ITS2, as well as 28S ribosomal DNA, as targets.

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Summary

What is already known about this topic?

Purpureocillium lilacinum is an environmental mold that can cause a range of infections in humans. Although infection in immunocompetent persons is uncommon, eye infections have been reported.

What is added by this report?

Three patients developed *P. lilacinum* corneal infections after laser eye surgery at a New York City ophthalmology clinic, one of whom required corneal transplantation. Investigation identified infection prevention and control deficiencies at the clinic that potentially resulted in mold exposure. After implementation of infection prevention and control measures, no further cases were identified.

What are the implications for public health practice?

Adherence to published infection prevention and control guidance during all procedures in ambulatory settings can reduce the risk for health care–associated infections and related complications.

Implications for Public Health Practice

This investigation identified IPC deficiencies that could have resulted in mold exposure, although none was conclusively linked to the clinic patients' infections. The prevalence of the IPC findings from this investigation in ophthalmology clinics remains unclear. Adherence to published IPC guidance during all procedures in ambulatory settings can reduce the risk for health care–associated infections and related complications.

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Pseudo-Outbreak of *Purpureocillium lilacinum* Skin Infections at a Dermatology Clinic — Washington, 2024

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Abstract

In April 2024, a Washington dermatology clinic reported multiple cases of atypical fungal skin infections caused by the environmental mold *Purpureocillium lilacinum* to Clallam County Public Health. *P. lilacinum* most frequently causes skin infections among immunocompromised persons but can occasionally infect immunocompetent persons. The diagnoses were made on the basis of swab specimens collected from patients' skin to diagnose a fungal skin infection, rather than from a biopsy or skin scraping, as is recommended. An investigation by the Washington State Department of Health and CDC revealed this to be a pseudo-outbreak caused by contaminated saline, ultimately affecting 22 patients during January–October 2024. The investigation found that the clinic had refilled and reused saline squeeze bottles during skin swab collection. This resulted in contamination of the saline with *P. lilacinum*, which was transferred to the skin when swab specimens were obtained. Whole genome sequencing confirmed that *P. lilacinum* isolates from patient swab specimens were closely related to environmental isolates from the contaminated bottles. The clinic discontinued use of refillable squeeze bottles in January 2025 and transitioned to single-use saline packets, after which no further cases were reported. This investigation underscores the importance of proper diagnostic specimen collection procedures and infection prevention and control practices in clinical settings.

Investigation and Findings

Public Health Notification

In April 2024, a Washington dermatology clinic notified Clallam County Public Health of atypical fungal skin infections in six patients who had been evaluated at the clinic during January 4–April 1, 2024. The patients reported rashes of varying descriptions, with onsets ranging from weeks to months before seeking care at the clinic, and all six had *Purpureocillium lilacinum* cultured from skin swabs. By June 2024, the clinic had identified *P. lilacinum* in skin swabs collected from 15 patients. However, because fungal skin infections can only be confirmed through punch biopsy or skin scrapings (1), the Washington State Department of Health (DOH) and CDC initiated an investigation into the reported cluster to verify the diagnoses and determine whether a common exposure

existed among patients with *P. lilacinum* cultures from skin swabs reported by the clinic. This investigation was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.*

Epidemiologic Investigation

Patient record review. DOH abstracted medical records and interviewed 15 patients reported with *P. lilacinum* cultured from their clinical specimens as of June 2024. Records included information from the index visit, medical history, and most recent progress notes. Abstracted information included demographic characteristics, *P. lilacinum* laboratory testing results, and clinical history (e.g., signs, symptoms, preexisting conditions, surgeries, and treatment). Because little was known about potential sources of infection, telephone interviews using a standardized questionnaire inquired about a wide range of potential community exposures, including animals, recreational activities (e.g., use of recreational water sources and outdoor activities), social spaces (e.g., gyms and social organization or group settings), congregate living settings, outdoor occupations, and skin care products applied to the rash site.

Clinical characteristics. Among 15 patients with reported positive *P. lilacinum* culture results during January 4–June 11, 2024, all but one had a rash; the reason the patient without a rash received testing is not known. Among the 14 patients with rashes, the rash was on the lower extremities of eight patients, on the head or neck of four patients, and in the genital area of two patients. Only one patient had had surgery during the year preceding rash onset, and the surgical site differed from the rash location. Among all 15 patients, 10 were prescribed topical antifungal medications, including seven who received ketoconazole and three who received clotrimazole. No information about the reported effectiveness of these medications in resolving reported rashes among patients is available.

Ascertainment of potential exposures. DOH completed interviews with 10 patients, eight of whom reported exposures to pets or participation in yardwork or gardening. Three of 10 patients reported frequenting social spaces, and two patients reported visiting outdoor recreation spaces or water sources, having an outdoor occupation, or living in a congregate setting.

*45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

Six of the 10 patients reported using various ointments, lotions, or other skin care products near the rash site before receiving testing for *P. lilacinum*. Neither a common product used by all patients nor a common community exposure source was identified.

Review of fungal culture results and identification of additional cases. On October 9, 2024, the clinic reported to DOH seven additional patients with *P. lilacinum* isolates from specimens collected during July 22–September 30, 2024, for a total of 22 patients in 2024. Fungal cultures yielding *P. lilacinum* performed by a commercial laboratory (Labcorp) during January 2023–October 2024 were analyzed. The laboratory, which received specimens from the clinic, reported that the number of *P. lilacinum* isolates from Washington during 2024 (30) was approximately four times the number reported during 2023 (seven) and that 28 (93%) of 2024 Washington specimens were skin swabs submitted by the clinic in 2024. The laboratory did not observe an increase in *P. lilacinum* isolates from other states during this period. DOH contacted other dermatology clinics in the region and did not identify any additional *P. lilacinum* isolates. The clinic did not provide additional patient line lists after October 9, 2024; thus, DOH was not able to reconcile the number of isolates reported by the laboratory with the number of patients examined at the clinic or to verify that the 30 laboratory test results represented unique patients.

Review of clinic procedures. On January 13, 2025, DOH conducted a telephone consultation with the clinic to discuss its specimen collection protocol. The clinic reported that, when swabbing dry, nonpurulent rashes of unknown etiology, the clinic health care provider would first place a drop of saline solution from a refillable squeeze bottle onto sterile gauze pad and wipe the skin where the rash was located (Figure). A drop of saline from the same squeeze bottle would then be placed onto the tip of the sterile swab before swabbing the rash and packing the swab in the transport tube. The plastic squeeze bottles were repeatedly opened and refilled using commercially produced single-use, 1-L containers of 0.9% sodium chloride (sterile saline) solution. The same squeeze bottles had been used regularly by clinic providers for at least 1 year and were not cleaned or sterilized between refills. Leftover solution from 1-L saline containers was occasionally saved and used to refill the squeeze bottles as needed. DOH observed this process during a subsequent on-site visit in February 2025, which included a specimen collection procedure demonstration.

Laboratory Investigation

In February 2025, DOH visited the clinic and retrieved six refilled squeeze bottles, four 1-L source saline bottles (three opened and one unopened), and three unopened swabs. An

Summary

What is already known about this topic?

Purpureocillium lilacinum is a common environmental mold. *P. lilacinum* skin infections are rare and mostly occur in immunocompromised persons.

What is added by this report?

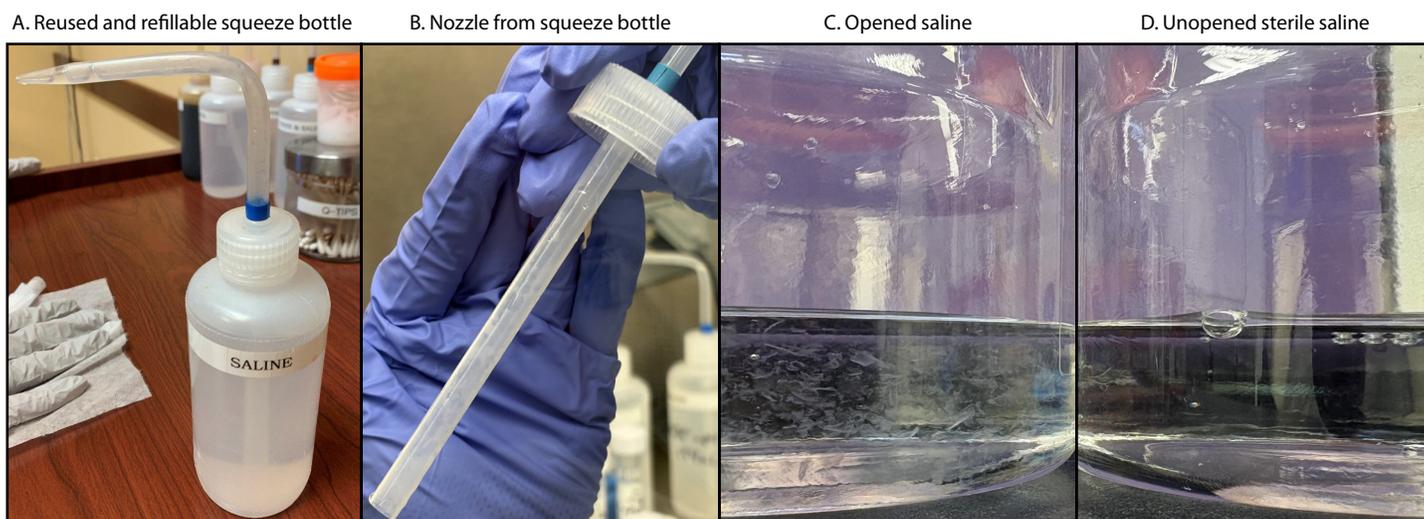
In 2024, a Washington dermatology clinic that collected skin swab specimens for diagnosis of fungal skin infections, rather than the recommended biopsy or skin scraping specimens, reported 22 patients with cultures yielding *P. lilacinum*. All swab specimens were contaminated by saline from squeeze bottles that had been repeatedly refilled and reused by clinic staff members during specimen collection. Isolates from patient swab specimens and from the contaminated bottles were closely related by whole genome sequencing; in this investigation, no patient received confirmation of clinical infection with *P. lilacinum*.

What are the implications for public health practice?

Proper specimen collection procedures, diagnostic practices, and infection prevention and control measures are critical to providing recommended care in clinical settings.

additional swab, used by clinic staff members to demonstrate specimen collection with single-use saline during the DOH visit, was also collected. All samples were received by CDC for culture and identification of *P. lilacinum*. Aliquots (10-mL and 100-mL samples from the squeeze bottles and the source saline bottles, respectively) were filtered through 0.22-micron filters and cultured on Sabouraud dextrose agar with chloramphenicol and gentamicin (SAB with C+G). Swab samples were extracted in phosphate-buffered saline containing 0.02% Tween-80, vortexed, and plated on SAB with C+G. Plates were incubated aerobically at 98.6°F (37°C) and observed for up to 7 days for growth of suspected *P. lilacinum* colonies. Confirmatory identification of suspected *P. lilacinum* isolates was performed on the basis of polymerase chain reaction (PCR) amplification and Sanger sequencing of the internal transcribed spacer (ITS) region of the ribosomal RNA (rRNA) gene locus within the ribosomal DNA that codes for rRNA using ITS4 and five PCR primers (2,3). *P. lilacinum* was identified from the six refilled squeeze bottles and one of the 1-L opened source saline bottles. *P. lilacinum* was not isolated from the unopened 1-L source saline bottles, the demonstration swab used by clinic staff, or any of the unopened swabs. In addition to these tests, one isolate from a patient's skin swab was sent from the commercial laboratory to CDC; whole genome sequencing was performed to assess relatedness among this skin swab isolate, environmental isolates, and nonrelated comparator isolates. The skin swab isolate and environmental isolates were within 100 single nucleotide polymorphisms (SNPs) of each other; comparator isolates differed by approximately 200,000 SNPs.

FIGURE. Refillable squeeze bottle contaminated with *Purpureocillium lilacinum* (A), cap and nozzle from refillable squeeze bottle (B), and opened (C) and unopened (D) saline bottles* used to refill squeeze bottles — Washington, 2024



Photos/Washington State Department of Health; CDC

* Opened bottle includes particulate matter; unopened (sterile) bottle is clear.

Public Health Response

On January 28, 2025, DOH provided clinical standards of care information to the clinic and advised changing specimen collection procedures. DOH advised the clinic to immediately remove all reusable squeeze bottles in the clinic. In addition, DOH advised the clinic to confirm suspected fungal skin infections through biopsies, not superficial skin swabs. On January 29, 2025, clinic staff members transitioned to using single-use saline packets. Since February 2025, no swabs have been submitted for fungal cultures to the commercial laboratory and no patients with cultures yielding *P. lilacinum* have been reported by the clinic. During a telephone check-in with the clinic on May 29, 2025, clinic staff members noted that none of the patients who had *P. lilacinum* erroneously diagnosed by skin swab have had subsequent biopsies or other clinical specimens collected. DOH advised clinic staff members to reevaluate diagnoses of patients who had *P. lilacinum* isolates identified from cultures. As of June 5, 2025, none of the patients had received an alternative diagnosis. No evidence indicates that *P. lilacinum* caused the reported rashes among patients.

Discussion

P. lilacinum is a mold found commonly in the environment. Skin infections caused by *P. lilacinum* most frequently occur among immunocompromised persons (4). Previous reports of *P. lilacinum*-associated skin infections (4–6) describe tender, red plaques with pustules or ulcers. Many reported *P. lilacinum* infections have been associated with having had a recent surgical procedure or having an immunocompromising

condition (7). Other clinical signs of *P. lilacinum* infections include invasive disease, endocarditis, fungal keratitis, and pneumonia (8,9).

In this investigation of a *P. lilacinum* pseudo-outbreak, no patient had undergone recent surgery or was immunocompromised. No patient received confirmation of a clinical infection through *P. lilacinum* detected from a biopsy specimen or skin scraping or had a rash consistent with a *P. lilacinum* skin infection. In addition, whole genome sequencing indicated that *P. lilacinum* isolated from a patient's skin swab was closely related to environmental isolates (e.g., refilled saline squeeze bottles), providing strong evidence that swabs were contaminated at the time of specimen collection. Because the date when the squeeze bottles were first used in the clinic is not known, the mechanism that led to fungal colonization of the squeeze bottles cannot be determined. Fungi were likely present in or near the clinic and proliferated within multiple squeeze bottles because they were being refilled without sterilization.

The identification of this pseudo-outbreak depended on close collaboration among the commercial laboratory, state and local public health agencies, and CDC. Coordination among all parties enabled timely data sharing and resulted in the identification of the contamination source.

Implications for Public Health Practice

This investigation highlights the value of using recommended diagnostic procedures and implementation of infection prevention and control procedures to avert contamination of medical equipment. An appropriate tissue specimen (e.g., punch biopsy) is needed to confirm a fungal skin infection.

Refilling bottles with aqueous solutions for clinical use can lead to proliferation of certain microorganisms (10). Although this pseudo-outbreak did not involve clinical skin infections caused by *P. lilacinum*, exposing an open wound to contaminated products or medical equipment could result in infection. Antifungal treatment should only be prescribed when appropriate clinical specimens (e.g., biopsy) confirm clinical infection. To reduce the risk for misdiagnosis due to clinical specimen contamination, medical equipment and products must be used and maintained according to manufacturers' instructions.

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