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Review of *Candida auris* – An Emerging Global Threat

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Abstract

Candida auris has emerged as a significant global health threat due to its unique characteristics and challenges in management. This literature review aims to provide an overview of why *C. auris* is a current topic of interest, its distinct features compared to other *Candida* species, its morphology, clinical symptoms, molecular detection methods, and the factors contributing to its pathogenicity in human infections. The review also discusses the challenges in controlling *C. auris* infections, including its high prevalence and multidrug resistance. Additionally, it examines the epidemiology and global spread of *C. auris*, highlighting the need for effective prevention strategies. Furthermore, the review explores the interaction between *C. auris* and COVID-19, emphasizing the importance of understanding this relationship in the context of the ongoing pandemic. Finally, the review outlines future research directions and potential strategies for combating *C. auris* infections.

Keywords – Antifungal resistance – COVID-19 – prevalence – superbug – virulence factors

Introduction to *Candida* sp.

Candida is a genus of yeasts, specifically classified within the kingdom Fungi, phylum Ascomycota, class Pichiomycetes, order Serinales and family Debaryomycetaceae (Schoch et al. 2020, Wijayawardene et al. 2022, ACIR Community 2024). They are one of the most common causes of fungal infections worldwide. Most *Candida* species coexist peacefully as endosymbionts with their hosts, including humans. However, they may invade and result in opportunistic infections when mucosal barriers are disrupted, or the immune system is weakened (Basmaciyan et al. 2019, Romo & Kumamoto 2020). In addition to the skin, *Candida* can be found on most mucosal surfaces, primarily in the gastrointestinal tract (Spampinato & Leonardi 2013). Although, most members of the *Candida* genus can undergo a reversible morphological switch from yeast to hypha. This switch occurs under adverse environmental conditions or during pathogenic infection in the human host (Gabaldón 2019, Chow, Pang & Wang 2021).

Infection caused by *Candida* is known as candidiasis (Naureen & Rafiq 2024). If the conditions within the mouth, throat, vagina, or esophagus shift in a way that promotes fungal growth, *Candida* may proliferate and result in an infection. Oral candidiasis typically presents as white pseudomembranes, while vulvovaginal candidiasis causes intense pruritus and edema (McCort 2021). Invasive candidiasis is a dangerous infection, rather than vaginal yeast infections or *Candida* infections of the mouth and throat (commonly known as "thrush"). Invasive candidiasis can affect the blood, heart, brain, eyes, bones, and other organs of the body (Koundal & Cojandaraj 2020,

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McCarty White & Pappas 2021). Invasive candidiasis can have mortality rates reaching 40% even with antifungal treatment (Kullberg & Arendrup 2019).

As of the latest records in Index Fungorum, approximately 902 species of *Candida* have been documented (Index Fungorum 2024). However, only a few of these species are of medical importance, including whereas only a few numbers of these species are of medical importance such as, *Candida albicans*, *Candida krusei*, *Candida guilliermondii*, *Candida lusitaniae*, *Candida kefyr* (pseudotropicalis), *Candida rugosa*, *Candida famata*, *Candida inconspicua*, *Candida norvegensis*, *Candida dubliniensis*, *Candida lipolytica*, *Candida zeylanoides, Candida pelliculosa*, *Candida nivariensis*, *Candida albicans* var *Africana*, *Candida glabrata*, *Candida tropicalis* (Nasirian 2017) and *Candida auris*.

This review focuses on *Candida auris,* a multidrug-resistant fungal pathogen that poses a significant public health threat, particularly in hospital settings (Imtiaz et al. 2022).

Why is *Candida auris* a current topic of interest, and how does it differ from other *Candida* species?

Candida auris is the first fungal pathogen to pose a threat to public health worldwide, which has recently emerged (Johnson et al 2018). This section reviews why *C. auris* is of particular interest, how it differs from other *Candida* species, and the implications for public health and clinical management.

The most isolated species in patients with invasive fungal infection (IFI) are *Candida albicans*, *Candida dubliniensis*, *Candida glabrata*, *Candida krusei*, *Candida parapsilosis*, and *Candida tropicalis* (Guinea 2014, Pfaller et al. 2014). However, since its initial description in 2009 (Satoh et al. 2009), *Candida auris*, a novel species of *Candida* that has simultaneously emerged on all five inhabited continents as a significant and novel public health hazard, has ended up being responsible for most *Candida* isolates and IFI in certain regions. (Garcia-Bustos et al. 2021)

One of the key distinctions of *Candida auris* is that it distinguishes itself from other *Candida* species through its extensive resistance to antifungal drugs and reduced susceptibility to azoles, polyenes, and echinocandins (Sarma & Upadhyay 2017, Worku & Girma 2020, Sanyaolu et al. 2022). Therefore, *Candida auris* infections have elevated mortality rates due to poor response to therapy (Kaki 2023).

Additionally, unlike many other species of *Candida, Candida auris* is not usually found as a resident commensal organism in the human gastrointestinal tract (Jackson et al. 2019, Nett 2019, Sikora & Zahra 2021).

Furthermore, *Candida auris* is distinguished from other *Candida* species by its ability to easily colonize both the human body and the environment (Iguchi et al.2019) and its high rate of transmission (Shyni & Lavanya 2021).

In terms of transmissibility when shed from infected or colonized patients, contaminated surfaces, and objects (fomites) can facilitate the spread of *Candida auris* from person to person. According to research, *C. auris* can be found in a variety of patient rooms as well as public areas such as windowsills, counters, chairs, beds, blood pressure cuffs, infusion pumps, and hallways. Commonly used medical devices with multiple uses, like pulse oximeters and temperature probes, could potentially act as reservoirs for *C. auris* (Biswal et al. 2017).

Because of its resistance to drugs and ability to persist in healthcare settings, *Candida auris* has been referred to as a "superbug" fungus that presents difficulties in its eradication.

Unlike other *Candida* species, *Candida auris* poses a significant identification challenge due to its potential for misidentification as other fungi and the need for specialized testing or molecular techniques for accurate detection. *Candida auris* can be mistaken for a variety of different organisms when using traditional phenotypic methods for yeast identification, such as VITEK 2 YST, API 20C, BD Phoenix yeast identification system, and MicroScan, leading to diagnostic delays and mismanagement (Forsberg et al. 2018, www.cdc.gov 2020).

These distinct characteristics not only make *Candida auris* a formidable pathogen but also highlight the urgent need for improved diagnostic methods, effective treatment strategies, and rigorous infection control practices.

Morphology of *Candida auris.*

On Sabouraud-dextrose agar, it is described as white to cream colonies with a smooth edge, which are germ tube test negative. On CHROMagar *Candida* medium, they produce pale to dark pink or rarely beige colonies (Iguchi et al. 2019). The yeast *Candida auris* is capable of growing at 42°C, a key distinguishing feature that helps differentiate it from other *Candida* species, which cannot grow at this elevated temperature (Kathuria et al. 2015, Casadevall et al. 2019).

Under a microscope, they can be observed individually, in pairs, or groups (Iguchi et al. 2019). However, *Candida auris* can exhibit various morphological phenotypes depending on the culture conditions, including round, ovoid, elongated, and pseudohyphal forms. For example, high concentrations of sodium chloride can induce the formation of pseudohyphal-like structures. Conversely, cycloheximide at concentrations of 0.1% and 0.01% inhibits its growth (Cortegiani et al. 2018).

Candida auris reproduce by budding, just like other *Candida* species. It has an oval form and measures 2.5–5.0 µm (Iguchi et al. 2019). *Candida auris* exhibits two distinct phenotypes: an aggregative form in which some isolates retain daughter cells after budding, forming large aggregates that cannot be separated by physical disruption even after vigorous vortexing for several minutes, and a non-aggregative form in which yeast cells are arranged as isolated or coupled cells like other *Candida* species (Garcia-Bustos et al. 2021).

Pseudohyphae are not produced in *Candida auris* therefore the germ tube test is negative. However, the formation of pseudohyphae can happen in the presence of high salt concentrations and depletion of heat shock protein, suggesting that stress may also be the cause of this morphological alteration (Bidaud et al. 2018).

However, none of the morphological characteristics of *Candida auris* are sufficient for definitive identification. Therefore, other methods, such as molecular techniques are needed to accurately distinguish *Candida auris* from closely related *Candida* species (Forsberg et al. 2018).

***Candida auris* symptoms and molecular detection**

Symptoms of a *Candida auris* infection depend on the location and severity of the infection. There is not a common set of symptoms specific to *Candida auris* infections (CDC 2024). Commonly these infections are associated with a range of symptoms, including fever, weakness, and respiratory issues (Konjengbam et al. 2022). Some patients may develop severe symptoms due to *Candida auris* infection, while others may harbor *C. auris* without exhibiting any symptoms (asymptomatic), a condition known as colonization. Patients who are colonized with *Candida auris* have the same potential to spread the organism as those who are symptomatic. Therefore, early detection of *Candida auris* is crucial in preventing and controlling outbreaks in healthcare facilities, as it helps identify both symptomatic and asymptomatic (colonized) patients who can spread the pathogen (CDC 2024).

Moreover, the pathogen's rapid emergence and high mortality rate underscore the need for early diagnosis in order to implement effective infection prevention measures (Navalkele et al. 2017). Delays in early and accurate identification of *Candida auris* lead to significant setbacks in applying appropriate infection control principles (Fasciana et al.2020). Prompt identification enables timely intervention and effective management strategies, crucial for controlling the spread and minimizing the impact of *C. auris* in healthcare settings (Vallabhaneni et al. 2019).

However, the accurate identification of *C. auris* can be challenging, with misidentification as other *Candida* species being common (Mahmoudi et al. 2019). This underscores the need for reliable and cost-effective diagnostic tools, such as DNA-based tests and matrix-assisted laser desorption ionization-time of flight mass spectrometry (Mahmoudi et al. 2019). Early and accurate detection using molecular techniques is crucial for preventing the spread of *C. auris* in healthcare settings, where it often causes outbreaks (Caceres et al. 2019).

Various molecular detection methods have been developed for *Candida auris*, a multidrug-resistant pathogen. Kordalewska (2017) and Ruiz-Gaitán (2018) designed PCR assays targeting specific nucleotide sequences and GPI protein-encoding genes to identify *C. auris* and related species accurately. Sattler (2021) compared the performance of two commercially available qPCR kits, AurisID and Fungiplex *Candida auris* RUO Real-Time PCR, and found that both could *detect C. auris*, with the former showing a lower limit of detection but also a higher rate of false positives. Walchak (2020) developed a real-time PCR assay for the direct detection of *C. auris* from surveillance swabs, blood, and urine, demonstrating its ability to differentiate *C. auris* from closely related species. These studies collectively highlight the potential of molecular methods for accurate and rapid detection of *C. auris*.

Unveiling the menace: Dangerous Factors of *Candida auris* in Human Infections.

Candida auris has become a major fungal pathogen due to its ability to cause invasive infections and outbreaks in healthcare facilities that have proven difficult to control and treat. It is also often resistant to medications. Recently, there have been significant outbreaks in numerous countries due to *C. auris*' remarkable capacity to easily contaminate the environment around colonized patients and persist for extended periods (Ahmad & Alfouzan 2021).

Possibly because it forms resilient "dry" biofilms on plastic surfaces, in hospital environments, and on medical devices, *Candida auris* is difficult to eradicate through standard cleaning and decontamination methods (Welsh et al. 2017).

Additionally, they increase the risk of death, especially in people with compromised immune systems or pre-existing medical conditions. The information that is currently available suggests that the risk factors for developing an infection with *Candida auris* are comparable to those for other species of *Candida*. The immune system suppressors include diabetes mellitus, cancer, chemotherapy, central line catheterization, the use of broad-spectrum antibiotics, neutropenia, total parenteral nutrition, hemodialysis, blood transfusion, major surgery within a month, critical care, concurrent bacteremia or candidemia, candiduria, indwelling urinary catheter, and chronic kidney diseases (Raiesi et al.2019).

Challenges in controlling *Candida auris* infections: insights into the high prevalence of *Candida auris*.

Candida auris can lead to various infections, with candidemia or bloodstream infection being the most common manifestation. Other infections associated with intravascular devices, such as central catheters, as well as endocarditis, urinary tract infections (candiduria), central nervous system infections, respiratory tract infections, intra-abdominal infections, skin and soft tissue infections, external otitis, otomastoiditis, panophthalmitis, and even osteomyelitis and spondylodiscitis, have also been described (Garcia-Bustos et al.2021)

Candida auris demonstrates thermotolerance, thriving best at 37°C and remaining viable up to 42°C. Moreover, it exhibits salt tolerance, and its cells tend to aggregate into large, resilient clusters that are challenging to disperse, potentially aiding its persistence in hospital settings (Rossato & Colombo 2018)

Also, their high prevalence is associated with factors like adherence and the ability to form biofilms. *C. auris* has two growth characteristic phenotypes, i.e., aggregative and non-aggregative. In aggregate form, it does not release its daughter cells after budding. This characteristic leads to the formation of large cell aggregates with high physical resistance, potentially providing the cells with increased resilience in tissues and the environment (Borman et al. 2016). Additionally, the non-aggregated form of *Candida auris* can create more robust biofilms with greater thickness and higher rates of cell death compared to the aggregated form. This ability to form diverse biofilms contributes to *C. auris* being a challenging pathogen to eradicate and capable of causing hospital epidemics of invasive and persistent infections (de Cássia Orlandi Sardi et al. 2018) Due to these characteristics, *C. auris* is resilient on the environmental surfaces despite disinfection.

Recognized worldwide as a significant health concern, *Candida auris* is an invasive fungal pathogen known for its broad innate and acquired resistance to antifungal medications. There is a rising number of reported cases of *C. auris* that are resistant to standard antifungal treatments such as azoles, echinocandins, and polyenes, posing challenges in treatment. Their antifungal resistance plays an important role in their prevalence. (Sanyaolu et al. 2022)

It has been discovered that the fungal pathogen *Candida auris* can evade the immune response in several ways. Both Horton et al. 2021 and Johnson et al. 2018 discovered that *C. auris* poorly recruits neutrophils and evades immune attack, the latter suggests that this is because of the pathogen's cell wall mannosylation. In patients with invasive candidiasis, Kernien (2020) showed that the inhibition of neutrophil extracellular traps (NETs) formation increases this evasion. Also, *Candia auris* employs metabolic strategies to evade the immune system and kill macrophages, as demonstrated by Weerasinghe et al. 2023. These results provide insight into the immune-evading mechanisms that *C. auris* uses to maintain its virulence and high mortality rates.

Overall, *Candida auris* is a dangerous pathogen that is difficult to control because of its capacity to cause severe infections, high tolerance, environmental persistence, multidrug resistance, and ability to elude the immune system.

Epidemiology and Global Spread of *Candida auris.*

Since the first reported in 2009 which isolated from a patient's ear canal in Japan, *Candida auris* has emerged as a major human fungal pathogen (Satoh et al. 2009). Since then, this species has become a "serious threat" in healthcare settings, according to the United States Centers for Disease Control (CDC), and is now listed as a "most wanted" critical pathogen by the World Health Organization (WHO).

Estimating the global incidence rates of *C. auris* colonization and infection has been challenging, as this fungus may not be included in surveillance programs in many countries, and some jurisdictions may have limited laboratory detection capacity. However, available data suggest an increasing trend over the last decade, with outbreaks occurring in numerous countries. The number of cases has also been reported to increase during the COVID-19 pandemic.: (Main conclusions and options for response 2022) *Candida auris* has emerged as a global concern, with reported cases in at least 50 countries across six continents (Vaseghi et al. 2022, Ahmad & Asadzadeh 2023).

Between 2013 and 2021, a total of 1,812 cases of *Candida auris* were identified in the European Union. Sporadic cases of *C. auris* have been detected in all European countries, with hospital outbreaks reported in the UK, Denmark, France, Germany, Greece, Italy, and Spain. In Canada, from 2012 to 2022, there were 43 individuals known to test positive for *C. auris*, with 19 (44.2%) identified in the last three years (Geremia et al. 2023).

In the United States, in the most recent 12 months (January 2022 - December 2022), there were 2,377 clinical cases and 5,754 screening cases reported (Anon 2019). Some studies have also reported *C. auris* infections in over 50 countries and territories worldwide. These include countries/territories in Asia such as Bangladesh, China, India, Iran, Israel, Japan, Kuwait, Lebanon, Malaysia, Oman, Pakistan, Qatar, Saudi Arabia, Singapore, South Korea, Taiwan, Thailand, the United Arab Emirates, and Vietnam; in Europe such as Austria, Belgium, Britain, Denmark, France, Germany, Greece, Italy, Netherlands, Norway, Poland, Russia, Spain, and Switzerland; in the Americas including the Brazil, Canada, Chile, Colombia, Costa Rica, Guatemala, Mexico, Panama, Peru, the USA, and Venezuela; in Africa such as Algeria, Egypt, Kenya, Nigeria, South Africa, and Sudan; and in Oceania including Australia (Oladele et al. 2022, Ahmad & Asadzadeh 2023).

The spread of *Candida auris* around the globe is influenced by various factors, including environmental, and host immunity.

Environmental factors play a crucial role in *C. auris* spreading throughout the world, with the pathogen able to survive harsh environments (Chakrabarti & Sood 2021). Some studies suggest that climate change may have contributed to the spread of *Candida auris* as well (Ellwanger & Chies, 2022, Thakur. 2022, Garcia-Bustos et al. 2023)

The global rise in *Candida auris* infections is also significantly linked to the increasing number of immunocompromised patients (Sanyaolu et al. 2022, Cristina et al. 2023). *C. auris* primarily affects immunocompromised individuals, such as ICU patients, organ transplant recipients, and cancer patients (Sanyaolu et al. 2022). Prolonged hospitalization, mechanical ventilation, and broad-spectrum antibiotic use contribute to increased *C. auris* colonization and infection rates among patients (Khojasteh et al. 2022).

Multidrug resistance in *Candida auris.*

Since *Candida auris* has shown resistance to common antifungal medications, treatment can be challenging (Sanyaolu et al. 2022). In general, antifungal agents target similar mechanisms in *Candida auris* as they do in other fungal species. Azole, echinocandin, polyene, and flucytosine are the antifungal drug classes that are used against *Candida auris* (Frías-De-León et al. 2020). Many fungal processes, including the synthesis of ergosterol, cell walls, nucleic acids, microtubules, mitochondrial function, and protein synthesis, are impacted by these drugs. The effectiveness of these medications against *C. auris* may be restricted, due to the pathogen's special traits and propensity to evolve resistance mechanisms (Bhattacharya Sae-Tia & Fries 2020, Frías-De-León et al. 2020).

Determinative epidemiological cutoff values for antifungal susceptibility and clinical breakpoints for treating *C. auris* infections have not been established due to a lack of available epidemiological data and clinical experience. To assist healthcare providers, the CDC has suggested provisional breakpoints based on clinical and susceptibility data for *C. auris* that are currently available (Anon 2019). The estimated frequency of *Candida aruis* resistance to fluconazole, amphotericin B, and echinocandins exceeds 90%, 30%, and roughly 5%, respectively, based on CDC tentative breakpoints. Echinocandins are now the first-line treatment for *C. auris* infections due to the growing resistance to azoles and amphotericin B (Cortegiani et al. 2018).

Fluconazole and other triazole antifungals act by competitively inhibiting sterol demethylase, a key enzyme of the ergosterol-biosynthesis pathway in fungi. Fluconazole has limited effectiveness against *C. auris* because the majority of clinical isolates of the pathogen are resistant to it. The mutation of the gene encoding the sterol-demethylase enzyme (ERG11) is one mechanism of fluconazole resistance that has been repeatedly found in *C. auris*, another common contributor to clinical triazole resistance among multiple species of *Candida* is increased expression of efflux-pump-encoding genes, another is mutations in genes encoding zinc-cluster transcription factors (ZCF), such as TAC1B and MRR1A, can lead to increased expression of efflux pump-encoding genes and contribute to fluconazole resistance, Aneuploidy (An increase in ERG11 copy number as a result of aneuploidy can amplify the effects of mutations in ERG11), Additional, less common mutations in ERG11 and other genes have been reported in *C. auris* isolates, particularly among isolates from specific genetic clades. Some of these mutations have been shown to increase fluconazole MIC. Overall, fluconazole resistance in *C. auris* is likely the result of a combination of multiple resistance mechanisms and mutational stacking in single isolates. The specific mechanisms may vary among isolates from different genetic clades of *C. auris*. (Rybak et al. 2022).

The echinocandins work by inhibiting the synthesis of 1,3-beta-glucan, a major component of the fungal cell wall. Approximately 5% of *C. auris* clinical isolates are resistant to echinocandins, and in many cases, this resistance emerges during therapy. The most observed mutations in echinocandin-resistant isolates of *C. auris* involve substitutions at the amino acid position S639, including S639F, S639P, and S639Y (Biagi et al. 2019) Additional mutations in both hot-spot regions one (D642Y, S639T, F635L/Y, and F635del substitutions) and two (R1354S/H substitutions) have been reported less frequently (Al-Obaid et al. 2022).

Amphotericin B exerts its antifungal activity by directly binding it to ergosterol, the predominant fungal membrane sterol. This binding leads to the formation of pores in the cell membrane and/or sequestration of ergosterols. In *Candida* species, mutations in ergosterol biosynthesis genes such as ERG2, ERG3, ERG5, ERG6, and ERG11 can reduce susceptibility to amphotericin B, likely due to reduced ergosterol levels in the cell membrane. While amphotericin B resistance is uncommon among clinically common *Candida* species, approximately 50% of all *C.*

auris isolates are amphotericin B resistant according to tentative breakpoints proposed by the CDC. However, the specific mechanism(s) by which *C. auris* becomes resistant to amphotericin B are poorly understood (Rybak et al. 2022).

Also, biofilm formation enables drug sequestration within the extracellular matrix, leading to antifungal tolerance seen in numerous *Candida* species. A study revealed that *C. auris* isolates with biofilms displayed no susceptibility to any antifungal agent, including fluconazole, echinocandins, and polyenes, unlike planktonic (free-living) *C. auris* isolates, which were only resistant to fluconazole. (Romera et al. 2019).

Candia auris and Covid -19

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2; generally known as Covid 19) has emerged as a major global health crisis, reminiscent of the Spanish influenza pandemic of the early 20th century (Hu et al. 2021. The mortality rate associated with COVID-19 in hospitals ranges from 15% to 20% and can increase to 40% among patients requiring intensive care unit (ICU) admission (Wiersinga et al. 2020). Sever patients often require intensive medical interventions, such as mechanical ventilation, extracorporeal membrane oxygenation, continuous renal replacement therapy, glucocorticoids, and intravenous immune-globulin therapy. These interventions can increase the risk of co-infections with various microorganisms, including fungi like *Candida auris* (Villanueva-Lozano et al. 2021, Khojasteh et al. 2022, Nazari et al. 2022). This co-infection has been associated with high mortality rates, even with appropriate antifungal therapy (Villanueva-Lozano et al. 2021).

Candida auris is particularly concerning due to its ability to persist on hospital surfaces and its high resistance to antifungal drugs.

The COVID-19 pandemic has created an environment conducive to such fungal infections, especially among ICU patients (Villanueva-Lozano et al.2021). In the latter 2020, several countries, including Brazil, Colombia, India, Italy, Guatemala, Lebanon, Mexico, Panama, Peru, and the United States, reported cases or outbreaks of co-infection with *C. auris* in COVID-19 patients. This highlights the importance of studying and understanding the characteristics of these co-infections (Khojasteh et al. 2022). In 2021 in a COVID-19 specialty care unit in Florida, an outbreak of *C. auris* was reported, highlighting the need for aggressive measures to limit its spread (Prestel 2021). The comprehensive review on *Candida* by Khojasteh et al. (2022) has identified 27 studies, 14 of which provided data on COVID-19-associated *C. auris* infections. These infections have been reported in various regions, including the Americas, Europe, and Asia, suggesting a global concern (Khojasteh et al. 2022)

Prevention strategies for _Candida auris_ infections.

Primary infection control measures for preventing the transmission of *Candida auris* in healthcare settings include adherence to hand hygiene practices, ensuring the appropriate use of Transmission-Based Precautions based on the setting, and regular cleaning and disinfection of the patient care environment and reusable equipment using recommended products (Special attention should be given to shared mobile equipment, such as glucometers and blood pressure cuffs), Communication about a patient's *C. auris* status is essential when transferring them to another facility, screening contacts of newly identified case patients to identify any *C. auris* colonization and to conduct laboratory surveillance of clinical specimens to detect additional cases promptly. (CDC. 2021).

When it comes to hand hygiene, alcohol-based hand sanitizer (ABHS) is the recommended method for hand hygiene when hands are not visibly soiled due to *C. auris*. However, if hands are visibly soiled, it is important to wash them with soap and water. It's crucial to keep in mind that good hand hygiene cannot be replaced by wearing gloves. (CDC 2019).

Transmission-based precautions, including contact precautions, must be adhered to for individuals with confirmed hospital-acquired infections such as *C. auris*. Contact precautions entail

wearing specific personal protective equipment (PPE) such as gowns, gloves, and possibly eyewear when caring for individuals with *C. auris* infections. (CDC 2020).

Since *C. auris* live on surfaces for weeks, it is critical to clean and disinfect surfaces and medical equipment continuously throughout the day (CDC 2024). Cleaning surfaces in rooms with *C. auris*-positive patients twice or three times daily using chlorine-based or other sporicidal disinfectants is highly effective in controlling cross-transmission of infection. To streamline cleaning procedures, it is advisable to use single-use items such as pillows, bedding material, and fiber cloth wipes for cleaning, as well as single-use equipment like thermometers and blood pressure cuffs for *C. auris*-positive patients. Less expensive items that are difficult to clean should be discarded (Ahmad & Asadzadeh 2023). CDC recommends using an Environmental Protection Agency (EPA)–registered hospital-grade disinfectant effective against *C. auris* (EPA's list (US EPA 2020).

Also, Patients under contact precautions should ideally be accommodated in single or private rooms to reduce the risk of spreading the infection to other patients (Isler 2023).

According to the CDC, Screening for *C. auris* colonization involves swabbing the armpits and groin area and is recommended for close healthcare contact with newly diagnosed patients, those who stayed in non-U.S. healthcare facilities in the past year, patients needing higher care levels like mechanical ventilation, and individuals in facilities suspected of ongoing transmission. (www.cdc.gov 2020).

Rapid and accurate detection of *C. auris* is crucial for preventing its transmission. Delayed recognition of infection or colonization and delayed implementation of infection control practices can lead to the rapid spread of C. auris among hospitalized patients who share space, facilities, and equipment (Kenters et al.2019, Ahmad & Alfouzan 2021).

Advances in molecular diagnostic procedures now enable the rapid identification of invasive *C. auris* infections within a few hours, with high sensitivity and specificity (Lockhart et al. 2022). Upon identifying a *C. auris*-positive case, hospitals should immediately inform their infection control team to implement transmission-based precautions (TBPs) to prevent the spread of the fungus to other patients in the facility. (Ahmad & Asadzadeh, 2023).

Future work

Candida auris has emerged as a significant global health threat due to its multidrug resistance and ability to cause severe infections in healthcare settings. Unlike *Candida albicans*, which has been extensively studied, *Candida auris* presents unique challenges in terms of diagnosis, treatment, and infection control.

The pathogen's resistance to multiple antifungal classes complicates treatment regimens and necessitates a deeper understanding of its underlying mechanisms. Despite the growing recognition of *Candida auris* as a critical pathogen, research into this species lags behind that of other *Candida species*. However, with ongoing outbreaks of *Candida auris* worldwide, there is a pressing need for more information, particularly in areas such as new diagnostic methods and treatment approaches for this multidrug-resistant superbug.

Additionally, molecular characterisation and understanding of the immunometabolism changes induced by the host immune system in response to *Candida auris* infection is crucial. These studies could provide valuable insights and approaches to better control and manage *C. auris* infection. Currently, there are numerous ongoing research projects focusing on these areas, aiming to enhance our understanding and develop effective strategies against *Candida auris*.

In addition to the infection mechanisms, further studies on comprehensive genomic and transcriptomic studies to understand the genetic diversity, evolution, and gene expression of different *Candida auris* strains, including those resistant to antifungal drugs. Investigating the virulence factors of *Candida auris* and conducting epidemiological studies to determine the global prevalence, distribution, and risk factors associated with *Candida auris* infections, as well as improving surveillance systems for early detection and containment of outbreaks.

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