

***Candida auris* prevalence, risk factors and outcomes among acute inpatient physical
rehabilitation patients**

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Abstract:

Background: *Candida auris* (*C. auris*) is multi-drug resistant fungus that is known to cause serious and sometimes fatal infections. The organism also persistently colonizes hospital environments and multiple body sites of patients. The high transmissibility of *C. auris*, contributes to prolonged outbreaks in healthcare settings, which are challenging to manage, as there is uncertainty on how to best stop the spread of *C. auris*, identify *C. auris*, and treat *C. auris* colonization and infection.

Objective: To identify risk factors for *C. auris* colonization and infection in patients undergoing rehabilitation; these results will inform future surveillance and screening programs targeted towards patients at risk for *C. auris* colonization and infection.

Design: Retrospective analysis of risk factors associated with *C. auris* infection or colonization.

Setting: Acute rehabilitation facility (ARF) affiliated with an academic medical center.

Participants: Patients receiving care in an ARF from October 1, 2019 to January 31, 2020.

Methods: Risk factors, including presence of immunodeficiency, care location, presence of a feeding tube, tracheostomy, mechanical ventilation, presence of a central line, history of other multi-drug resistant organisms (MDROs), and the presence of non-intact skin, wounds, and pressure injuries were reviewed retrospectively via the patient's electronic medical record (EMR). The main outcome measure was the presence of a *C. auris* laboratory test result indicating infection or colonization.

Statistical Analysis: We used descriptive statistics to describe the study population and the frequency of study outcomes. Odds ratios were performed to examine statistically significant differences. All the analyses were done using Microsoft Excel.

Results: Of the 205 eligible ARF patients, 11 (5.37%) patients were positive and 194 (94.63%) patients were negative for *C. auris* lab result. The prevalence of positive *C. auris* lab culture was 5.37 patients per 100 patients tested *C. auris* colonization or infection during the study period. Patients with a prior history of infection or colonization of other MDROs were more likely to be at risk for *C. auris* colonization or infection, OR=6.55 (95% CI 1.38-31.13). However, there was no significant association between *C. auris* infection or colonization and presence of immunodeficiency, care location, presence of feeding tube, tracheostomy, mechanical ventilation, or central line, and the presence of non-intact skin, wounds, and pressure injuries.

Discussion: Among patients in an ARF, prior history of colonization or infection with other MDROs was associated with a significantly increased risk of a positive *C. auris* lab result. Other risk factors studied also had increased odds ratio for positive *C. auris*, however the relationship was not statistically significant. Further research, incorporating a larger sample and timeframe is needed to overcome the current study's limited power to investigate the association between *C. auris* and the other exposures or clinical factors. These results may help identify patients at risk for *C. auris* colonization and target patients for surveillance.

Introduction:

Candida auris (*C. auris*) is a multi-drug resistant yeast that is known to cause serious bloodstream, urinary, respiratory and wound infections.¹ These infections are difficult to treat, and in some cases have been resistant to all three main classes of antifungal medications.^{1,2} *C. auris* infections can also be fatal.^{1,3} Findings from various studies indicate that the crude mortality rates for *C. auris* infections range from 32-66%, depending on the patient's underlying medical conditions, geographic region, age, and the clinical management of the infection.⁴⁻¹⁰

The first case of *C. auris* was described in 2009, after it was isolated from the ear canal of a 70-year-old woman at Tokyo Metropolitan Geriatric Hospital in Japan.¹¹ Since then, *C. auris* infections have emerged in many facilities across the globe.^{3,5,6,8,12-15} *C. auris* can spread through contact with affected patients and contaminated environments or surfaces. Individuals may also be colonized with *C. auris*, such that the person has the fungus somewhere on their body, but does not have an infection or symptoms of an infection. Findings suggest that *C. auris* may persistently colonize hospital environments and multiple body sites of patients, leading to high transmissibility, and prolonged outbreaks.^{3,8,10}

The prevalence and epidemiology of *C. auris* remains uncertain. One of the causes may be underestimation due to limited availability of accurate and conventional diagnostic tools.¹⁶ When using traditional phenotypic yeast identification methods, including VITEK 2 YST, API 20C, BD Phoenix yeast identification system, and MicroScan, *C. auris* can be misidentified as number of different organisms.¹⁷ Most often, *C. auris* is misidentified with *Candida haemulonii*, another rare yeast, but it has also been shown to be misidentified with *Candida duobushaemulonii*, *Rhodotorula glutinis*, *Candida sake*, *Candida intermedia*, *Saccharomyces*

kluyveri, *Candida catenulate*, *Candida famata*, *Candida guilliermondii*, *Candida parapsilosis*, and *Candida lusitaniae*. Accurate identification for *C. auris* is important, as early detection can help limit the spread of *C. auris*, while misidentification can lead to inappropriate patient treatment and delay appropriate infection control precautions.¹⁷

The prevalence *C. auris* colonization in certain regions and healthcare settings has been estimated. In a study assessing *C. auris* in 19 New York healthcare facilities, which included hospitals, long-term care facilities, and private medical offices, the average prevalence of *C. auris* colonization was estimated at eleven per 100 screened patients.¹⁸ A similar study in Chicago screening over 1,300 patients across 20 facilities, highlighted that 6.7 percent of the patients were positive, where the median prevalence ranged 0 to 7.7 percent depending on the type of healthcare facility.¹⁹ Of those colonized patients, it is not certain how many develop an active *C. auris* infection, but one study's findings demonstrated that approximately 25% of colonized patients developed bloodstream infections.²⁰ Data collected by IDPH demonstrated that 84 (11%) of the 784 known screening-positive cases later developed clinical infections.²¹

There are populations of patients who are identified as being at-risk for colonization or infection with *C. auris*. Most people who acquire *C. auris* infections are already sick from underlying medical conditions.¹ Patients who require medical devices, including ventilators, tracheostomy tubes, feeding tubes, and central lines, are at increased risk of *C. auris*.^{1,3} The risk of *C. auris* is also heightened for those with weakened immune system, history of other MDROs, parenteral nutrition, recent invasive surgery or procedure, and exposure to antimicrobial agents.^{6,19,22-24} In the United States, the overwhelming majority of clinical and colonized *C. auris* cases are among patients or residents who are currently or have recently received healthcare in skilled nursing facilities (SNFs) and long-term acute care hospitals (LTACHs).^{1,2} SNFs and

LTACHs may have environmental contamination of the organism that leads to transmission to residents. Residents may also transmit these organisms to other residents. The high transmissibility of *C. auris* demonstrated in these facilities is impacted by SNF and LTACH residents increased risk for infections with MDROS and other HAIs, including *C. auris*, because of underlying health conditions, medical devices, recent or invasive surgery or procedures, and antibiotic use.^{1,19,21,24,25}

While *C. auris* is a topic of particular interest for hospitals and healthcare facilities, and public health more generally, there is still uncertainty on how to best stop the spread of *C. auris*, identify *C. auris*, and manage or treat *C. auris* colonization and infection.²⁶ In order to limit the spread of *C. auris* and to continue to learn more about this emerging pathogen, public health prevention efforts and interventions are of particular importance. As of April 2019, data from Illinois Department of Public Health (IDPH) demonstrates that *C. auris* cases are increasing in Chicago and the surrounding area with over 600 confirmed cases, 158 of which are clinical cases and 450 of which are colonized cases.²⁴ IDPH issued recommendations and guidelines for healthcare facilities to use personal protective equipment, implement isolation protocols for *C. auris*-positive patients, and practice disinfection of the patient environment and equipment in order to address risks related to *C. auris*. Furthermore, IDPH provided recommendations for screening and surveillance guidelines, where they identified patients with prior admission to a skilled nursing facility (SNF) or long term acute care hospital (LTACH) who also have a tracheostomy or mechanical ventilation, as being at-risk for colonization or infection with *C. auris*.^{21, 24} Additional data presented by IDPH, suggested that patients from these facilities presenting with feeding tubes and central lines may also be at increased risk for *C. auris*.²¹

In November of 2019, Shirley Ryan AbilityLab (SRAlab), a medicine and rehabilitation research hospital, initiated an on-admission *C. auris* screening program. This was a time-limited study to identify patients colonized with *C. auris* and determine the prevalence of *C. auris* at their facility. Prior to this study, it was unknown how prevalent *C. auris* was in an acute inpatient rehabilitation population where patients are referred from various types of national and international care settings, including acute care hospitals (ACHs), SNFs and LTACHs. SRAlab implemented an admission screening program in order to limit the spread of this pathogen and, hopefully, better identify patients at risk for colonization or infection. The implemented screening program used the pre-identified criteria provided by the IDPH, which emphasized that patients with medical devices who previously received care in SNFs or LTACHs are at increased risk of *C. auris*.

Given the limited number of *C. auris* cases in Illinois, it is unclear if the IDPH criteria and the risk factors it relies on are representative of the risk of *C. auris* among ARF patients for acquiring this organism. As previously highlighted, other studies suggest that weakened immune system, history of other MDROs, parenteral nutrition, recent surgery and/or exposure to antimicrobial agents may also be associated with *C. auris*. Consequently, it appears that further analysis should focus on assessing risk factors for *C. auris*, in order to improve screening policies .

The Present Study

The current paper aims to investigate clinical factors that may increase ARF patients' risk of *C. auris* colonization and infection. More specifically, this secondary risk analysis and needs assessment of the data from SRAlab's pilot screening program for *C. auris*, considers the association between *C. auris* and presence of immunodeficiency, care location, presence of

feeding tube, tracheostomy, mechanical ventilation, or central line on admission, history of other MDROs, and the presence of non-intact skin, wounds, and pressure injuries. Through this analysis, we hope the current study will consider:

1. How effective are recommended screening programs at identifying at-risk patients for *C. auris* colonization?
2. How is this public health issue impacting ARF patients?

In turn, the results of the proposed study will further the general knowledge of *C. auris* in the fields of public health and infection prevention, and improve patient care provided to ARF patients.

Materials and Methods:

Population and Sample Selection:

The design of this study follows a retrospective cohort, and the protocols used were approved by the governing institutional review board for SRAlab.

The patient population consisted of inpatients at SRAlab, a nationally ranked physical medicine and rehabilitation research hospital based in Chicago, Illinois. SRAlab's flagship facility houses 242 licensed beds and receives patient transfers from local, regional, national, and international ACHs, LTACHs, SNFs and home care. At SRAlab patients stay in private rooms designated within a given Innovation Center, which is based off of the patients' primary clinical diagnoses or needs. The different Innovation Centers focus on pediatric care and four areas of adult care relating to brain, nerve + muscle + bone, cancer, and spinal cord. In terms of rehabilitation care, SRAlab therapy spaces focus on arms + hands, legs + walking, strength + endurance, and think + speak. These different therapy spaces, which are also referred to as AbilityLabs, are located on different floors, such that many patients travel throughout the

hospital to participate in their different services and therapies. SRAlab also provides patients with services to physician clinics, prosthetics and orthotics, outpatient rehabilitation, pool therapy, diagnostic imaging, dialysis, wound care, and laboratory services. Understanding that SRAlab houses many different employees, who provide a variety of different services, across several spaces, to a diverse patient population, underscores the expansive infection control needs of SRAlab, such as managing the spread of HAIs, like *C. auris*. Consistently, this dynamic health care environment calls for responsive infection control plans and policies to maintain access to SRAlab services, while upholding patient and employee safety, and high quality care.

SRAlab Patients were identified for inclusion in the study using reporting capabilities of Infection Prevention and Control Department surveillance software. Two data sources were compiled to generate the patient population:

1. Report of patients with laboratory tests ordered for *C. auris* colonization
2. Report of patients with clinical cultures for *C. auris* infection

Other information detailed in these reports included patient name, medical record number, culture collection date, body site tested, culture result, attending physician, admission date, care location, date of birth, and gender. Individuals meeting exclusion criteria were removed from the report output.

From these reports, all adult inpatients of SRAlab with documented *C. auris* laboratory tests or laboratory confirmed history of *C. auris*. were included into the study. Patients younger than 18 years of age during the study period and patients with documented history of *C. auris* history that is not laboratory confirmed were excluded from the sample.

Patients were identified from four different patient pools: SRAlab admits, SRAlab patients transferred to a nearby academic medical center, SRAlab patients included in *C. auris*

ring surveillance investigation, and SRAlab patients with laboratory confirmed history of *C. auris*. The first patient pool included patients admitted to SRAlab from November 21, 2019 to January 31, 2020. Of the 655 patients admitted to SRAlab and screened during this time frame, 33 patients were identified of meeting the inclusion criteria for *C. auris* screening: presenting to SRAlab on admission directly from a SNF or LTACH with a feeding tube, artificial airway, tracheostomy, and/or central line. Of those 33 patients, 32 patients (97%) were included in the statistical analysis; the lab culture for the one excluded patient was never finalized and could not be included in the analysis. An additional two patients admitted to SRAlab were included in the analysis, despite not meeting SRAlab's *C. auris* screening criteria. In total, 33 patients admitted to SRAlab were included in the final sample.

The second patient pool included SRAlab inpatients who were transferred or went on leave of absence to a nearby, participating academic medical center from October 1, 2019 to January 31, 2020, and had *C. auris* specimens collected and finalized, as a result of meeting this hospital's criteria for *C. auris* screening. Of the 181 SRAlab patients transferred to this nearby academic medical center during this time-frame, 128 patients (71%) were captured by their *C. auris* screening procedure with finalized specimens. In turn, 128 patients met the definition for the second patient pool and were included in the analysis.

The third patient pool included SRAlab inpatients with *C. auris* specimens collected as part of ring surveillance procedures. These procedures were carried out to rule-out and identify possible transmission events, occurring from lapses in isolation for patients colonized with *C. auris*, as documented from a positive screening culture. All 44 patients meeting the definition for the third patient pool had finalized *C. auris* lab cultures, and were, therefore, included in the study.

The fourth patient pool consisted of those SRAlab patients with a known history of *C. auris* colonization or infection confirmed by laboratory tests, who were not captured by the definitions for the first three patient pools; two patients met this definition. From these 4 different patient pools, a total of 205 patients were identified and included into the study.

Data Collection and Management:

Source data were compiled from multiple existing hospital resources generated from the Electronic Medical Record (EMR) and Electronic Data Warehouse (EDW). Additionally, individual chart review of the EMR was conducted to identify missing information. Using these sources, information on patient demographic data, history of other multidrug-resistant organisms, presence of immunodeficiency, utilization of medical devices, oral intake restrictions, presence of wounds, and wound types was collected or calculated. More detailed information on the data compiled from the EMR and EDW are detailed in the remaining paragraphs of this section.

Demographic and information relating to the study sample's characteristics were collected. Date of birth was collected and used to calculate age, which was defined as the patients' age on the date of their *C. auris* specimen collection. Patient gender was recorded as male, female, or unspecified. The admitting facility, or the referring facility that the patient was admitted from, was recorded as LTACH, SNF, or other.

The exposures and risk factors of interest were care location, presence of central line, feeding tube, tracheostomy, and/or mechanical ventilation, history of other MDROs, presence of immunodeficiency, and non-intact skin on admission. In order to obtain more information relevant to the exposure and risk factors, additional data on the following variables was obtained: hospital service, admission date, White Blood Cell count (WBC) date, WBC, MRSA, VRE,

CRE, ESBL, CDI, Other MDRO, diet type, liquid type, NPO, wound, pressure injury, multiple pressure injuries, and functional oral intake (FOI) score.

The hospital services documented in patients' EMRs were categorized into the service categories of brain injury, spinal cord injury, medically complex, neurology, orthopedic, cardiac, multiple major trauma, and other. The brain injury service category included patients designated with a traumatic brain injury, non-traumatic brain injury, nontraumatic brain injury with oncology, and AmiCous (minimally conscious) brain injury. The major multiple trauma service category included patients assigned to the major multiple trauma service with or without a brain injury or a spinal cord injury. Medically complex patients included those designated to the medically complex oncology, medically complex transplant liver/kidney, medically complex transplant lung/heart, and general medically complex services. Spinal cord injury (SCI) patients included those documented with nontraumatic SCI, traumatic SCI, traumatic SCI-quadruplegic, traumatic SCI-paraplegic, and a traumatic SCI requiring mechanical ventilation. The neurological services category included patients admitted for neurological associated health conditions, including Parkinson's disease and multiple sclerosis. Orthopedic services included those patients assigned to an orthopedic service for lower extremity fractures and amputations, as well as other orthopedic related health conditions. The service categories of cardiac and stroke included patients admitted to cardiac and stroke services, respectively. Lastly, the services that were not encompassed in the previously listed service categories were placed into the other service category. Related to the different service categories, each patient's care location, which are the floors where the patient was admitted to and received services while at SRAlab, was also recorded.

Presence of central line, feeding tube, tracheostomy, and/or mechanical ventilation was determined on admission to SRAlab. To supplement the investigation of how feeding tubes may impact *C. auris*, data on patient's diet type, liquid type, and NPO status on admission was recorded. Diet type and liquid type were scored according to the International Dysphagia Diet Standardization Initiatives scores for solid diet and liquid intake, respectively. Solid diet scores, ranging from three to seven, indicate the extent to which the food is texture-modified for patient swallowing. A lower score corresponds to more texture modification, while a higher score indicates less texture modification. More specifically, a score of three corresponds to liquidized food, a score of four indicates pureed food, a score of five documents minced and moist food, a score of six corresponds to soft and bite-sized food, and a score of seven denotes swallowing of regular food. The liquid diet scores range from zero to four, where a higher score indicates the extent to which drinks or liquids are thickened in order to reduce risk of aspiration. A liquid score of zero corresponds to consumption of a thin drink, indicating a "regular" liquid score. While scores of one, two, three, and four correspond to consumption of slightly thick, mildly thick, moderately thick, and extremely thick liquids, respectively. All patients' diet and liquid scores on admission were recorded; unless patients nutrition status was documented as NPO. NPO patients' nutrition assessments do not include liquid and diet scores due to their oral intake restrictions. In this way, NPO status was a binary variable, as patients were either documented as NPO or not NPO.

Lastly, functional oral intake (FOI) scores on admissions were recorded to further supplement nutritional information. The FOI Scale is an objective assessment of oral intake limitations and liquid and/or diet restrictions that follows a seven-point scale, from one to seven.²⁷ Scores one through three relate to varying degrees of nonoral feeding, indicating tube

dependence, such as no oral intake, tube dependent with minimal/inconsistent oral intake, and tube supplements with consistent oral intake. Scores four through seven relate to varying degrees total oral intake without nonoral supplementation, including total oral intake of a single consistency, total oral intake of multiple consistencies requiring special preparation, total oral intake with no special preparation while avoiding specific foods or liquid items, and total oral intake with no restrictions.²⁷

History of methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridioides difficile* infection (CDI), carbapenem-resistant enterobacteriaceae (CRE), vancomycin-resistant *Enterococcus* (VRE), extended spectrum betalactamase-producing organisms (ESBL), and other MDROs on admission was recorded. Presence of immunodeficiency was approximated by patients recorded white blood cell (WBC) count on admission. Furthermore, the difference between date of collection for *C. auris* culture or specimen and the date of the WBC count on admission was recorded to account for the degree to which the on-admission WBC count is a reasonable proxy for presence of immunodeficiency patient's at the time of *C. auris* specimen or culture collection.

Non-intact skin on admission was recorded if the patient had a pressure injury and/or wound present on admission. Furthermore, if the patient had a documented presence of non-intact skin, as a result of any kind of wound other than a pressure injury, the presence of the wound and the description of the wound type was documented. If there was a pressure injury on admission, the presence, location, and the stage of the pressure injury was recorded. The four different stages for pressure injuries increase in severity, where stage one pressure injuries are the least severe, while stage four pressure injuries are the most severe. Pressure injuries with no indicated stage were either recorded as unstageable or suspected deep tissue injury (DTI) as

documented in the EMR. Furthermore, if patients had multiple pressure injuries, the presence of multiple pressure injuries was recorded, and the stage and location of each pressure injury was also noted. For these cases, the pressure injury with highest severity, as indicated by the stage, was included in the pressure injury analysis.

The primary outcome variable was the finalized *C. auris* culture or specimen result. The culture or specimen results were finalized as either positive or negative for *C. auris*. As previously stated, non-finalized or cancelled cultures were excluded from the analysis. For the finalized results, the date of *C. auris* specimen collection, the facility where the culture was collected, and the type of *C. auris* specimen, or the body site, was also recorded.

Protected health information (PHI) and personal identifiers, such as name, medical record number (MRN), financial identification number (FIN), gender, date of birth, age, admission date, culture collection date, service, and care location were collected. Patients names were de-identified and coded with generic identifiers. MRN, FIN, admission date, and culture collection date were recorded for data source integrity and were not reported. Date of birth was not reported, but, as previously stated, was used for age calculations. For patients over 90 years of age, their age was recorded as 90 years old in the data file in order to preserve patient identity. Age, gender, service, and care location, were not reported individually, but rather as aggregate data, estimates, or counts only.

Data Analysis:

The primary analysis was based on prevalence of the different exposures of interest among all patients with positive *C. auris* results for those included in the study over the time period of October 1, 2019 to January 31, 2020. More specifically, prevalence was calculated as the proportion of patients with positive *C. auris* results and exposure to the given factor or

characteristic of interest over all patients with positive *C. auris* results. The prevalence of exposure among positive patients was calculated for the different care locations, presence of central line, feeding tube, tracheostomy, and/or mechanical ventilation, history of any MDRO, and non-intact skin. To further analyze the different risk factors, odd ratios (ORs) were calculated to estimate the relative risk because *C. auris* is rare and the prevalence of *C. auris* is low in most populations. ORs were calculated using the equation: $OR = p1/(1 - p1) / p0/(1 - p0)$, where $p1$ is the proportion of patients with a positive *C. auris* result and exposure to the predicted risk factor, while $p0$ is the proportion of patients with a positive *C. auris* result and were not exposed to a predicted risk factor. Additionally the confidence intervals associated with each OR were calculated using Woolf's method. This methods uses the standard approach of taking the natural log of the OR, and calculating the 95 percent confidence interval (95% CI) for the natural log OR, using the equation $\ln(OR) \pm 1.96 \cdot se[\ln(OR)]$. The standard error for the natural log OR is calculated using the equation: $se[\ln(ORs)] = [1/a + 1/b + 1/c + 1/d]^{1/2}$. To obtain the 95% CI for the OR, each end of the 95% CI for natural log of OR was exponentiated, $\exp\{\ln(ORs) \pm 1.96 \cdot se[\ln(ORs)]\}$.

Prevalence and ORs were calculated for evaluating the association with care location, presence of central line, feeding tube, tracheostomy, and/or mechanical ventilation, history of MDROs, and non-intact skin on admission with a positive *C. auris* culture, indicating *C. auris* colonization or infection. Additional descriptive statistics, including frequency and measures of central tendency, were calculated to investigate non-dichotomous exposures, such as presence of immunodeficiency. Furthermore, these descriptive statistics were also used in secondary analyses to further investigate pressure injury stages, types of MDROs, FOI scores relationship to feeding tubes, and FOI scores relationship to nutrition status. Ultimately, these secondary analyses were

conducted to help with hypothesis generation by providing the opportunity to supplement and further investigate the primary analyses, which looked at the association of a *C. auris* infection or colonization with care location, presence of central line, feeding tube, tracheostomy, and/or mechanical ventilation, history of MDROs, and non-intact skin on admission. All statistical tests and analyses were conducted in Microsoft Excel.

Results:

A total of 205 SRAlab patients were identified and included into the study. Thirty-three (16.10%) of these patients were identified from the patients captured in SRAlab *C. auris* admission screening program; 128 (70.72%) patients went on leave of absence and had cultures collected as part of a nearby medical center's *C. auris* admission screening program; 44 (21.56%) patients had cultures collected as part of a ring surveillance and transmission investigation at SRAlab; 2 (0.98%) patients had a known history of *C. auris* colonization or infection confirmed by laboratory tests. Of these 205 patients included in our sample, eleven patients had positive *C. auris* cultures, corresponding to a prevalence of 5.37 *C. auris* positive patients per 100 patients screened for *C. auris* colonization or infection during the study period (Table 1). Demographic and characteristic information is provided in Table 1.

Of patients admitted, 22 (10.73%) patients were inpatients on the 25th floor, 39 (19.02%) patients were inpatients on the 24th floor, 27 (13.17%) patients were inpatients on the 23rd floor, 65 (31.71%) patients were inpatients on the 22nd floor, 12 (5.85%) patients were inpatients on the 21st floor, 18 (8.78%) patients were inpatients on the 20th floor, 19 (10.24%) patients were inpatients on the 19th floor, and 1 (0.49%) patient was an inpatient on the 18th floor. Little association for the risk of *C. auris* colonization or infection and the care location patients were admitted to was observed (Table 2) . The highest ORs were observed among patients admitted to

the 24th floor, 23rd floor, 20th floor, and was lowest for patients admitted to the 22nd and 19th floor; however, all of the confidence intervals for the ORs included one, indicating little statistical significance (Table 2).

For devices, 83 (40.49%), 36 (17.56%), 2 (0.98%), and 40 (19.5%) patients presented to SRAlab on admission with feedings tubes, tracheostomies, mechanical ventilation, and central lines, respectively. The prevalence of *C. auris* colonization or infection was highest among patients with feeding tubes and tracheostomy tubes. The ORs for feeding tubes and tracheostomy tubes, were 1.82 (95% CI, 0.54 to 6.18) and 1.83 (95% CI, 0.46 to 7.26), but were not statistically significant (Table 2).

One hundred fifty-seven (76.59%) patients presented with non-intact skin on admission to SRAlab. Among patients with positive *C. auris* cultures, non-intact skin was prevalent in approximately 80 per 100 patients. However, there was no significant association observed for the risk of *C. auris* colonization or infection and the presence of non-intact skin (Table 2). Non-intact skin was further investigated by differentiating between pressure injuries and wounds. Pressure injuries were observed in 98 (47.80%) patients, where the prevalence of pressure injuries among *C. auris* colonization or infection patients was approximately 37 per 100 patients (Table 2). The odds *C. auris* colonization or infection of those with a pressure injury compared to those without pressure injuries trended towards a decreased risk of *C. auris*. However, ultimately there was no statistically significant association observed between pressure injuries and *C. auris* colonization or infection (Table 2). Beyond looking at the presence of at least one pressure injury, multiple pressure injuries were observed in 44 (21.46%) patients. The prevalence of multiple pressure injuries among *C. auris* colonization or infected patients was approximately 19 per 100 patients (Table 2). While there was ultimately no observed significant association

between multiple pressure injuries and *C. auris* colonization or infection, the general trend depicted that the odds of *C. auris* positive culture was increased for multiple pressure injuries when compared to odds of *C. auris* positive culture for those with one pressure injury (Table 2).

Beyond non-intact skin, when exclusively looking at cases of wounds, 122 (59.51%) patients presented on admission with wounds, such as surgical incision, skin tears, excoriation and abrasions. The prevalence of these wound among positive *C. auris* patients was 73 per 100 patients. The calculated odds ratio trended towards suggesting an increased risk of *C. auris* colonization and infection among patients with wounds compared to those without wounds; however, ultimately this estimated risk was not statistically significant, suggesting no observed association between *C. auris* and presence of wounds.

When looking at history of other MDROs, 88 (42.93%) patients presented to SRAlab with a history of the presence of at least one MDRO other than *C. auris*. Some patients presented with different MDROs; 116 cases of MDROs were observed. The highest number of cases was observed for VRE and MRSA with 33 (28%) and 25 (22%) cases (Table 3). The number of cases for CRE, ESBL, CDI, and other MDROs, which was most often *Pseudomonas aeruginosa*, was fairly consistent, ranging between 11(9%) to 18 (16%) cases each (Table 3). The prevalence of presenting on admission with a history of other MDROs among positive *C. auris* patients was fairly high, at 82 per 100 patients (Table 2). Overall, the odds of *C. auris* colonization or infection was increased for patients with a history of at least on other MDRO compared to patients without MDROs (Table 2).

When looking at the association between *C. auris* positive cultures and exposure to these different dichotomous variables, there was little evidence of statistically significant associations, with the exception of MRDOs. The association between MDROs and *C. auris* indicated that

MDRO patients are at increased risk of *C. auris* colonization or infection compared to patients without a prior history of MDROs (Table 2).

In addition to the factors previously described, presence of immunodeficiency, as estimated by WBC count on admission, was evaluated as a potential risk or contributing factor to *C. auris* colonization by using qualitative methods. The median white blood cell count was similar across patients with positive and negative cultures, largely overlapping with the study sample median WBC count of 7.35 (1.3-20.9) (Table 1). The median WBC count for positive *C. auris* patients was 7.2 (4.6-18.6), while the median WBC count for negative *C. auris* patients was 7.6 (1.5 -20.9) (not shown). Furthermore, there was no evidence of an association between leukopenia, or a low white blood cell (WBC < 2), and *C. auris*, as there were no cases of leukopenia among patients with positive *C. auris* cultures and very few cases of leukopenia among patients with negative *C. auris* cultures (not shown). Additionally, there were very few cases of high white blood cell count in positive and negative *C. auris* patients, further suggesting that the white blood cell count in our sample of patients, regardless of *C. auris* result status, was generally within normal range (not shown). Ultimately, the qualitative data on WBC count indicates that, within our sample, there is no association between presence of immunodeficiency and *C. auris*.

Despite the fact that there was little observed evidence for significant associations between the investigated exposures and *C. auris* positive cultures, secondary analyses were conducted to further investigate some of these variables and supplement the observed results. While there was a little evidence of significant association between presence of at least one pressure injury and *C. auris*, there were concerns that relationship between more severe pressure injuries and *C. auris* colonization infection was obscured by looking at pressure injuries as a

whole (Table 2). To investigate this concern, the frequency of pressure injuries within each stage were examined for patients with negative and positive *C. auris* results (Table 4). A majority of the positive *C. auris* patients with pressure injuries had more severe (stage three and stage four) pressure injuries than less severe pressure injuries (stage one and stage two). Additionally a decreased percentage of negative *C. auris* patients with stage three and stage four pressure injuries was observed compared to the percentage of negative *C. auris* patients with stage one and stage two pressure injuries (Table 4). Ultimately these trends may highlight a need to consider the severity or staging of pressure injuries when investigating the association between *C. auris* and pressure injuries, rather than investigating how the general presence of pressure injuries may contribute to *C. auris*. Unfortunately, because the sample size in the present study is small and the number of positive *C. auris* patients with pressure injuries is low, there was limited statistical power to conduct this investigation in the current study.

Additionally, the data were further analyzed to investigate whether any of the risk factors were masking the association of other variables with *C. auris* colonization or infection. While there were concerns with pressure injuries and the impact of how staging may obscure its possible association with *C. auris*, additional analyses indicated that the presence of feeding tubes was confounding the analysis of pressure injuries and *C. auris*. More specifically, when looking at the cases of patients with and without feeding tube and pressure injuries, the analysis revealed that the two variables were mutually exclusive among *C. auris* positive patients, as no patients had both a feeding tube and a pressure injury, and very few patients had neither a feeding tube nor a pressure injury. Consequently when excluding feedings tube patients from the analysis of the association between pressure injuries and *C. auris*, the prevalence of pressure injuries among positive patients remained the same, while the odds of *C. auris* colonization or

infection for patients with pressure injuries was greater than the odds of *C. auris* colonization or infection for patients without pressure injuries (Table 5). However, similar to many of the other investigated association, there is no evidence of a statistically significant association for pressure injuries and *C. auris* when excluding and controlling for the impact of feeding tubes (Table 5).

Because the analysis revealed that pressure injury patients and feeding tube patients, were mutually exclusive among *C. auris* positive patients, the association between presence of a feeding tube and *C. auris* was reinvestigated when excluding pressure injury patients from the analysis. The prevalence of feeding tubes among positive patients remained the same, while the odds of *C. auris* colonization or infection for patients with feeding tubes was greater than the odds of *C. auris* colonization or infection for patients without feeding tubes; this result was statistically significant (Table 5).

Lastly, to supplement the investigated association of the presence of feeding tubes and *C. auris*, further descriptive analyses were conducted to consider how this association may be influenced by patients' functional oral intake capabilities and nutrition regimens, as is documented by FOI scores, diet type, liquid type, and NPO status. One hundred twenty-nine (62.9%) patients from the sample had FOI scores documented on admission. Of these patients, 73 (56.6%) had feeding tubes, while 56 (43.4%) did not present with feeding tubes (Figure 1, Figure 2). Of those patients without feeding tubes, no positive or negative *C. auris* cases with tube dependence were observed (Figure 1). Conversely, for patients with feeding tubes, a majority of both positive and negative *C. auris* patients were tube dependent (Figure 2). This trend may indicate that tube dependence impacts or mediates the association between feeding tubes and *C. auris* colonization or infection.

To further investigate the association between feeding tube and *C. auris*, the relationship between FOI scores and nutrition regimen, as documented by patients drink score, food score, and NPO status was investigated. Bubble charts were created to depict the frequency of the different possible FOI score and drink score combinations (Figure 4) and FOI score and food score combinations among feeding tube patients (Figure 3). When looking at the frequency of FOI Score and Food Score combinations among feeding tube patients, there is no clear association between FOI score and food score and how they impact *C. auris*, as there are both positive and negative *C. auris* patients across the range of FOI score and food score values. Similarly, when investigating the frequency of FOI Score and Drink Score combinations among feeding tube patients, there is no clear association between FOI score and food score and how they impact *C. auris*, as there are both positive and negative *C. auris* patients across the range of FOI score and drink score values.

Discussion

The objective of this paper is to identify risk factors that may increase ARF patients' risk of *C. auris* colonization and infection. The risk factors that were investigated include presence of immunodeficiency, care location, presence of feeding tube, tracheostomy, mechanical ventilation, or central line, history of other multi-drug resistant organisms (MDROs), and the presence of non-intact skin, wounds, and pressure injuries. We found that prevalence of positive *C. auris* cultures, indicating colonization or infection, in this sample was 5.37 per 100 screened patients over the course of the four-month investigation. History of colonization or infection with other MDROs was associated with an increased risk of *C. auris*. Presence of feeding tubes and the presence of pressure injuries were mutually exclusive among positive patients, such that association for each of these risk factors with *C. auris* was reinvestigated when excluding for the

other variable. In this analysis, presence of feeding tubes when excluding for the presence of pressure injuries was associated with an increased risk of *C. auris*.

C. auris infection and colonization are of increasing concern for many public health organizations and health care facilities, with its increasing prevalence in regions across the globe. While the number of studies investigating risk factors associated with *C. auris* colonization and infection is increasing, there is little evidence documenting the prevalence of *C. auris* among acute inpatient rehabilitation patients or the risk factors associated with colonization or infection of *C. auris* in this patient population.

The prevalence of positive *C. auris* cultures, indicating colonization or infection, in this sample of ARF patients was 5.37 per 100 screened patients. This finding is consistent with other screening-based research conducted in Chicago, which estimated that 6.7 per 100 patients screened for *C. auris* across 20 facilities, such as ACHs, LTACHs, and SNFs, were positive.¹⁹ This consistency suggests that prevalence of *C. auris* in Chicago ARFs is similar to average prevalence of *C. auris* observed across healthcare facilities in Chicago.

The ARF inpatients in this study were targeted for sampling as they all had known lab cultures collected in order to test for *C. auris* colonization or infections. In turn, a large majority of these patients had samples collected because they were identified as being at risk of colonization according to SRAlab's and the participating medical center's on-admission screening policies for *C. auris*. Relying mostly on sampling patients whose cultures were collected as part of these screening policies may have contributed to calculating a prevalence value for *C. auris* that most likely underestimates the true prevalence of positive *C. auris* results among rehabilitation patients screened for *C. auris*. The SRAlab's screening procedure was not implemented until the end of November, and the participating medical center's capture rate for

specimen collection for eligible patients was lower during the first few weeks of implementing this new policy. On other hand, because a large majority of individuals included in this study were identified of being at risk for *C. auris* colonization of infection, it is likely that the prevalence of *C. auris* colonization and infection among all ARF inpatients is lower.

While *C. auris* is generally rare, the current study investigates the association between *C. auris* and different clinical factors in order to add to the current knowledge of *C. auris*. This knowledge would be able to improve patient care and prevention efforts, as it would hopefully allow healthcare and public health professionals to increase the effectiveness of isolation and screening policies for *C. auris* by targeting those patients who are most at risk for colonization of infection. The current study investigates the association between *C. auris* and presence of immunodeficiency, care location, presence of feeding tube, tracheostomy, mechanical ventilation, or central line on admission, history of other MDROs, and the presence of non-intact skin. Due to the small sample size of our study and the low prevalence of *C. auris* in this sample, there was little statistical power to develop conclusions. In turn, our analyses provides limited evidence of an association between *C. auris* and the clinical factors investigated. Many of the investigated association were increased but were not statistically significant, likely due to limitations in sample size. However, prior history of MDRO colonization or infection and presence of feeding tube when excluding for presence of pressure injuries were two statistically signification associations observed when looking at risk of *C. auris*.

Consistent with other studies, history of colonization or infection with other MDROs was associated with an increased risk of *C. auris*. In general, invasive infection and colonization of MDROs have been identified almost exclusively in patients in high-dependency areas with the

highest degree of medical intervention, such that it is valuable to try to determine what clinical factors or exposures that make patients susceptible to MDROs, including *C. auris*.

While our current study provides limited support for statistically significant associations, some of the observed trends may be useful to generate hypotheses and consider future areas of study. When looking at the relationship between *C. auris* and the units and floors patients were admitted to, it appears that the 24th, 23rd, and 20th floors had the highest prevalence of positive *C. auris* patients combined with a potential increased risk for *C. auris*. These findings may have been influenced by the screening policies, as more patients admitted to these floors may have been eligible for testing. In turn, it is likely that more patients on these floors were swabbed for *C. auris*, increasing the likelihood of finding more positive *C. auris* cases on these floors. Nevertheless, determining what floors are most burdened with *C. auris* infected or colonized patients can provide insights to what potential types of patients may be at increased risk of *C. auris*. A majority of the positive patients on these floors were either admitted to brain injury or stroke services. This may indicate that patients with neurological conditions are at increased risk for *C. auris* colonization or infection. This hypothesis is consistent with other MDRO research, which indicates that neurologically impaired patients, including spinal cord injury patients, experience a higher rate of healthcare-associated infections, as these patients are often medically complex and exhibit higher dependence, requiring more intensive observation, treatment, and nursing care from healthcare workers.^{29,30}

Similarly, research indicates that healthcare associated infections and exposure to these germs are also heightened for patients requiring medical devices, such as ventilators, tracheostomy tubes, central lines, and feeding tubes.^{1,21} The current available data from the IDPH demonstrates that a majority of the colonized *C. auris* patients require tracheostomy tubes,

feeding tubes, and mechanical ventilation, while approximately a third of colonized *C. auris* patients require a central line.²¹ Patients who require medical devices are often medically fragile and potentially more susceptible to infection.^{21,30} Additionally, the inherent requirement of using medical devices increases a patient's risk of infection or colonization as these patients are presented with unique challenges concerning hygiene practices and cleaning or disinfecting procedures, which are effective in reducing MDRO transmission and colonization.³¹ Because of the evidence supporting the association between medical devices and *C. auris*, many screening policies, including the SRAlab screening policy, targeting individuals with medical devices.

To help further validate that the use of medical devices is associated with *C. auris* colonization and infection, the current study also investigates if the presence of feeding tubes, tracheostomy tubes, mechanical ventilation, and central lines were associated with *C. auris* in our sample of rehabilitation patients. Very few patients admitted to SRAlab require mechanical ventilation, such that we were not able to investigate this association. Despite this limitation, when looking at feeding tubes, central lines, and tracheostomies, it appeared that feeding tubes were the most prevalent device among positive patients, as a majority of positive patients required feeding tubes, while less than a third of positive patients required tracheostomies or central lines. When investigating the association between feeding tubes and *C. auris*, the current study provides evidence that presence of feeding tubes is trending towards and increased risk of *C. auris*, but this result was not statistically significant. However, the association between feeding tubes and *C. auris* was reinvestigated when excluding for the presence of pressure injuries, as pressure injuries and feeding tubes were discovered to be mutually exclusive variables among positive patients. This analysis revealed that the presence of feeding tubes,

when excluding for the presence of pressure injuries, was associated with an increased risk of *C. auris*.

Additionally, secondary descriptive analyses, suggested that feeding tube patients with a strong dependence on their feeding tube, as indicated by their FOI score, is a potentially important indicator to consider for risk of *C. auris* colonization or infection. Beyond the disinfecting challenges associated with feeding tubes and other medical devices, the trend of feeding tube use combined with increased tube dependence, may also further bolster hypotheses and theories that suggest patients with limited mobility, who are more medically complex, and are highly dependent on healthcare workers may be susceptible to HAIs, including *C. auris*.

Furthermore, feeding tube dependence may also be impacted by the relationship between diet, the microbiome, and immunity.³² For example, perhaps patients who are highly dependent on feeding tubes for nutrition are more likely to require a modified diet, which includes non-natural dietary supplements, that in turn negatively impacts the microbiome, the patient's immune system, and increases their susceptibility to colonization of infections of MDROs, such as *C. auris*. While the current study cannot provide conclusive evidence in support of either of these hypotheses, future research should continue to investigate medical devices role in *C. auris* colonization and infection, as well as the mechanisms or factors that influence this association. In the current study, many patients presented with multiple medical devices. When investigating the association between one type of device and *C. auris*, the presence of other devices potentially acted as confounders, making it difficult to parse out to what extent each device contributes to risk of *C. auris*. Hopefully by sampling a larger population of ARF patients, future research would be better able to investigate the association between *C. auris* and the presence of feeding tubes, mechanical ventilation, central lines, and tracheostomies in this population, and whether or

not these findings are consistent with the increased risk of *C. auris* that has been demonstrated in LTACHs and SNFs for patients presenting with these devices.²¹

A third major area of focus for the current study was looking at the presence of non-intact skin, and differentiating between pressure injuries and other wounds. Available risk factor data from IDPH indicated that 36% of colonized *C. auris* patients also present with wounds. This may not be surprising, as wounds and areas of non-intact skin have a higher risk of becoming infected. Additionally, research looking at the relationship between other MDROs, such as VRE and MRSA, and pressure ulcers suggest that pressure ulcers in patients play a role in the transmission and spread of MDROs.³³ Consistent with these findings, in the current study non-intact skin was highly prevalent among *C. auris* positive patients.

However, when distinguishing between pressure ulcers and other wounds, such as surgical incisions, skin tears, excoriation and abrasions, there was conflicting results. As expected, the trend of the association between wounds and *C. auris* suggests that wounds may be an important indicator for increased risk of *C. auris*. Interestingly, in this sample of patients a majority of the documented wounds were surgical incisions, potentially providing support that the general trend documented for wounds may be a good proxy for recent surgical intervention or procedures, which is one risk factor that has been supported in *C. auris* literature.^{6,22-24} On other hand, when investigating pressure injuries, the observed association was trending towards a decreased risk for *C. auris*, a finding that is not supported in the current literature. Further analyses of the pressure injury data revealed concerns that the relationship between more severe pressure injuries, as well as the number of pressure injuries, with *C. auris* colonization and infection was obscured when looking at all pressure injuries without accounting for these other factors. Secondary qualitative analyses revealed that majority of positive patients with pressure

ulcers presented with more severe, stage three and stage four, pressure ulcers rather than the lower staged, less severe pressure ulcers. When focusing on multiple pressure injuries, secondary analyses indicated that the odds of *C. auris* associated with the presence of multiple pressure injuries compared to the odds associated for patients with only one pressure injury was trending towards an increased risk. Future studies should continue to investigate non-intact skin, wounds, and pressure injuries as risk factors, while considering how the severity, extent, degree, and wound type may further increase a patient's risk for *C. auris*.

Lastly, beyond the different clinical factors investigated and discussed in this current study, IDPH and US Centers for Disease Control and Prevention (CDC) highlight that patients or residents who are currently or have recently received healthcare in skilled nursing facilities (SNFs) and long-term acute care hospitals (LTACHs) are often at increased risk of *C. auris* colonization or infection.^{1,21} More specifically, in Illinois a select number of SNFs and LTACHs have been identified as healthcare facilities with probable environmental contamination of *C. auris*. In turn, while there was no initial analyses investigating the number of patients in our sample who previously received care from these facilities, it is valuable to note that a retrospective review of positive patients' admissions histories revealed that over half of these patients were directly admitted to SRAlab from these facilities associated with *C. auris* contamination, while approximately 90 percent of the positive *C. auris* patients previously received health care at one of these facilities prior to admission at SRAlab. This finding highlights the importance of public health surveillance and designing screening programs that target patients who have previously received care in healthcare facilities with an increased prevalence of *C. auris* colonization. Surveillance allows researchers to more easily investigate possible exposures and outbreaks, which in turn allows for better targeted interventions and

policies.^{1,21,26} It is not always known where a person becomes infected with *C. auris*; however, when healthcare facilities implement screening and surveillance protocols, it is easier for healthcare professionals to determine the facility where a given patient was exposed and became infected or colonized with *C. auris*.^{24,27} This allows for improved prevention measures that decrease the spread of *C. auris* and other MDROs, as other healthcare facilities can target their screening and/or presumptive isolation to include patients transferred from these facilities associated with a high prevalence of *C. auris* or other MDROs.

Overall, because the current study was conducted in a short time-frame with a small sample of patients, the findings are limited in guiding conclusions regarding what clinical factors are associated with an increased risk of *C. auris* colonization or infection in acute rehabilitation inpatients. Despite these limitations, the current study aids in hypothesis generation and provides guidance for future areas of research concerned with identifying risk factors for *C. auris*. Thus, it is important that future studies when investigating *C. auris* risk factors consider study designs over a longer period of time with a larger sample of patients in order increase the power of the study to detect an association.

Additionally, it is important that future research continues to investigate the prevalence and spread of *C. auris* in the setting of acute rehabilitation hospitals. A lot of the current research investigates MDROs and other HAIs within either long-term care facilities, such as SNFs and LTACHs, or ACHs. While the knowledge generated from this research is valuable for acute rehabilitation hospitals, because they share many patients with these facilities, it is not known to what extent these findings are generalizable to ARF inpatients. The mission of rehabilitation hospitals is to improve patients daily life and functioning by helping patients increase or regain their independence. As a result, many rehabilitation hospitals require a minimum of three hours

of physical therapy, occupational therapy, and/or speech therapy daily. In contrast to other healthcare settings, there is an increased emphasis on socialization and assimilation within the environment, potentially presenting unique challenges with regards to isolation procedures and other policies designed to manage and limit the spread of MDROs, such as *C. auris*. In addition, acute rehabilitation inpatients often are medically complex, presenting with severe health conditions, comorbidities, and increased dependence on healthcare workers for activities of daily livings, all of which are factors often associated with increased risk of MDROs, including *C. auris*. Because of these challenges and the unique mission and design of acute rehabilitation hospitals, it is valuable that more research is conducted in this healthcare setting, so that public health professionals working in and with rehabilitation hospitals can design prevention efforts that improve patient care, uphold employee and patients safety, and better meet the needs and goals of rehabilitation facilities and their stakeholders.²⁵

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Appendix*Tables:***Table 1: Demographics and Characteristics of Study Population**

Patient characteristics (n=205)		
Age in years	Mean (sd)	60 (17)
Gender	Number (%)	
Male		134 (65.37)
Female		71 (34.63)
Admitting Facility	Number (%)	
Other		162 (79.02)
LTACH		33 (16.10)
SNF		10 (4.88)
Hospital Service	Number (%)	
Stroke		39 (19.02)
Brain Injury		38 (18.54)
Spinal Cord Injury		35 (17.07)
Medically Complex		25 (12.20)
Other		19 (9.27)
Neuro		15 (7.32)
Orthopedic		14 (6.83)
Cardiac		11 (5.37)
Major Multiple Trauma		9 (4.39)
White Blood Count	Median (Min-Max)	7.35 (1.5 - 20.9)
<i>Candida auris</i> Positive	Number (prevalence per 100)	11 (5.37)

Table 2: Prevalence and Odds Ratios (OR) of *C. auris* by Risk Factor

Risk Factor	Prevalence of exposure among positive patients	OR(CI)
Care Location		
25	0	-
24	0.3636	2.60 (0.72-9.35)
23	0.1818	1.50 (0.31- 7.36)
22	0.1818	0.46 (0.10-2.21)
21	0	-
20	0.1818	2.47 (0.49-12.43)
19	0.0909	0.87 (0.11-7.16)
18		-
Device		
Feeding Tube	0.5454	1.82 (0.54-6.18)
Tracheostomy	0.2727	1.83 (0.46-7.26)
Mechanical Ventilation	0	-
Central Line	0.1818	0.91 (0.19-4.40)
Non Intact Skin	0.8182	1.40 (0.29-6.71)
Pressure Injuries (PI)		
PI	0.3636	0.61 (0.17-2.14)
Multiple PIs	0.1881	1.24 (0.26-5.95)
Wounds	0.7273	1.87 (0.48-7.27)
MDROs	0.8182	6.55 (1.38-31.13) *

* Confidence Interval (CI) does not include 1.0; statistically significant

Table 3: Count and Percentage of MDRO Cases (n=116) by Organism

	Count	% of all MDROS
MRSA	25	22%
VRE	33	28%
CRE	11	9%
ESBL	14	12%
CDI	15	13%
OTHER MDROS	18	16%

Table 4: Frequency Table for Stage of Most Severe Pressure Injuries for those Presenting with at least 1 Pressure injury (n=98)

	Frequency f		Relative Frequency $rf=f/n$		Percentage Frequency $p=100 * rf$	
	CA +	CA-	CA +	CA-	CA +	CA-
Stage1	0	17	0.00	0.173	0.00	17.3
Stage 2	2	27	0.020	0.276	2.0	27.6
Stage 3	4	4	0.041	0.041	4.1	4.1
Stage 4	1	11	0.010	0.112	1.0	11.2
Suspected Deep Tissue Injury	0	16	0.00	0.163	0.00	16.3
Unstageable	0	19	0.00	0.194	0.00	19.4

Table 5: Prevalence and Odds Ratio for *C. auris* among Risk Factors when Excluding Cases Presenting with Another Risk Factor

Risk Factor	Exclusion Risk Factor	Count of Positive Patients	Prevalence of Exposure among Positive Patients	OR(CI)
PI	Feeding Tube	4	0.36	4.36 (0.47-40.16)
Feeding Tube	PI	6	0.5454	9.38 (1.09-80.96)*

* Confidence Interval (CI) does not include 1.0; statistically significant

Figures:

Figure 1:

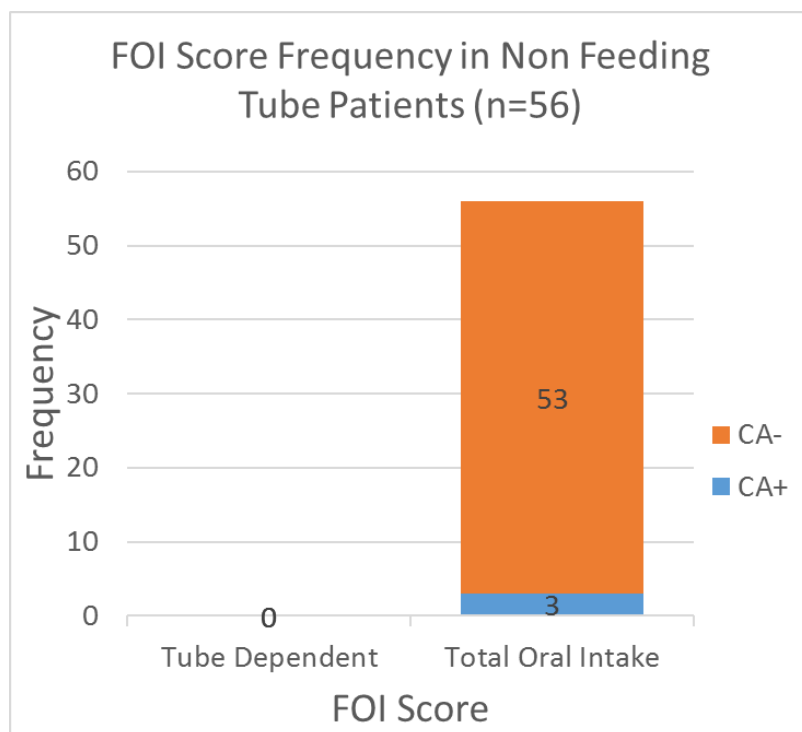


Figure 2:

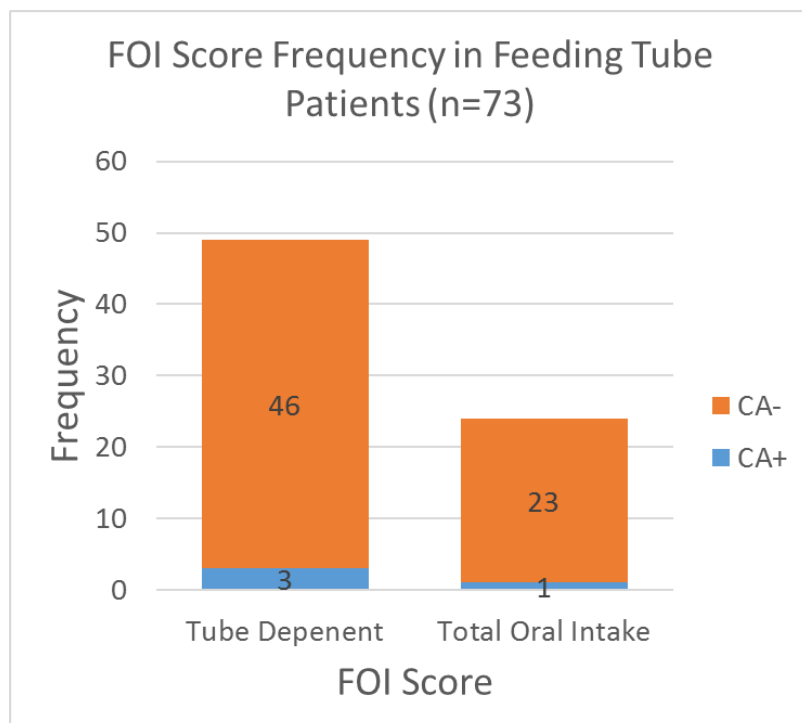


Figure 3:

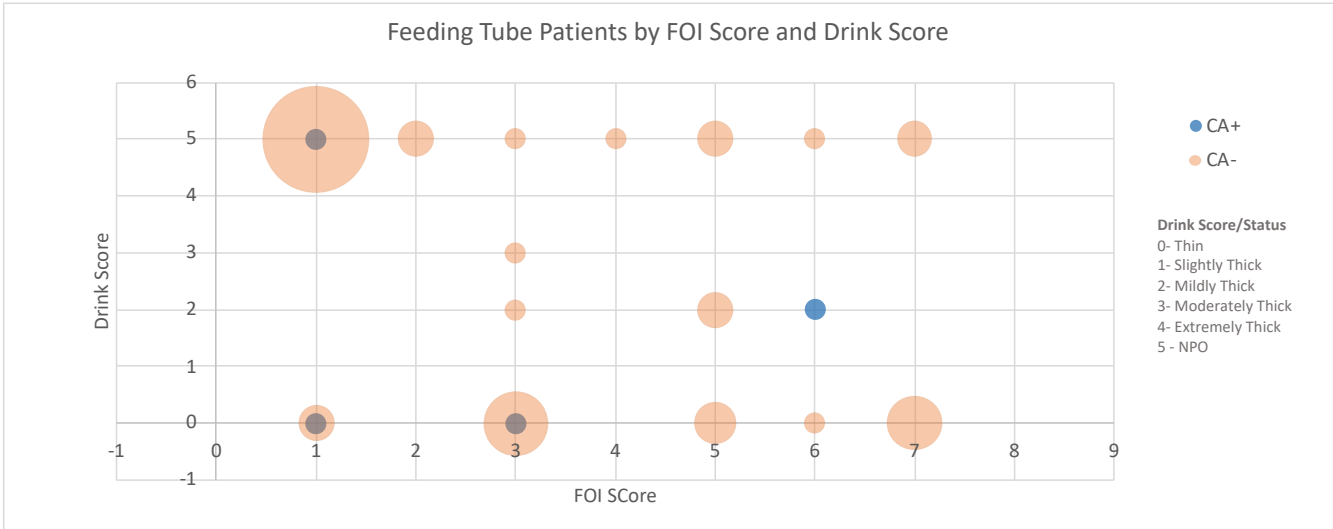


Figure 4:

