Knowledge, Attitude, and Practices (KAP) Study of Physicians, Medical Technologists, and Nurses on the Emergence of Nosocomial Fungemia Caused by *Candida auris*: A Comparative Study between a Government and a Private Primary Hospital in Atimonan, Quezon Province

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Abstract: - *Candida auris* is a globally emerging fungus due to its multidrug resistant profile and nosocomial transmissibility. Although there were no known cases in the Philippines as of the performance of the study, the presence of South and East Asian clades is a cause of concern. The study was performed to assess the knowledge, attitude, and practices of health workers from a government and a private primary hospital in Atimonan, Quezon Province regarding the emergence of *C. auris.* This was done by using a questionnaire made by the researchers, which was based on the guidelines proposed by the Centers for Disease Control and Prevention (CDC). 35 participants participated in the study, 26 (74.3%) participants were from the primary government hospital and nine (25.7%) were from the private primary hospital. Pearson's Chi-Square test of association and the Two-sample T-test were used to determine significant differences in the answers of the participants. After the interpretation of the data, it was found that there were no significant differences between the Knowledge, Attitude, and Practices of the health workers of primary hospitals in Atimonan, Quezon Province in comparison to the guidelines proposed by the CDC (2020). Furthermore, there were no significant differences between the Knowledge *(p= 0.554),* Attitude *(p=0.575),* and Practices of health workers from a government and a private primary hospital from Atimonan, Quezon Province with regards to *C. auris*. These results could be attributed to the close geographical proximity of the hospitals, and as there were no recorded cases of *C. auris* in the Philippines, the knowledge, attitude, and practices of the health worker respondents were solely grounded on theoretical means.

Key Words: — ***Candida auris, nosocomial, fungemia, candidiasis, primary government hospital, primary private hospital, Atimonan, Quezon Province, Philippines.***

I. INTRODUCTION

Candida auris has become a rapidly emerging multidrug-resistant ascomycete yeast pathogen, causing numerous significant nosocomial fungemia outbreaks ever since its identification in 2009 [1]. Although outbreaks caused by other *Candida* species are rare, *C. auris* possesses the ability to spread between patients in healthcare facilities. It can also colonize human skin for long periods, survive on several surfaces for weeks, and even be tolerant to commonly used disinfectants [2]. It is being isolated in a widespread geographical area, and it is probable that the number of individuals affected is remarkably higher than what the current available literature suggests. The initial priority when it comes

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to emerging pathogens is the local control of the organism to prevent further spread of nosocomial fungemia caused by *C. auris* [3].

Controlling *C. auris*, however, is difficult due to its resistance to various antifungals and is prone to misidentification when compared to other yeasts through the use of currently accessible identification methods. Its prominence in antifungal resistance and its transmissibility is what makes it different compared to other *Candida* spp. [4].
Since controlling the emergence of *C. auris* is the initial priority, it is important that health workers in the Philippines are aware and knowledgeable about *C. auris* and the threats it poses on public health, as well as the proper measures to be taken in cases concerning *C. auris*. Although there are currently no known cases of *C. auris* infections in the Philippines, it is still a globally emerging pathogen. The possibility of spreading rapidly in both affected and unaffected countries is a challenge for health workers in terms of their ability to deliver effective therapeutic management and a challenge for hospitals that do not have modern identification facilities needed to identify *C. auris* [5].

Therefore, the study aimed to gather information on the current Knowledge, Attitude, and Practices (KAP) of health workers in Atimonan, Quezon Province regarding the emergence of *C. auris* by assessing a government and a private primary hospital. The results of the assessment can pose significant insights and benefits for the immunocompromised patients, healthcare workers, hospitals, limited information regarding *C. auris*, and the overall improvement of measures taken against *C. auris* in the Philippines.

II. METHODOLOGY

A quantitative cross-sectional survey design was used in gathering the data needed. Questionnaires were distributed to physicians, medical technologists, and nurses who have or have not handled cases related to nosocomial fungemia caused by *Candida* spp. and *C. auris.* The data gathered from both the government and private primary hospitals were then compared in terms of their adherence to CDC guidelines as well as the awareness, diagnosis, prevention, and management of *C. auris.*

Two hospitals from Atimonan, Quezon Province, one primary government hospital and one primary private hospital, were asked to participate in the study. A purposive sampling method was used for the selection of the participants. 35 physicians, medical technologists, and nurses were involved in the study. Demographic and experience identifiers were included in the survey, and only the participants who met the criteria were included in the analysis and the results of the study.

The set of questions were subdivided into four different categories wherein each category focuses on addressing topics that were substantial to a certain objective of the study. The categories are general information and demographics, Knowledge, Attitude, and Practices. The knowledge category has a set of questions regarding general information, risk factors, symptoms, identification, and treatment. The attitude category has a set of questions regarding the disposition towards the infection/being infected, and towards the patients. The practice category covered the hand hygiene, personal protective equipment (PPE), and cleaning and disinfection. The questionnaire was validated with the use of Cronbach Alpha.

The data gathering procedure of this study was divided into five phases: hospital selection, participant selection, pre-survey, survey proper, and post-survey phase. The hospitals that were included must have obtained a primary care level accreditation, must be legally operating and compliant with the local and national regulations, and should only be located within Atimonan, Quezon Province. Participant selection was based on the preliminary hospital selection, thus only the health workers from the qualifying hospitals were selected for the study. Health workers included in the study were: physicians, nurses, and medical technologists. The specified health workers must be licensed and eligible to practice in their respective fields. Physicians included were not limited to one specialty/subspecialty, although infectious disease, pathology, and epidemiology specialists were preferred. Additionally, prior experience in handling cases of fungemia was also preferred in participant selection but was not required.

In conformance to standard ethical practice, the selected primary hospitals were given a letter of invitation to participate in the study, and their respective hospital managements were formally asked for their informed consent. Subsequently, the selected health workers were given a letter of invitation to participate in the study and were formally asked for their informed consent. The informed consent form contained general information regarding the nature and purpose of the

study and included a substantial discussion of the rights of the participants, e.g., right to confidentiality and privacy, right to refuse or withdraw from the study, and right to ask questions and report concerns. Furthermore, the participants were also informed of the possible risks/discomforts that they may encounter, as well as the potential benefits of participating in the study.

Health workers who have confirmed their participation by submitting properly signed informed consent forms were subsequently given instructions on answering the survey questionnaires. The participants were briefed on what actions to take, such as how to properly input and submit their answers in order to prevent the invalidation of data. They were also informed of the date by which they must accomplish the survey. The survey questionnaires were sent out by the researchers and delivered directly to the participating primary hospitals. A print-out of the survey was given to the hospital directors along with the informed consent. To ensure that the survey was given to legitimate employees of their respective institutions, the hospital secretary of each hospital helped a member of the group in disseminating the forms to the participants. The participants were given one week to answer the survey, and the surveys were personally collected by the researchers.

III. RESULTS AND DISCUSSION

A. Demographic profile of Physicians, Medical Technologists, and Nurses

Table.1. Demographic Characteristics of the participants

Demographic data	Parameter	n	Percentage (%)
Sex	Male	10	28.6
	Female	23	65.7
	Not stated	2	5.7
Age Distribution	22-27 years old	5	14.3
	28-32 years old	5	14.3
	33-38 years old	9	25.7
	39-43 years old	2	5.7
	44-49 years old	7	20.0
	50 years old & above	7	20.0
Type of Institution	Private	9	25.7
	Government	26	74.3
Years of Service in the Hospital	1 year or less	3	8.6
	2-5 years	13	37.1
	6-10 years	7	20.0
	More than 10 years	12	34.3
Profession	Registered Nurse	24	68.6
	Registered Medical Technologist	7	20.0
	Physician	4	11.4

A total of 35 of physicians, medical technologists, and nurses from government and private primary hospitals were surveyed. The questionnaires were distributed from March 5, 2021 to March 12, 2021. Among them, 23 (65.7%) were female, 10 (28.6%) were male, while 2 (5.7%) participants preferred not to state their identity. 33-38 years old comprise 25.7% of the sample, followed by 44-49 years old (20%) and 50 years old & above (20%). The sample came from 9 private (25.7%) and 26 government (74.3%) hospitals and is composed of 24 registered nurses, 7 registered medical technologists, and 4 physicians. Most of the participants (37.1%) have 2 to 5 years of experience in their respective hospital, followed by those (34.3%) who have rendered more than 10 years.

Table.2. Frequency and Percentage on History of Handling Cases of Nosocomial Fungemia

	Yes	%
Handled cases of Nosocomial Fungemia caused by *C. auris*	7	20.0
Handled cases of Nosocomial Fungemia caused by other *Candida* spp.	10	28.6

Only 7 out of 35 participants (20%) have reported they have experienced handling cases of Nosocomial Fungemia caused by *C. auris* while only 10 have handled cases caused by other *Candida* spp., as per Table.2.

B. Knowledge

Knowledge in both the Government and the Private Hospitals: The Knowledge part of the survey in relation to *C. auris*, was comprised of questions 1 to 4 which were questions pertaining

to general information; questions 5 to 9 which were questions about the risk factors; question 10 which was the symptoms; questions 11 and 12 which were about the identification; and question 13 which was about the treatment of *C. auris*.

Table.3. Descriptive Statistics of Statements under Knowledge Domain

Questions	Mean	Std. Deviation	Verbal Interpretation
General Information			
1. Do you agree that *Candida* spp. are normally found on the skin, in the mouth, throat, gut, and vagina?	4.20	.833	Strongly Agree
2. Do you agree that *Candida auris* is a multidrug-resistant fungus?	4.17	.822	Agree
3. Do you agree that *C. auris* can spread in healthcare settings through contact with contaminated environmental surfaces or equipment?	4.29	.667	Strongly Agree
4. Do you agree that *C. auris* cannot be spread from person to person and cause outbreaks in healthcare settings?	2.46	1.268	Disagree
Risk Factors of *C. auris* Infection			
5. Do you agree that healthy people are less likely to acquire *C. auris* infection?	3.51	.981	Agree
6. Do you agree that patients who have a central venous catheter in their body are less likely to acquire *C. auris* infection?	2.40	1.006	Disagree
7. Do you agree that patients who have previously taken antibiotics or antifungal treatment are less likely to acquire *C. auris* infection?	2.46	.980	Disagree
8. Do you agree that hospitalized patients suffering from other serious illnesses have a high risk of acquiring *C. auris* infections?	4.29	.524	Strongly Agree
9. Do you agree that only adults can acquire *C. auris* infection?	2.11	.832	Disagree
Symptoms			
10. The symptoms of nosocomial fungemia caused by *C. auris* infection are fever and	4.17	.747	Agree

chills that don't improve after antibiotic treatment for suspected bacterial infection.			
Identification of *C. auris*			
11. Do you agree that *C. auris* can be easily distinguished from other *Candida* spp.?	2.69	.963	Neutral
12. Do you agree that special laboratory tests are not needed to identify *C. auris*?	2.68	1.224	Neutral

Table.3. presented the descriptive statistics of statements used to assess the knowledge and awareness of the sample participants regarding the topic while Table 4 shows the verbal interpretation of a Five-point Likert-Scale data, which was used for the interpretation of statements.

Table.4. Five-Point Likert-Scale Unbiased Interpretation

Likert Scale	Interval	Description
2	1.80-2.59	Disagree
3	2.60-3.39	Neutral
4	3.40-4.19	Agree
5	4.20-5.00	Strongly Agree

Under the General Information section, the majority of the participants strongly agreed that *Candida* spp. are normally found on the skin, in the mouth, throat, gut, and vagina (mean=4.20, SD=.833). This coincides with one study wherein 41% of the *C. auris* isolates was from the skin [6]. Majority of the participants also strongly agreed that *C. auris* specifically spreads through contact with contaminated surfaces (mean=4.29, SD=.667), which has been described in various studies. *C. auris* can adhere on abiotic, dry, and moist surfaces, and persist in common hospital equipment, and even human skin and cavities [7]. In addition, a study conducted by [8] stated that there is a rapid and horizontal spread of this yeast in the hospital through direct and indirect transmissions. Most participants agreed that *C. auris* is a multidrug-resistant fungus, which corresponds with the fact that *C. auris* is described as a fungus that behaves like a transmissible bacterial multidrug-resistant organisms (MDROs) in the healthcare setting [9]. Meanwhile, most of the participants disagreed that the aforementioned fungus cannot be spread from one person to another and could not be a cause for outbreaks. In the same study conducted by [9] in 2019, it is stated that *C. auris* can be transmitted from patient to patient.

In terms of risk factors, the majority of the participants strongly agreed that people experiencing serious diseases are highly prone to contract the infection of the fungus in study (mean=4.29, SD=.524). Patients with underlying respiratory and neurologic diseases are more prone to *C. auris* infection [9]. The participants agreed that healthy people are less likely to acquire the said infection (mean=3.51, SD=.981), which correlates with the fact that *C. auris* infections mainly affect immunocompromised patients, including those who are confined in the ICU [10].

On the other hand, the sampled participants disagreed that it is less likely to acquire infection when patients have a central venous catheter present in their body (mean=2.40, SD=1.006) and have previously taken antibiotics or antifungal treatment (mean=2.46, SD=.980). According to the CDC (2019), patients with breathing tubes, feeding tubes, and other similar equipment inside their bodies as well as ones who recently used broad-spectrum antibiotics and antifungal drugs are at higher risk of infection. The participants have also disagreed about only adults being able to contract the disease (mean=2.11, SD=.832), as CDC also stated that *C. auris* infections can be found in patients of all ages [11].

Most of the participants agree that the symptoms of the disease are fever and chills (mean=4.17, SD=.747), which corresponds to a study wherein it is stated that *C. auris* infection is characterized by fever or sepsis [12]. However, most of them are indifferent about the identification of *C. auris* when compared to other *Candida* spp. and when using appropriate devices to identify such disease. *C. auris* is often misidentified in laboratories as this fungus is difficult to identify using standard laboratory methods. In 2019, [4] stated that the phenotypic characteristics of *C. auris* is not enough for definitive identification. Furthermore, *C. auris* is commonly misidentified with *C. haemulonii* when biochemical methods are used. Other commercially available tests such as API AUX

20C, BD Phoenix, MicroScan, and VITEK-2 YST misidentify *C. auris* with *C. catenulate, C. famata, C. guilliermondii, C. lusitaniae, C. parapsilosis, C. sake, R. glutinis, R. mucilaginosa,* and *Saccharomyces.* It is also stated that matrix-assisted laser desorption/ionization time of flight (MALDI-TOF) mass spectrometry is a reliable test that can be used to identify *C. auris* when compared to other *Candida* spp., given that the reference database includes the *C. auris* spectrum [13]. Specific PCR assays development using cultured colonies of *C. auris* and other related species can also be utilized for rapid and accurate identification of *C. auris* during outbreak settings.

Table.5. delineates the most common drugs used to treat nosocomial fungemia. Based on the knowledge of the participants and on their rankings, the top 3 drugs are Fluconazole, Anidulafungin, and Caspofungin.

Table.5. Most Common Drugs in Treating Nosocomial Fungemia

Drugs	Rank # 1	Rank # 2	Rank # 3	Mean Rank	Total Rank
Fluconazole	22	1	2	2.8	1
Anidulafungin	6	1	4	2.2	2
Caspofungin	2	11	2	2.0	3
Amphotericin B	2	13	3	1.94	4
Micafungin	1	5	19	1.3	5

Participants favoring the use of fluconazole as the main treatment for nosocomial fungemia is an area of concern, since more than 90% of *C. auris* isolates are resistant to this drug [14]. Anidulafugin and caspofungin, the top 2 and 3 choices respectively, are echinocandins – this class of antifungals is currently established as the first-line treatment for *C. auris* infection [5]. CDC also recommends the use of echinocandins as treatment [15].

Micafungin is another echinocandin but has been selected as the least common drug. Yet, micafungin has shown the highest efficacy as compared to fluconazole and amphotericin B [3].

Amphotericin B is another antifungal that can be used, but 50% of *C. auris* isolates are resistant to this drug, or sometimes documented with varying susceptibility [16]. Amphotericin B being chosen as the fourth most common drug positively correlates with the efficacy of the drug against *C. auris.*

Knowledge across the Government and the Private Hospitals: Table.6. depicts the descriptive statistic and T-test statistic of the knowledge score of the private and government primary hospitals.

Table.6. Descriptive Statistics and T-Test Statistic of the Knowledge Score

	Knowledge Score (Mean ± SD)	t-test Statistic	P-value
Private	38.33 ± 4.330	-.598	.554
Government	39.54 ± 5.464		

This table displays that the health workers from the government primary hospital have higher knowledge score compared to those of the health workers from the private primary hospital. However, the t-test result showed that the knowledge score of those from the government primary hospital is not statistically significantly different from that of the knowledge score of those from the private primary hospital, $t\,(33)=-.598$, $p=.554$.

Table.7. exhibits the chi-square results of the statements covering the knowledge score of the survey.

Table.7. Chi-Square Results of the Knowledge Statements across Type of Institution

Questions	Chi-Square Statistic	p-value	Interpretation (5% level of significance)
General Information			
1. Do you agree that *Candida* spp. are normally found on the skin, in the mouth, throat, gut, and vagina?	.848	.838	Not significant
2. Do you agree that *Candida auris* is a multidrug-resistant fungus?	5.122	0.163	Not significant
3. Do you agree that *C. auris* can spread in healthcare	6.348	.096*	Not significant

	settings through contact with contaminated environmental surfaces or equipment?			
4.	Do you agree that *C. auris* cannot be spread from person to person and cause outbreaks in healthcare settings?	4.593	.332	Not significant
Risk Factors of *C. auris* Infection				
5.	Do you agree that healthy people are less likely to acquire *C. auris* infection?	6.324	.097*	Not significant
6.	Do you agree that patients who have a central venous catheter in their body are less likely to acquire *C. auris* infection?	2.300	.681	Not significant
7.	Do you agree that patients who have previously taken antibiotics or antifungal treatment are less likely to acquire *C. auris* infection?	4.824	.306	Not significant
8.	Do you agree that hospitalized patients suffering from other serious illnesses have a high risk of acquiring *C. auris* infections?	1.072	.585	Not significant
9.	Do you agree that only adults can acquire *C. auris* infection?	1.464	.833	Not significant
Symptoms				
10.	The symptoms of nosocomial fungemia caused by *C. auris* infection are fever and chills that don't improve after antibiotic treatment for suspected bacterial infection.	3.193	.363	Not significant
Identification of *C. auris*				
11.	Do you agree that *C. auris* can be easily distinguished from other *Candida* spp.?	1.383	.847	Not significant
12.	Do you agree that special laboratory tests are not needed to identify *C. auris*?	.942	.918	Not significant

**Significant at 10% level of significance*

This table illustrates that none of the statements in the knowledge domain is statistically significantly different when tested across types of institution, $p>.05$. However, when we try

considering at 10% level of significance, we can say that there is an association between the institution and when it is about the contact spreading of *C. auris* in contaminated surfaces *(p=.096)*, as well as, when it is about the acquiring of the infection to healthy people *(p=.097)*.

C. Attitude

Attitude in both the Government and the Private Hospitals:
The following tables reveal the distribution of health workers' attitude category towards C. auris in both the government and the private hospitals.

Table.8. Frequency and Percentage of Attitude towards Infection and People

		Yes	%
Attitude Towards the Infection/Being Infected			
1.	Do you feel any concern towards the emerging *C. auris* infections in the country?	31	88.6
2.	Do you feel that should there be a rise in *C. auris* infections, your workplace would be able to manage?	17	48.6
3.	Do you think *C. auris* is regarded as a pathogen that needs immediate attention in your workplace?	31	88.6
4.	Do you think you can manage this infection in a patient?	21	60.0
Attitude towards Patients			
1.	Can you easily identify if the nosocomial fungemia of the patient is caused by *C. auris*?	7	20.0
2.	Do you know the proper precautions when handling patients suspected of *C. auris* fungemia?	25	71.4

Table.8. displays the frequency and percentage of the attitude of the participants towards the infection of C. auris and infected patients. Majority of the participants (88.6%) do have concern about *C. auris* being present in the country, as well as, considering immediate attention once identified. This is in line with the currently available study of *Candida* spp. in the Philippines from [17] which states that candidiasis occurs at approximately 80.40% of fungal infections in 2016. 21 (60%) participants believed that they would be able to control the infection. However, only 17 (48.6%) felt that their current workplace would be able to manage the infection when detected, which is also in conjunction with a study by [10], which states that the Philippines has problems in managing fungal infections (e.g., timely diagnosis, proper antifungal intervention, patient compliance with long-term treatment, and expensive antifungal treatment). Moreover, a study conducted by [18] states that the Asian healthcare system is not fully equipped to control the potential threats of this fungus. Additionally, in an online survey conducted in 2017 by [19], which included 241 laboratories in the Philippines, China, India, Indonesia, Singapore, Taiwan, and Thailand showed that out of the 26 Philippine laboratories, only 3/26 (11.5%) and 9/26 (34.6%) laboratories conduct regular and occasional staff training respectively. However, a large number of these laboratories, 23/26 (88.5%) were said to utilize biosafety hoods inside their workplace.

25 out of 35 (71.4%) participants stated that they know the proper precautions when handling patients infected with the diseases, but only 7 (20%) could easily identify the diseases on patients. *C. auris* cannot be identified easily because of its similarity to other *Candida* spp. with regards to the risk factors [20]. Also, *C. auris* is frequently misidentified in laboratories that use biochemical methods to diagnose diseases [14] and the identification of its isolates with the use of its phenotypic characteristics are not accurate [21].

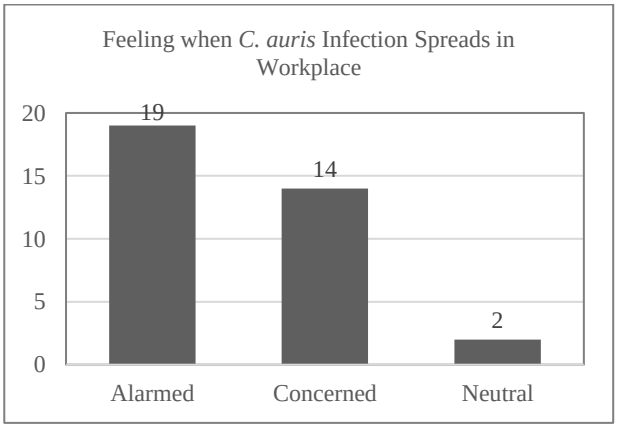

Fig.1. Participants Reaction about Diseases Spreading in the Workplace

Figure.1. displays the graphical representation of the feelings of the sampled participants if *C. auris* infection spreads in their respective workplace. More than half (54.3%) of the participants stated that they would feel alarmed if they knew that the said disease is propagating in their workplace, 40% would feel concerned about it, and 8.6% would be indifferent towards it. These results are consistent with the fact that *C. auris* is a multi-drug resistant species and is now a globally

emerging pathogen hence, should be approached with alarm and concern [22] Furthermore, several studies suggest that *C. auris* is prevalent in nosocomial outbreaks. This species is the first fungus to be seen with potential to cause epidemics and is shown to be easily transmitted in healthcare settings [3]. In addition, the fungus is noted to be persistently present around bed-space areas [23]. A study by [24] also reported that *C. auris* can survive on plastic surfaces in the hospital for at least two weeks.

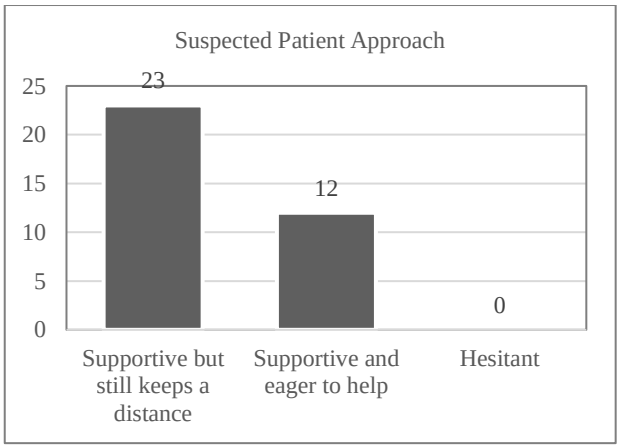

Fig.2. Percentage of Approach to Suspected Patient

Figure.2. displays the approach the respondents would exercise when dealing with suspected patient. 23 (66%) of the respondents indicated that they would approach and still remain a specific distant from the suspected patient, but only 12 (34%) of them would approach and be eager to help. None (0%) of them would be hesitant to approach a patient suspected to have the infection.

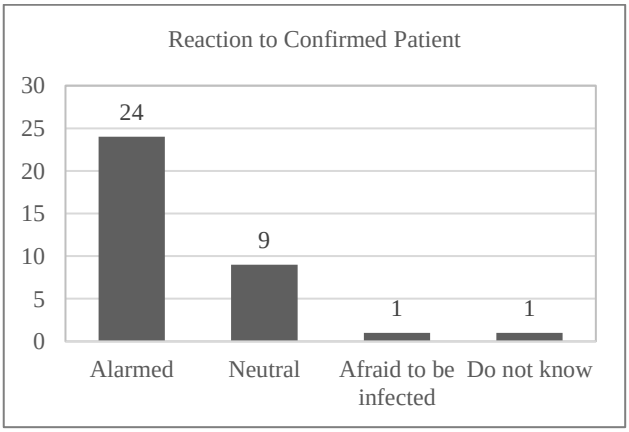

Figure.3. Reaction of the participants to Confirmed and Infected Patient

Figure.3. discusses the reaction of the sampled participants to confirmed patients. 24 out of 35 (68.6%) participants said that they would feel alarmed, 9 (25.7%) would be indifferent, 1 (2.6%) would be afraid they would be able to contract the diseases, and another (2.6%) would not know how to react.

With regards to Figure.2. and Figure.3., the majority of the participants answered that they will be supportive but remain distant and would feel alarmed if a patient is infected or potentially infected by *C. auris.* According to the study of [4], there is still much to know about the cell biology and virulence characteristics of the fungi, thus, causing the participants to feel a distant and alarmed attitude towards patients. In addition to that, another factor that contributes to that certain attitude by the participants is the epidemiology of *Candida* spp. in the Philippines.

Attitude across the Government and the Private Hospitals:

Table.9. presents the descriptive statistic and T-test statistic of the attitude score of the private and government primary hospitals.

Table.9. Descriptive Statistics and T-Test Statistic of the Attitude Score

	Attitude Score (Mean ± SD)	**t-test Statistic**	**P-value**
Private	8.67 ± 1.936	-.566	.575
Government	9.08 ± 1.853		

Table.9. shows that consistent with the knowledge score, health workers from the government primary hospital have a higher attitude score compared to those from the private primary hospital. However, the t-test result showed that the attitude score of those from the government primary hospital is not statistically significantly different from that of the knowledge score of those from the private primary hospital, *t(33)=-.566, p=.575.*

Table.10. Chi-Square Results of the Attitude Statements across Type of Institution

	Chi-Square Statistic	**P-value**	**Interpreta-tion**
Attitude Towards the Infection/Being Infected			
1. Do you feel any concern towards the emerging *C.*	3.199	.074*	Not significant

	auris infections in the country?			
2.	Do you feel that should there be a rise in *C. auris* infections, your workplace would be able to manage?	1.909	.385	Not significant
3.	Do you think *C. auris* is regarded as a pathogen that needs immediate attention in your workplace?	.936	.333	Not significant
4.	Do you think you can manage this infection in a patient?	1.571	.456	Not significant
5.	How would you feel if *C. auris* infection spreads in your workplace?	.893	.640	Not significant
Attitude towards Patients				
1.	Can you easily identify if the nosocomial fungemia of the patient is caused by *C. auris*?	.000	1.000	Not significant
2.	Do you know the proper precautions when handling patients suspected of *C. auris* fungemia?	.841	.359	Not significant
3.	If a patient is suspected to have the infection, what would be your approach?	.228	.633	Not significant
4.	If a patient is confirmed to have *C. auris* infection, how would you feel?	.972	.808	Not significant

**Significant at 10% level of significance*

Table.10. delineates the chi-square results of the statements covering the attitude score. This table shows that, at 5% level of significance, none of the statements in the attitude domain is statistically and significantly different when tested across types of institutions, *p>.05*.

However, when considering at 10% level of significance, we can say that there is an association between the institution and the concern towards the emerging *C. auris* infections in the country *(p=.074)*, as shown in Table 10.

D. Practices

Under practice, the responses of health workers in the survey were analyzed with regards to hand washing, availability and accessibility of PPE, and frequency of cleaning and disinfecting healthcare facility and equipment.

Practices in both the Government and the Private Hospitals:
Table.11. and Figure.4. depict the distribution of health workers' practice category towards *C. auris* in both the government and the private hospitals.

Table.11. Protocols in terms of Hand Hygiene and Availability and Accessibility of Personal Protective Equipment

Questions	**R 1**	**R 2**	**R 3**	**MR**	**TR**
Hand Hygiene					
1. Decontaminates hands with an alcohol-based hand rub instead of washing with soap and water when hands are not visibly soiled.	1	0	1	0.11	9
2. Decontaminates hands with soap and water when hands are visibly soiled.	0	3	0	0.17	7,8
3. Wearing gloves as a substitute for hand hygiene, especially in the absence of soap, water, and alcohol.	2	2	2	0.34	4
4. Presence of functional and well-maintained handwashing stations and necessary hand hygiene supplies (e.g., gloves, hand	14	7	5	1.74	2

soap or hand rub, disinfectants, and so forth) at or near the point of care.					
5. Performs hand hygiene before and after touching a patient.	17	13	3	2.29	1
6. Performs hand hygiene after direct contact with patient's blood, body fluids, contaminated surfaces, or environment.	0	8	7	0.66	3
7. Performs hand hygiene before donning and immediately after doffing gloves.	1	1	5	0.29	5
8. Performs hand hygiene before handling medical devices and procedures that are performed under sterile conditions.	0	0	6	0.17	7,8
9. Performs hand hygiene before proceeding to work on a clean body site after handling a soiled body site on the same patient.	0	1	6	0.23	6
Personal Protective Equipment					
Laboratory Gown	4	7	14	1.14	3
Gloves	14	17	0	2.17	1
Protective eyewear	0	3	8	0.40	4
Face shield	0	1	7	0.26	5
Mask	17	7	6	2.03	2
Shoe cover	0	0	0	0.00	6

R1 Rank 1, R2 Rank 2, R3 Rank 3
MR Mean Rank
TR Total Rank

Table.11. reveals the ranking of the participants about hand hygiene. The topmost answer of the majority of the participants was performing hand hygiene before and after touching a patient (MR=2.29), followed by the presence of working handwashing stations and necessary hand hygiene supplies (MR=1.74) and by performing hand hygiene after direct contact with patient's blood or any blood fluids (MR=0.66).

In terms of the healthcare facility's availability and accessibility of personal protective equipment (PPE) when manipulating a known or suspected *Candida* spp. isolates, most of the participants voted for gloves (MR=2.17), followed by a mask (MR=2.03) and a laboratory gown (MR=1.14).

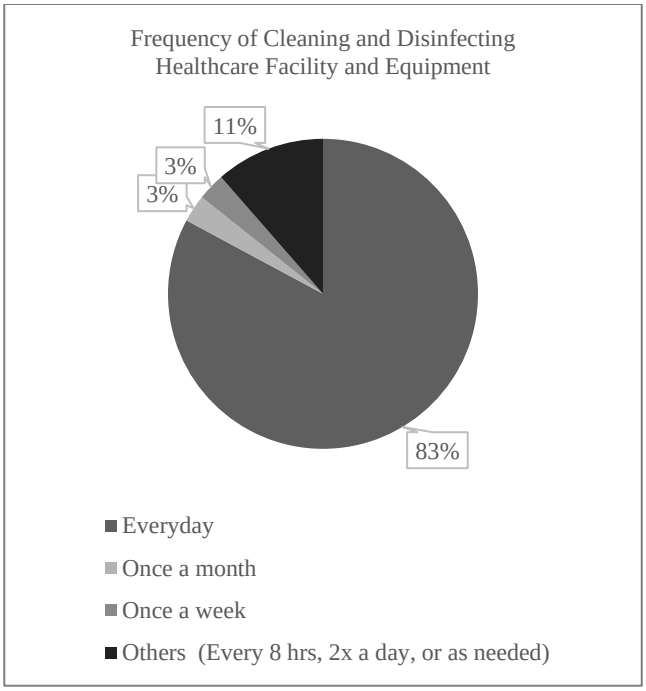

Figure.4. Frequency of Cleaning and Disinfecting Healthcare Facility and Equipment

Figure.4. explains the percentage of cleaning and disinfecting healthcare facility and equipment in the workplace. 23 (83%) have reported that they are cleaning and disinfecting their facility every single day, 4 (11%) have stated that their facility is being cleaned and prepared every eight (8) hours, sometimes even twice a day or as needed, while one (3%) has reported that they only clean their facility once a month and one (3%) has only clean their facility once a week.

It is important then that strict protocol measures must be observed to prevent further nosocomial outbreaks. Some of these measures include isolation of patients and those who had been in close contact, wearing of personal protective equipment, patients screening on affected wards, decontaminating the skin with chlorhexidine, cleaning of environment with chlorine-based reagents, and using hydrogen peroxide vapor or ultraviolet (UV) light for terminal decontamination [5]. It is noted that ammonium-based disinfectants are ineffective against *Candida* species including *C. auris*. Instead, chlorine-based disinfectants are more preferred since they have shown good in-vitro disinfection efficacy [25]. On the other hand, the CDC guidelines recommend to thoroughly disinfect and decontaminate patients' rooms, biological safety cabinet, and shared

equipment with freshly prepared 10% bleach (excess bleach solution must be wiped off after the recommended contact time) and 70% ethanol following bleach treatment; environmental and equipment disinfection must be done daily to ensure the institution's safety [26].

Practices across the Government and the Private Hospitals: Table.12. reveals the distribution of health workers' practice category towards *C. auris* across the government and the private hospitals.

Table.12. Ranking of the Practice Statements across Type of Institution

Questions	**MR**	**TR**	**MR**	**TR**	**Interpretation* using MR**
Hand Hygiene	Private		Government		
1. Decontaminates hands with an alcohol-based hand rub instead of washing with soap and water when hands are not visibly soiled.	0.00	9	0.00	9	Private = Government
2. Decontaminates hands with soap and water when hands are visibly soiled.	0.22	5, 6, 7	0.15	7, 8	Private > Government
3. Wearing gloves as a substitute for hand hygiene, especially in the absence of soap, water, and alcohol.	0.56	4	0.27	5	Private > Government
4. Presence of functional and well-maintained handwashing stations and necessary hand hygiene supplies (e.g., gloves, hand soap or hand rub, disinfectants, and so forth) at or near the point of care.	1.67	2	1.77	2	Private < Government
5. Performs hand hygiene before and after touching a patient.	2.11	1	2.35	1	Private < Government
6. Performs hand hygiene after direct contact with patient's blood, body fluids, contaminated surfaces, or environment.	0.89	3	0.58	3	Private > Government
7. Performs hand hygiene before donning and immediately after doffing gloves.	0.11	8	0.35	4	Private < Government
8. Performs hand hygiene before handling medical devices and procedures that are performed under sterile conditions.	0.22	5, 6, 7	0.15	7, 8	Private > Government
9. Performs hand hygiene before proceeding to work on a clean body site after handling a soiled body site on the same patient.	0.22	5, 6, 7	0.23	6	Private < Government
Personal Protective Equipment					
Laboratory Gown	1.00	3	1.19	3	Private < Government
Gloves	2.56	1	2.04	2	Private > Government
Protective eyewear	0.44	4	0.38	4	Private > Government

Face shield	0.33	5	0.23	5	Private > Government
Mask	1.67	2	2.15	1	Private < Government
Shoe cover	0.00	6	0.00	6	Private = Government

MR Mean Rank
TR Total Rank

**Higher Mean Rank = Higher Mean Rating*

Table.12. exhibits the ranking of the hand hygiene protocols and of PPE. Regardless of institution, the topmost important hand hygiene protocol for the sampled participants was performing hand hygiene before and after touching a patient. However, the health workers from the government primary hospital provided higher mean rating on the protocol as compared to those from the private health workers. This was then followed by the presence of functional and well-maintained handwashing stations and necessary hand hygiene supplies at or near the point of care, with government primary hospital again obtaining a higher mean rating than private primary hospital. The third most important protocol was performing hand hygiene after direct contact with a patient. In this case, the health workers from the private institution provided a higher mean rating than those from the government hospital. In either institution, they do not prefer alcohol-based hand rub instead of washing with soap and water when hands are not visibly soiled. In accordance with the CDC guidelines, using alcohol as opposed to soap and water when hands are not visibly soiled was the preferred method as alcohol-based hand sanitizer (ABHS) was proven to be effective against *C. auris* [27]. Still on the upper scale of ranking, wearing gloves as a substitute for hand hygiene, especially in the absence of soap, water, and alcohol ranked fourth and fifth for private primary hospital and government primary hospital, respectively. However, it is stated in the CDC guidelines that healthcare providers should not wear gloves as a substitute for proper hand washing and sanitizing (CDC, 2021). It is recommended to use alcohol-based hand sanitizer or wash with soap and water immediately before and after touching a patient with known or suspected *C. auris* infection to prevent further transmission of the disease.

For the personal protective equipment (PPE), the topmost important PPE in the private setting is gloves, followed by mask and laboratory gown. On the other hand, mask is the highest ranked PPE in the government setting and then followed by gloves and laboratory gown. In either institution, they find shoe cover as the least important part of PPE. As per the CDC (2020), under the safety considerations when working with known or suspected isolates of *C. auris*, health workers are to follow their institution's policy on use of PPE. Though health workers should at least be equipped with laboratory coats and gloves as well as eye protection in cases of spatter or splashes. Moreover, according to CDC, before the beginning of the procedure and collection of patient swabs of *C. auris*, aside from performing hand hygiene, health workers are to wear PPE as indicated by the patient's clinical care team in which gloves, gown, and mask are mentioned as examples. There was no shoe cover mentioned by the CDC with regards to infection prevention and control of *C. auris* which is in congruence with the responses of the health workers having shoe cover with the lowest rank in the choices under the practice category regarding PPE.

D. Factors Affecting Knowledge, Attitude, and Practices

Table.13. showed the factors affecting Knowledge, Attitude, and Practices.

Table.13. Factors Affecting the Knowledge, Attitude, and Practices Scores

	Knowledge Score		**Attitude Score**		**Practice Score**	
	Beta	p-value	Beta	p-value	M-W/K-W	p-value
Constant	38.216	.000*	9.223	.000*	-	-
Sex	-3.445	.024*	-.281	.613	-1.071[a]	.284
Age	.646	.766	-1.002	.226	2.087[b]	.837
Type of Institution	-.590	.371	.291	.251	.000[a]	1.000
Years of Service	-.388	.852	-.467	.558	6.772[b]	.080
Profession	2.187	.089	-.311	.516	.000[b]	1.000

**Significant at 5% level of significance*
[a] Mann-Whitney Test
[b] Kruskal-Wallis Test

For the Knowledge domain, knowledge score was the dependent variable while the demographics variables were the independent variables. For the Attitude domain, attitude score was the dependent variable while the same demographic variables were the independent variables. Meanwhile, the Practice domain was tested using Mann-Whitney Test (for two groups) or Kruskal-Wallis Test (for three or more groups) since the statements or questions comprising the practice domain were rankings rather than Likert-scale and or *Yes/No* questions that may directly transform into score.

Multivariate linear regression was used to describe and explain the relationship between the dependent and independent variables. For the Knowledge score, the regression result shows that the Knowledge score was predicted to be 34.771 when the sex variable was male, and 38.216 when it was female. For the Attitude and Practice scores, no demographic variables appeared to be significant at 5% level of significance. Hence, no factors affecting both the Attitude and Practice scores.

In such a case that we consider a 10% level of significance, profession *(p=0.089)* as a demographic variable would be a factor that would show a significant variation in knowledge of primary hospital health workers about the emergence of *C. auris*. Moreover, at 10% level of significance, years of service (*p=0.080*) as a demographic variable would then be a factor that would show a significant variation in practice towards the response of primary hospital health workers to the emergence of *C. auris*.

IV. CONCLUSION

Based on the gathered data, the respondents exhibit satisfactory knowledge for the general information, risk factors, and symptoms of *C. auris* with regards to CDC and other studies. However, the respondents have poor knowledge regarding the identification and treatment of *C. auris*, which are possible causes of concern in case of an outbreak. The respondents express their concern towards the infection and/or being infected as they consider it as a pathogen that needs immediate attention and show a supportive yet alarmed attitude towards patients. The respondents also exhibit satisfactory practice in the prevention of *C. auris* concerning hand hygiene and the use of personal protective equipment. In conclusion, there is no significant difference between the Knowledge, Attitude, and Practices of the health workers in Atimonan, Quezon Province in comparison to the guidelines proposed by the CDC regarding the emergence of nosocomial fungemia caused by *C. auris*. Furthermore, there is no significant difference between the Knowledge, Attitude, and Practices of the health workers in the government primary hospital and private primary hospital in Atimonan, Quezon Province regarding the emergence of nosocomial fungemia caused by *C. auris*.

Ethical Considerations:

This study has been granted ethical approval by the University of Santo Tomas Faculty of Pharmacy Research Ethics Committee with a study protocol code FOP-REC-2021-02-219.

Conflict of Interest:

The authors of this study declare that there is no conflict of interest.

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