American Journal of Biology and Natural Sciences
https://biojournals.us/index.php/AJBNS
ISSN: 2997-7185

Evaluation of Knowledge and Awareness of Aspergillosis Infections among Healthcare Workers

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Received: 2024, 15, Feb
Accepted: 2025, 21, Mar
Published: 2025, 24, Apr

Annotation: Background: Aspergillus is a common saprophytic conidial fungus found in soil. Fungal infections caused by Aspergillus can have a wide range of clinical manifestations depending on the immunological state of the patient. Aspergillus can primarily affect the lungs and cause diseases such as allergic bronchopulmonary aspergillosis (ABPA), chronic pulmonary aspergillosis (CPA), and invasive pulmonary aspergillosis (IPA) ABPA the patients affected with asthma and cystic fibrosis, while CPA affects patients with underlying ولung conditions. IPA has a high mortality rate and can occur in patients without obvious immune compromise.

Objective: The study aimed to evaluate the knowledge of healthcare workers about aspergillosis using a quantitative and descriptive approach with an electronic questionnaire.

Methods: A descriptive cross-sectional study and non-probability convenience sampling were randomly conducted for 149 HCWs. This sample was distributed

throughout twenty hospitals and twenty-five healthcare workers centers, conducted from March to July 2022. Data was gathered and analyzed using both descriptive and inferential statistics using electronic questionnaires.

Results: The findings indicate that only 13% of healthcare workers had good knowledge about aspergillosis, while 60% had acceptable knowledge and 27% had poor knowledge. Statistically significant differences were found in the answers of healthcare workers for all questions except one. The study also found significant differences in knowledge between males and females, profession, and working unit.

Conclusions: These findings highlight the need for educational programs and training for healthcare workers to improve their knowledge about aspergillosis, which can ultimately lead to better patient care and outcomes. In summary, it is essential that healthcare workers understand the risks that aspergillosis disease poses to their health and the importance of following appropriate safety protocols, including the use of PPE, to minimize exposure to fungal spores. They must also be well-versed in identifying the symptoms of the condition so that they can diagnose and treat it promptly.

Keywords: Aspergillosis, Health care Workers, Knowledge, Evaluation.

Introduction:

Aspergillus is a common filamentous fungus that can be found in food, water, soil, and air worldwide. It is especially prevalent in decomposing plants. Although it is usual to inhale its spores, doing so in a host with healthy immune defenses seldom results in illness (Bennett et al., 2019). On the other hand, Aspergillus species can result in a wide range of clinical symptoms in a

vulnerable host, with the lung being the most common location of illness. (Griffiths et al., 2021). The presentation of the wide range of clinical diseases caused by aspergillosis depends on the host's immune system as well as the place of involvement. While up to 10% of patients may have spread, the most commonly affected areas include the upper airway, bronchi, lung parenchyma, and adjacent tissues (such as pleural or lymph nodes) (Cadena et al., 2016).

There are approximately 180 species of Aspergillus, but fewer than 40 of them are known to cause infections in humans (CDC, 2024). The most significant are Aspergillus fumigatus (50–67% of isolates in invasive disease), Aspergillus flavus (8–14%), Aspergillus terreus (5–9%), and Aspergillus niger (3–5%) (Bennett et al., 2019; Denning et al., 2018). All of these species may be found in a wide range of substrates, such as soil, organic waste, fruits, compost piles, animals, and, on occasion, people (Sugui et al., 2015). *Aspergillus species cause various forms of aspergillosis, including invasive pulmonary aspergillosis (IPA), chronic pulmonary aspergillosis (CPA), and allergic bronchopulmonary aspergillosis (ABPA)* (Yii et al., 2017). *Aspergillosis* is acquired by way of inhalation or traumatic inoculation of Aspergillus spores from dead and decaying organic matter in the environment (Takazono & Sheppard, 2017).

Over a billion individuals are afflicted by fungal illnesses, which claim the lives of over 1.5 million people. Even though the majority of deaths from fungal illnesses are preventable, public health officials continue to ignore them. According to recent estimates, there are around 250,000 instances of invasive aspergillosis and 3,000,000 cases of chronic pulmonary aspergillosis worldwide (Azoulay et al., 2020). According to estimates, 15% of serious respiratory infections are caused by invasive fungi (Bongomin et al., 2017). Death rates from Aspergillus can reach 40% to 50% in patients with acute leukemia and those who have received hematopoietic stem cell transplants (HSCTs), making it one of the most frequent infectious causes of death in individuals with severe immunocompromised conditions (Robin et al., 2019). In the late 1990s, surveillance clinical investigations showed that the prevalence of Aspergillus infections at major cancer centers had increased three to four times over the previous twenty years (Latgé & Chamilos, 2020).

The quickness of diagnosis and the accuracy of antifungal treatment are two critical components that determine the improvement of clinical outcomes in aspergillosis (Zhang et al., 2014). Microscopy and culture are crucial for the diagnosis; however, their sensitivity is restricted. Because it is more sensitive than culture, the imperfect gold standard for fungal cell wall detection is galactomannan (GM) detection (Rawlings et al., 2019). Treatment depends on the type of infection and includes antifungal medications (CDC, 2024). Triazoles are the first-line antifungal drugs used to treat aspergillosis, especially voriconazole, isavuconazole, and posaconazole for invasive infections and voriconazole or itraconazole for chronic infections (Cornely et al., 2019; Jenks et al., 2019).

Studies consistently reveal significant knowledge gaps and misconceptions regarding aspergillosis among healthcare workers (Muñoz et al., 2016). Addressing knowledge gaps and improving awareness of aspergillosis among healthcare workers is crucial for reducing the risk of infection and improving patient outcomes (Danesh et al., 2024). Increased awareness of aspergillosis among healthcare workers can significantly impact patient care, infection prevention, and reduced incidence and mortality in high-risk populations (Mareković, 2023; Talento et al., 2019).

Therefore, this study aims to evaluate healthcare workers' knowledge and awareness of Aspergillosis infections.

Material and methods:

Study Period:

The study period from March to July 2022.

Study Design:

A descriptive cross-sectional study design with an assessment approach was used to evaluate

healthcare workers' knowledge about the dangerous disease Aspergillosis.

Data Collection Method:

Data was collected using an electronic questionnaire, by convenience samples of 149, which were selected through the use of non-probability samples. The questionnaire was prepared through a comprehensive review of the relevant which was used as a study instrument to collect the data, was consist of the first part: socio-demographic characteristics and the second part was about the knowledge of the symptoms and the causative agents and the treatment of Aspergillosis disease, which include thirty-three items using MCQ questionnaire.

Statistical Analyses:

SPSS-23 (Statistical Packages for Social Sciences, version 23) was the statistical program that was used to analyze the data. Both descriptive statistical methods (using tables, percentages, frequencies, standard deviations, means, pies, and bar charts) and inferential statistical methods (using categorical tests, such as the Chi-square test) were used to analyze the data. The P-value was considered statistically significant if it was equal to or even less than 0.05.

Results:

Total of participant was 149 of health care worker included in this study. The mean +SD of age of them was 29.5+7.87 while Minimum and Maximum age from 20-71 years.54.4% of them were females and 45.6% were males. 90.6% of them was from urban residence in addition to 9.4% from rural residence. The higher number of health care worker in this study had Bachelor degree 58.4% followed by diploma degree 26.8% while lower number was in participants had Ph.D. degree 2.7%.the majority of study participants was medical technical staff 30.2% and nurse staff 20.8%. most of them working in different units in hospital 72% followed by emergency units 14.1% as appear in table 1.

Table 1: sociodemographic information.

1	**Age**	**Mean ± SD.**	**Minimum-Maximum**	
		29.5+7.8765	**(20-71) years**	
			Frequency	**Percent%**
2	**sex**	**Female**	**81**	**54.4**
		Male	**68**	**45.6**
3	**Residence**	**Rural**	**14**	**9.4**
		Urban	**135**	**90.6**
4	**Occupational status**	**Physician**	**25**	**16.8**
		Nurse	**31**	**20.8**
		Technical	**45**	**30.2**
		Technical assist	**28**	**18.8**
		Other	**20**	**13.4**
5	**Academic qualification**	**high school**	**11**	**7.4**
		Diploma	**40**	**26.8**
		Bachelors	**87**	**58.4**
		MSc	**7**	**4.7**
		Ph.D.	**4**	**2.7**
6	**Workplace**	**Emergency**	**21**	**14.1**
		ICU	**5**	**3.4**
		Laboratory	**13**	**8.7**
		operation rooms	**2**	**1.3**
		Other	**108**	**72.5**

Regarding the assessment of knowledge about Aspergillosis diseases among health care worker.

Table 2 shows that there was statistically significant difference between answers of heath care worker for all questions about knowledge about Aspergillosis at a P .value of :<0.05 except questions number 17 “Identify the cause of chronic pulmonary aspergillosis (CPA) as well as pulmonary tuberculosis (PTB) respectively?” was non-significant difference at a P.value of: < 0.134.

Table 2. knowledge assessment of health care worker about aspergillosis diseases

No.	Questions	Response	Fr.	Pe. %	Sig
1	Have you ever heard of aspergillosis?	Yes	72	48.3	0.001
		No	71	47.7	
		I don’t know	6	4.0	
2	Do you think this type of fungal infection is contagious and widespread in society?	Yes	35	23.5	0.042
		No	53	35.6	
		I don’t know	61	40.9	
3	Have you ever had aspergillosis or do you know someone who has been infected?	Yes	7	4.7	0.027
		No	109	73.2	
		I don’t know	33	22.1	
4	Have you noticed this fungal infection on people with the following conditions (asthma, Cystic fibrosis, undergoing chemotherapy or radiological treatment, has immune diseases)	Yes	29	19.5	0.000
		No	70	47.0	
		I don’t know	50	33.6	
5	Do you think the treatment of this type of infection is available in your country?	Yes	51	34.2	0.000
		No	22	14.8	
		I don’t know	76	51.0	
6	Do you think there is a lack of awareness about this type of fungal infections in Society?	Yes	116	77.9	.000
		No	10	6.7	
		I don’t know	23	15.4	
7	Do you think increased pollution has helped increase its spread?	Yes	114	76.5	.000
		No	6	4.0	
		I don’t know	29	19.5	
8	Do you think that the lack of care and control in hospitals has made it the epicenter of the spread of such types of diseases?	Yes	111	74.5	.000
		No	14	9.4	
		I don’t know	24	16.1	
9	Do you think that the lack of care and control in hospitals has made it the epicenter of the spread of such types of diseases?	Yes	68	45.6	.000
		No	26	17.4	
		I don’t know	55	36.9	
10	In your opinion, are the methods of prevention in health institutions sufficient to prevent the spread of this disease?	Yes	38	25.5	.000[b]
		No	83	55.7	
		I don’t know	28	18.8	
11	Do you think aspergillosis leads to long-term complications and poses a threat to life?	Yes	78	52.3	.0001
		No	17	11.4	
		I don’t know	54	36.2	
12	Have you ever seen these injuries?	Yes	48	32.2	.004
		No	92	61.7	
		I don’t know	9	6.0	
13	In your opinion, which age group is most susceptible to infection?	Newborn	3	2.0	0.038
		Children	34	22.8	

		Adolescents	21	14.1	
		Adult	33	22.1	
		Elderly	58	38.9	
14	Do you think is (chronic pulmonary disease Aspergillosis) has the same symptoms as pulmonary tuberculosis and can they be distinguished b symptoms only?	Yes	61	40.9	0.013
		No	33	22.1	
		I don't know	55	36.9	
15	In your opinion, are people prone to chronic pulmonary aspergillosis mentioned earlier also susceptible to pulmonary tuberculosis?	Yes	55	36.9	0.001
		No	27	18.1	
		I don't know	67	45.0	
16	In your opinion, is the treatment prescribed for chronic pulmonary aspergillosis the same as for pulmonary tuberculosis?	Yes	26	17.4	0.028
		No	56	37.6	
		I don't know	67	45.0	
17	Identify the cause of chronic pulmonary aspergillosis (CPA) as well as pulmonary tuberculosis (PTB) respectively?	Aspergillus spp., Mycobacterium. Tuberculosis	51	34.2	0.134
		Aspergillus spp, for both infections	29	19.5	
		Mycobacterium tuberculosis, Aspergillus. spp.	37	24.8	
		Mycobacterium tuberculosis. for both infections	32	21.5	

Concerning the overall knowledge of health care worker about Aspergillosis. The study found that only 13% of health care worker had good knowledge about aspergillosis and 60% of them had acceptable knowledge while 27% had poor knowledge about aspergillosis as shows in figure 1.

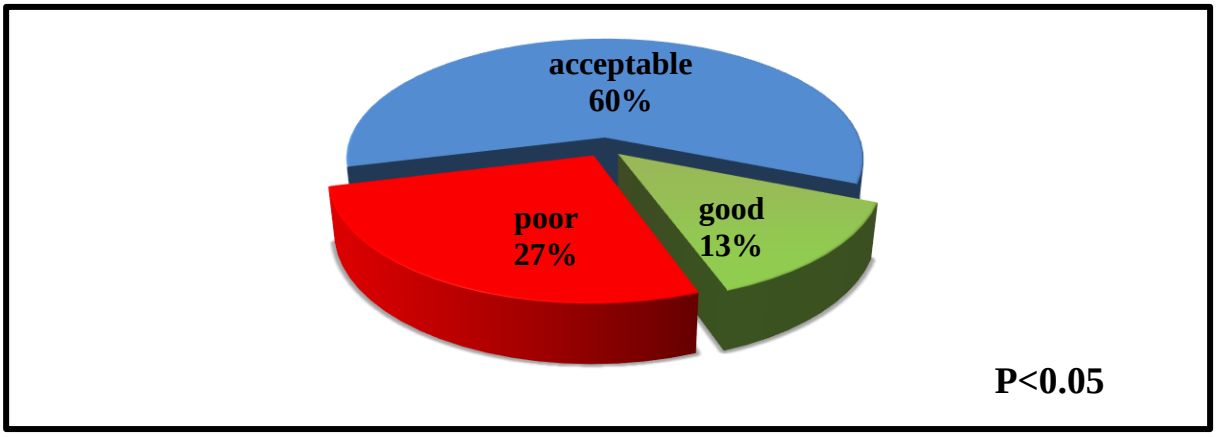

Fig. 1: Overall knowledge of health care worker about aspergillosis diseases.

On the other hand, the knowledge of health care worker about ***Aspergillus*** species such mode of transmission, severity of disease, and. The results show highest percentage of participant have good knowledge found to be about Aspergillus flavus was 50% while lowest found about Aspergillus fumigatus. Majority of health care worker have acceptable knowledge about ***Aspergillus*** species include 75% for both ***Aspergillus niger, Aspergillus fumigatus*** while 50% for both ***A. flavus, A. terreus***. In addition to percentage of poor knowledge the study finds 25% of

health care worker have poor knowledge about ***Aspergillus*** species (***A. terreus, A. fumigatus***) as shows in figure 2 (A, B, C, D).

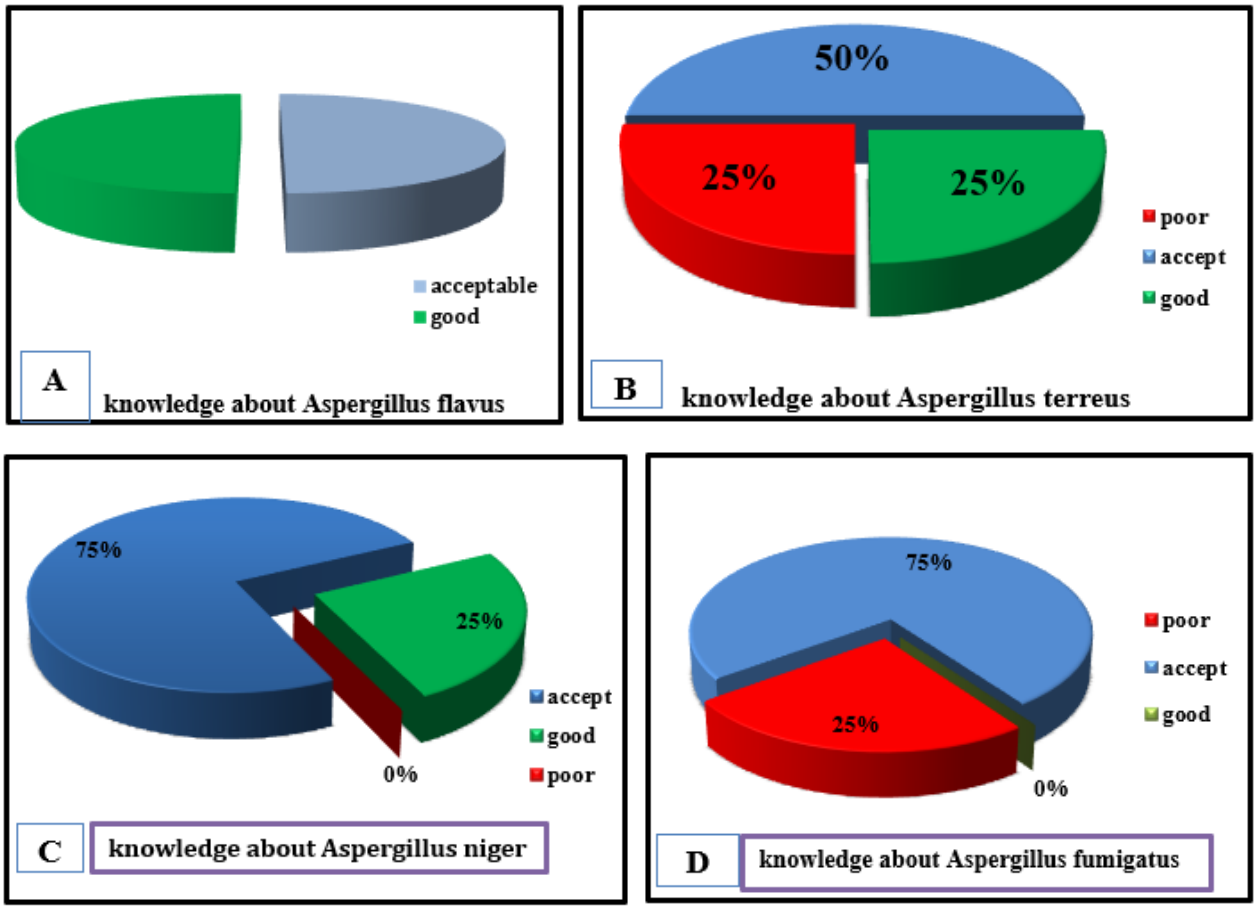

Fig. 2(A, B, C, D): Overall knowledge of health care worker about aspergillosis species and role of transmission and treatment.

The health care worker answers about questions of knowledge assessment about aspergillosis categorized by gender. the study found that 45% of females have good knowledge more than males 40% with statistically significant difference at a P .value of <0.05 as shows in figure 3.

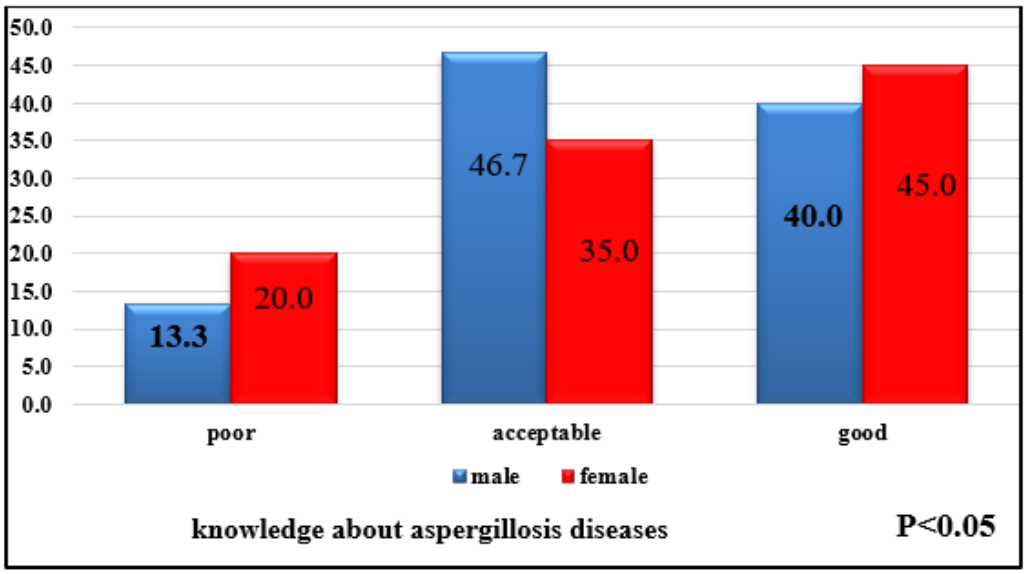

Fig. 3: knowledge assessment about aspergillosis categorized by gender.

Also, the health care worker answers about questions of knowledge assessment about aspergillosis categorized by profession. The study reports that statistically significant difference between health

care profession: physician have good knowledge more than another specialist with 62.5% followed by technical assist 50% while other profession have higher percentage of poor knowledge about aspergillosis at a P.value <0.05 as appear in figure 4.

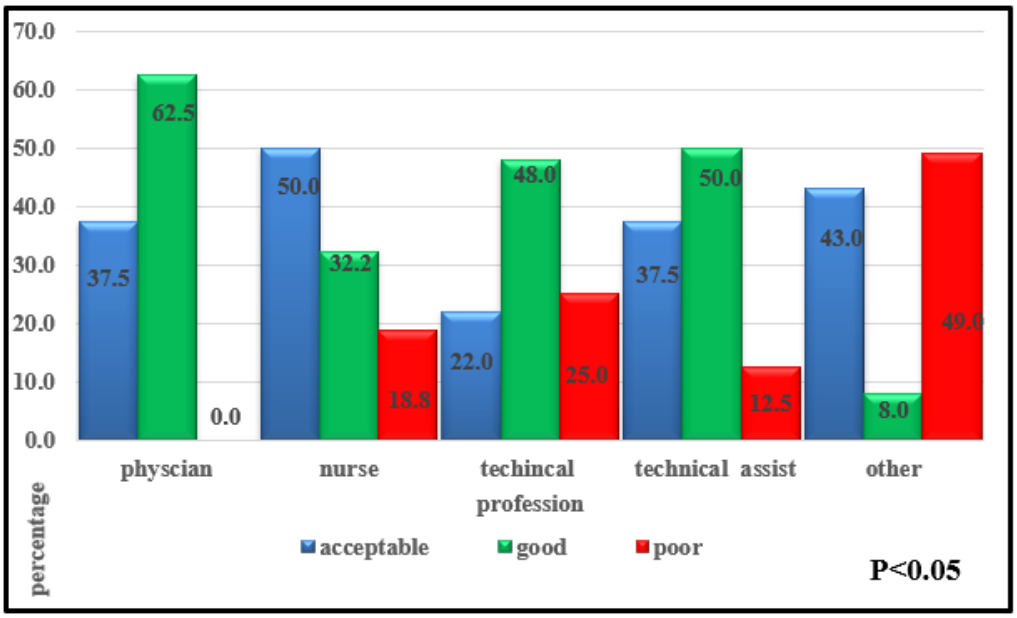

Figure 4: knowledge assessment about aspergillosis categorized by profession.

Furthermore, the health care worker answers about questions of knowledge assessment about aspergillosis categorized by working units. Figure 5 appear that the statistically significant difference between health care working units: health care worker working in medical laboratory have good knowledge more than another unit that monition in this study with 37% while health care working in ICU has higher percentage of poor knowledge about aspergillosis with 26.7% at a P.value <0.05 as appear in figure 5.

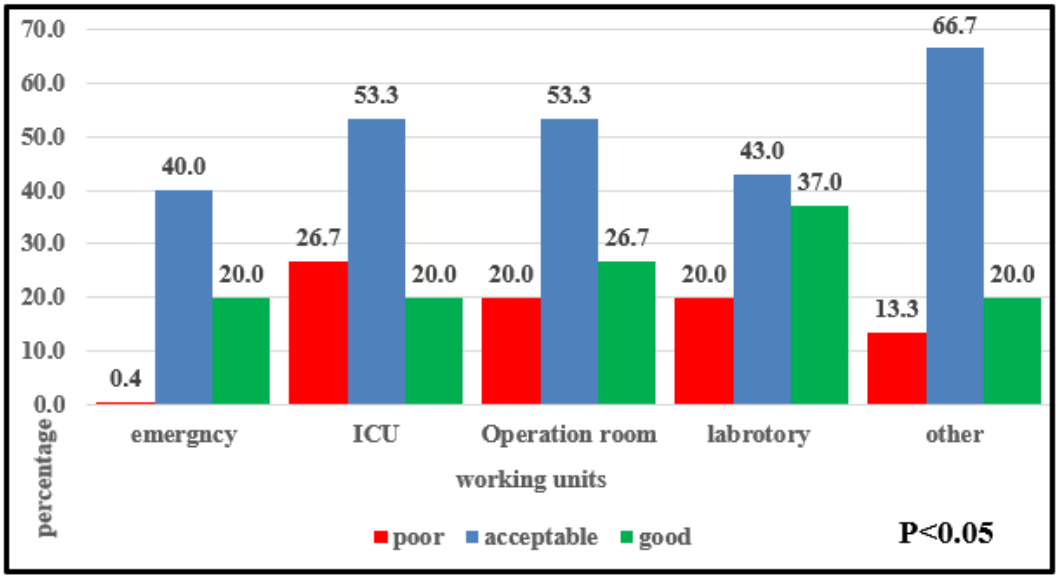

Fig. 5: knowledge assessment about aspergillosis categorized by working units.

Discussion:

People with significantly compromised immune systems are more likely to develop aspergillosis , nevertheless other studies indicate lung infections resulted from aspergillus is mortality in previously healthy people who were hospitalized for sever sickness linked to influenza virus infection (Wingard et al., 2010). The majority of these mold strains were not harmful, but a few of them could have been dangerous if inhaled by someone who had a compromised immune system,

a lung condition or asthma when the infection spreads to blood vessels and beyond, it results in invasive aspergillosis, the most dangerous type of aspergillosis. the course of treatment will depend on the type of aspergillosis and may include observation, antifungal drugs or in rare circumstances surgery. numerous Aspergillus spp. were startled to discover it in places we did not anticipate including in laboratories and hospital rooms where hygiene is required (CDC, 2024).

Results showed that only 13% of healthcare workers had good knowledge about aspergillosis, while 60% had acceptable knowledge and 27% had poor knowledge. Statistically significant differences were found in the answers of healthcare workers for all questions except one. The findings of this study disagreed with those of the other study in Iran, which stated that overall, 19.30% had very low awareness, 52.05% had low awareness, 26.32% had moderate awareness, and only 2.34% had high awareness (Danesh et al., 2024). Many healthcare workers may not receive specific training on aspergillosis during formal education. Additionally, if aspergillosis isn't a common condition in their practice setting, it might not be covered in depth in continuing medical education or clinical updates (Talento et al., 2021).

The study also found significant differences in knowledge between sex, profession, and working unit. The findings of this study agreed with those of the other study in Nigeria, which stated that healthcare workers have knowledge about the types of aspergillosis, as well as their transmission and treatment (Oladele et al., 2020). Knowledge levels might also be influenced by specific Aspergillus species' prevalence and clinical importance in healthcare settings. For example, Aspergillus fumigatus is a major cause of invasive aspergillosis, but its significance may not always be emphasized in all healthcare roles. A. niger and A. terreus, while also pathogenic, may not be as commonly encountered or studied in detail (Viegas et al., 2019). The results of this study conflicted with those of the other study in Iran, which stated that males have better knowledge than females (Danesh et al., 2024). Studies often show that women tend to engage more in discussions about health and medical topics, which may enhance their knowledge. Women may also participate more actively in continuing medical education or professional development opportunities (Cervini et al., 2023).

The findings of this study agreed with those of the other study in Nigeria, which stated that physicians have good knowledge more than others (Oladele et al., 2020). Doctors receive more extensive education and specialized training in a wide range of diseases, including infectious diseases like aspergillosis. This broad foundation enables them to better understand rare or complex conditions (Cole et al., 2017). The findings of this study disagreed with those of the other study in Nigeria, which stated that those working in anesthesiology and ophthalmology have good knowledge more than other units (Oladele et al., 2020). A worker’s specific field or specialization may limit their exposure to fungal pathogens. For instance: An infectious disease specialist may have better knowledge of Aspergillus species than general practitioners or nurses (Medina et al., 2022). These findings highlight the need for educational programs and training for healthcare workers to improve their knowledge about Aspergillosis, which can ultimately lead to better patient care and outcomes.

In summary, it is essential that healthcare workers understand the risks that aspergillosis disease poses to their health and the importance of following appropriate safety protocols, including the use of PPE, to minimize exposure to fungal spores. They must also be well-versed in identifying the symptoms of the condition so that they can diagnose and treat it promptly.

Based on the topic of Aspergillosis disease in healthcare workers, some studies that are similar and consistent with the aforementioned research found a high prevalence of Aspergillosis among healthcare workers in hematology/oncology units. Found that the use of invasive devices and underlying respiratory conditions are significant risk factors for developing invasive Aspergillosis in critically ill patients.

Moreover, non-pharmacologic preventive techniques aimed at reducing mold exposure should be taken into account. They include housing patients with severe immunodeficiencies in "protected

environments" that have positive pressure and high-efficiency particulate air (HEPA) filtering. Nevertheless, since gardening and construction are connected to higher Aspergillus exposure, outpatients should avoid doing (Wingard et al., 2010). Nearly 36% of people with CF were found to grow ***A. fumigatus*** **in** airway cultures in research by Sudfeld et al. utilizing the John Hopkins CF integrative microbiology database and the prevalence of ***A. fumigatus*** colonized increased from 1997 to 2007.

It has been determined that almost 32.8% of CF patients have Aspergillus sensitization, which determined by the measurement of ***A. fumigatus*** **-** specific **Ige** (Maturu & Agarwal, 2015). Higher values have been recorded in studies using skin prick testing, ranging from 42.8 % - 65% in certain series (Baxter et al., 2013). ***A. flavus*** was found in three patients 17%, two of whom survived and one of whom passed away (Geller et al., 1999)**.** There were 142 cases of invasive Aspergillosis observed in the multicentric study on ICU acquired mold infection from India, 12 of which 8.5 % cases were IAA and half of those were caused by ***A. flavus*** (Maturu & Agarwal, 2015)**.**

Particularly in underdeveloped nations, aspergillosis of sino-orbital region and ocular infection are linked to ***A. flavus*** (Chotirmall et al., 2008)**.** According to Leug et al., a cluster of eight cases of invasive fungal sinusititis were directly linked to higher airborne conidial counts following soil excavation for hospital renovation. A. flavus was the etiological agents in six of those cases (Fillaux et al., 2012)**.** Jubin et al. (2010) Revealed a 9.4 %prevalence incidence for CF in kids in France the finding of 45 research reporting the prevalence of ABPA and found that the published studies had significant publication bias and heterogeneity (Mastella et al., 2000)**.**

Conclusions:

The study found that the overall knowledge of health care workers about Aspergillosis was acceptable, but there were still knowledge gaps in some areas, such as the identification of ***Aspergillus*** species and their mode of transmission. The study also found that sex, profession, and working units had a significant impact on the level of knowledge about Aspergillosis. Therefore, it is recommended that educational interventions be designed and implemented to raise awareness among health care workers about aspergillosis, its causative agents, and the appropriate treatment options, which may help reduce the spread of this disease in hospitals and communities.

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