

# The Characteristics of Hospitalized Pneumonia Patients among Malaysian Hajj Pilgrims

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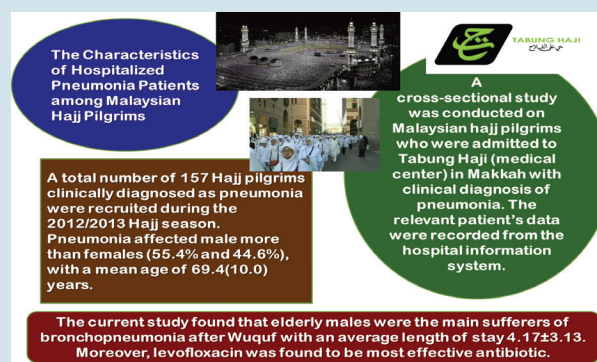
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## ABSTRACT

**Background:** Hajj is the largest annual gatherings in the Islamic world. Hajj pilgrims encounter a great deal of heavy physical and mental stress. Chest infection, especially pneumonia is a potentially life-threatening illness which poses global health problems, particularly among elderly performing hajj. The objective of this study was to identify the sociodemographic, clinical and laboratory characteristics of patients clinically suspected of having pneumonia during Hajj season. **Methods:** A cross-sectional study was conducted on Malaysian hajj pilgrims who were admitted to Tabung Haji (medical center) in Makkah with clinical diagnosis of pneumonia. The relevant patient's data were recorded from the hospital information system. **Results:** A total number of 157 Hajj pilgrims clinically diagnosed as pneumonia were recruited during the 2012/2013 Hajj season. Pneumonia affected male more than females (55.4% and 44.6%), with a mean age of 69.4(10.0) years. Coughing (96.2%) was recorded as the commonest symptoms followed by fever (84.7%) and breathlessness (47.1%). Most of the pilgrims were noted to have hypertension (60.5%) while 28.0% of them had diabetes, chronic obstructive pulmonary disease (25.5%) and asthma (12.7%). The laboratory finding showed mean white blood cell count was 16.9 (13.0)  $\times 10^9/L$ , and the neutrophils differential count was 81.1% (15.5). The most frequently prescribed antibiotic is levofloxacin (54.8%), followed by azithromycin (39.2%) and cefuroxime (23.6%). The mean length of hospital stay was 4.17( $\pm$  3.13) days, and most of the patients (97.5%) were discharged after getting treatment. **Conclusion:** The current study found that elderly males were the main sufferers of bronchopneumonia after Wuquf with an average length of stay 4.17  $\pm$  3.13. Moreover, levofloxacin was found to be most effective antibiotic.

**Key words:** Hajj, Pneumonia, Pilgrims, Clinical manifestation, Laboratory findings.

## PICTORIAL ABSTRACT



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## INTRODUCTION

Globally, Hajj is the largest and longest standing annual Muslim mass gatherings for religious and ritual performances which is performed in Makkah, Kingdom of Saudi Arabia (KSA).<sup>1</sup> Every year, more than 2.5 million Muslims from different parts of the world perform Hajj.<sup>2</sup> The gathering of Hajj pilgrims from various countries around the world for over a month's time, which inevitably causes overcrowding and confinement leading to a number of public health challenges.<sup>3</sup> As pilgrims encounter extreme 'physical exhaustion, extreme heat, and crowded accommodation encourage disease transmission, especially of airborne agents'.<sup>4</sup> Moreover, due to the very high thickness of pilgrims and the distance from one another remain very close and less than three feet, which promote infectious diseases to be transmitted among Hajj pilgrims.<sup>3</sup> Respiratory tract infections are the commonest ailment among Hajj pilgrims, and the primary cause of hospitalization and pneumonia was found to be top of the list.<sup>5,6</sup> Community-acquired pneumonia (CAP) is a common and potentially life-threatening illness and remains as one of the global public health challenges and leading cause of death.<sup>7,8</sup> Pneumonia remains as a life threatening disease among elderly Hajj pilgrims.<sup>8</sup> Among CAP, *Pneumococcal pneumonia* is one of the most

common bacterial disease need to be addressed by the clinicians.<sup>9</sup> It was considered as a significant source of morbidity and mortality throughout the worldwide.<sup>10</sup>

The clinical pneumonia is characterized by a variety of symptoms and signs that depend on types of pathogen causing infection, age and overall health.<sup>11</sup> The previous studies have identified the typical symptoms of CAP.<sup>12-16</sup> Patients with pneumonia often have a productive cough, followed by an abrupt onset of fever, chills, or rigors, shortness of breath, hypoxia, malaise, weakness, sharp or stabbing chest pain during deep breaths and an increased rate of breathing.<sup>12-16</sup> Confusion is the most prominent sign among elderly.<sup>12,16,17</sup> Generally, underlying diseases such as diabetes, HIV infection, renal failure, cancers, respiratory failure, malnutrition and treatment with immunosuppressive drugs are identified as the risk factors for pneumonia.<sup>18</sup> Commonly, pneumonia is diagnosed based on clinical features.<sup>19</sup> The diagnostic tools are used to substantiate the clinical diagnosis, to find the etiology and look for severity and complications. Chest radiographs, full blood count (FBC), blood culture and sputum culture are recommended as the diagnostic tools for routine evaluation as well as to identify the bacteria or other microorganisms that cause pneumonia infection. All this diagnostic methods are available at the Tabung Haji (TH), which commonly performed for the suspected

patient of having pneumonia. TH is the key organization of the Malaysian Government for Malaysian Hajj Pilgrims Healthcare during the Hajj time in Saudi Arabia. Pilgrims Fund Board (Lembaga Tabung Haji) or the more popular for Malaysian citizens as TH was first established on 30 September 1963 under the name "Malayan pilgrims saving corporation" which run by Malaysian government itself.<sup>20</sup> Its establishment was proposed by Royal Professor Ungku Aziz based his research on "Pilgrims Economy Improvement Plan in 1959."<sup>20</sup> Every year, 26,000 Malaysian Hajj travel to Makkah to perform Hajj and they are managed by TH. In terms of medical facilities, there are three main Health Centre in Makkah managed by TH, which provides health care for Malaysian Hajj pilgrims, namely Aziziah Medical Centre (80 beds), Syisy Medical Centre (98 beds) and Pusat Al-Janadriah Medical Centre (41 beds).<sup>21</sup> Both Syisy and Aziziah medical centers are wholly owned by the TH medical center where the management was fully supported by the Ministry of Health of Government of Malaysia. They are considered as major health centers, which provide patient treatment by trained staff and equipped with medical instruments and medications. The Syisy Medical Centre mostly cared for respiratory infection cases; hence, the majority of Hajj pilgrims was admitted to this medical center compared to Aziziah Medical Centre. The empirical antibiotic treatment has been recommended for all suspected CAP as an initial treatment which is based on prevalence of the pathogen and local antibiotic resistance profiles.<sup>22</sup> This research is intended to describe the clinical manifestation and laboratory findings among patients with clinically suspected pneumonia. The results could serve as baseline data in determining the pattern of characteristic of patients mainly Malaysian Hajj pilgrims hospitalized with pneumonia.

## MATERIALS AND METHODS

### Study Design and Patient Population

A cross-sectional study was conducted on Malaysian Hajj Pilgrims (age $\geq$ 18) who was admitted to TH in Makkah presenting with the sign and symptoms of pneumonia. The study, focused on the Syisy Medical Centre and Aziziah Medical Centre. The study was conducted during Hajj season in October to November 2012 (1433H) and September to October 2013 (1434H). A total of 157 patients with clinical diagnosis of pneumonia were included as participants in this study.

### Study Procedure

All patients who have symptoms and signs of pneumonia were admitted to TH hospitals. As the number of the study population was small, so Universal Sampling was adopted. The clinical diagnosis of pneumonia was made based on the clinical manifestations as well as chest radiograph findings. The demographic data, past medical history, pneumococcal vaccination status, clinical manifestations, investigations and management of the patients were recorded in a case record form. The suspected cases of pneumonia among Hajj pilgrim, during the Hajj season, who was admitted to the TH with or without the presence of underlying comorbidity were included in the study.

### Statistical Analysis

The Statistical Package for the Social Science (SPSS) version 20.0 was used for data entry and statistical analyses. Descriptive statistics were applied to assess the baseline characteristics in terms of clinical manifestation and laboratory diagnosis of whom was admitted to the TH medical centers.

### Ethical Approval

The official ethical approval was obtained from the Ministry of Health Research and Ethics Committee Malaysia (MREC) with the reference

number, NMRR-14-1177-21761 (IIR) dated 19<sup>th</sup> December 2014. The informed written consent was obtained for utilization of the data for research purpose from every subject involved in this study.

## RESULTS

### Socio-Demographic Characteristics of Respondents

A total of 157 respondents with the clinical diagnosis of pneumonia were recruited from TH medical centers during the hajj season (2012 and 2013) for this study. Males appeared to be affected more often compared to females (55.4% (n=87) and 44.6% (n=70) respectively, with a mean (SD) age of 69.4 ( $\pm$  10) years, ranging from 33 to 88 years. The distribution for the state of origin were from Johor (17.8%), followed by Selangor (12.7%), Kedah (11.5%), Kelantan (10.8%), Perak (10.2%), Pulau Pinang (7.0%), Terengganu (6.4%), Pahang (6.4%), Negeri Sembilan (4.5%), Sabah (3.8%), Sarawak (3.2%), Kuala Lumpur (3.2) and Melaka (2.5%). The majority of respondents was admitted to the Syisy Medical Centre with the percentage of 98.1% compared to Aziziah Medical Centre (1.9%) (Table 1).

### Clinical Characteristics

Seventy-six point four percent (120) of the patients was admitted to the TH hospitals after Wukuf. The Wukuf is the second obligatory acts of Hajj is in Arafat. Wukuf is known as "Standing before God" and one of the most very significant rituals of Hajj. "Arafat" is a desert about 20 km from Makkah, which has become semi-treed today and it is obligatory for Hajj pilgrims to stay at the Plain of Arafat, on the ninth day of Dhu'l-Hijjah (the Possessor of the Pilgrimage or The Month of the Pilgrimage). An enormous gathering of Hajj pilgrims at the Plain of Arafat.<sup>23</sup> The majority of pneumonia patients were non-smokers (81.5%), with only 3.2% of patients were smokers while 15.3% were former smokers. As for pneumococcal vaccination, only 21% of the Malaysian Hajj pilgrims received pneumococcal vaccines namely pneumococcal polysaccharide vaccine. More than half of the patients are hypertensive (60.5%) while 28.0% of the patient have diabetes, followed by chronic obstructive pulmonary disease (COPD) (25.5%), asthma (12.7%), ischemic heart disease (11.5%) and heart failure (5.7%). The majority (96.2%) of the respondents complained of having cough symptoms during Hajj season while more than half of them (84.7%) noted to have fever and half of respondents (47.1%) were having difficulty in breathing during Hajj activities. Basically, most of the respondents were having more than one of the presenting symptoms and underlying disease. 54.3% of patients were diagnosed as having bronchopneumonia, and the rest (45.7%) was classified as having lobar pneumonia. The mean length of stay among hospitalized respondents was 4.17  $\pm$  3.13 days, and most of the respondents were discharged (97.5%) after getting treatment, and 2.5% of them had to be transferred to Arab hospitals (Table 2).

### Laboratory Characteristics

The mean white blood cell count (WBC) on admission was 16.9 (13.0) $\times$ 10<sup>9</sup> /L with one missing value while the average of the neutrophils differential count was 81.1 (15.5)% with nine missing values and 10.9 (12.0)% of the lymphocyte count mean with nine missing values (Table 3). The culture of the sputum and blood samples was carried out in accordance to the standard of microbiological method to detect the specific causative agents of pneumonia and the results are shown in Table 4. Pathogens were isolated in only 4.6% of the sputum culture. The pathogens isolated were as follows: *Pseudomonas aeruginosa* (42.9%), *Klebsiella pneumoniae* (28.6%) and *Streptococcus pneumoniae* (28.6%). Only 3.2% of blood culture were performed among pneumonia patient and none of culture obtained pathogen isolated (Table 4).

**Table 1: The socio-demographic characteristic of patients with having pneumonia (n=157)**

Variables	Frequency	Percentage (%)	Mean (sd)
Gender			
Male	87	55.4	
Female	70	44.6	
Age			69.4 (10.0)
Hospital admission			
Syisy Medical Centre	154	98.1	
Pusat Rawatan Aziziyah	3	1.9	
States			
Johor	28	17.8	
Selangor	20	12.7	
Kedah	18	11.5	
Kelantan	17	10.8	
Perak	16	10.2	
Pulau Pinang	11	7.0	
Terengganu	10	6.4	
Pahang	10	6.4	
Negeri Sembilan	7	4.5	
Sabah	6	3.8	
Sarawak	5	3.2	
Kuala Lumpur	5	3.2	
Melaka	4	2.5	
Total	157		

## Antibiotic Therapy

The pattern of antibiotic therapy is given to Malaysian Hajj pilgrims who were admitted to TH medical centers for pneumonia are illustrated in Table 5. Based on the current study, the most frequently prescribed antibiotic was levofloxacin (54.8%), followed by azithromycin (39.2%), cefuroxime (23.6%), ceftriaxone (14.6%), cefepime (14.0%), amoxicillin+clavulanate (14.0%) and ampicillin+sulbactam (10.8%). Meropenem (1.3%), ciprofloxacin (1.3%), erythromycin ethyl succinate (2.5%) and were least prescribed (Table 5).

## DISCUSSION

In terms of gender, the study results illustrated that male respondents were slightly higher in number (55.4%) when compared to female (44.6%). Although a smaller gap proportion of gender has been obtained through this study, the similar findings noted in the previous study that pneumonia most frequently occurred in males.<sup>3</sup> In general, men are usually responsible for taking great care of their family since they are physically fit and tough pilgrims. The majority of women or elderly pilgrims will assign men pilgrims during Ramī Aj-Jamarāt (The Stoning of the Devil) ritual.<sup>24</sup> The mean age of Malaysian Hajj pilgrims who developed pneumonia during Hajj 1433/1434H season was 69.4 (10.0) years. The majority of Malaysian Hajj pilgrims were in the elderly, which is consistent with previous studies conducted on clinical and temporal patterns of severe pneumonia causing critical illness in Hajj pilgrims, which had revealed the mean age was rather similar to our study, that was 64 ( $\pm$  12) years.<sup>25</sup> Most of the pneumonia patients were admitted in Syisy Medical Centre (98.1%) compared to Aziziah Medical Centre (1.9%). In this study, The majority hospital admission for pneumonia among studied

**Table 2: The clinical findings of respondents (n=157)**

Variable	Frequency	Percentage (%)	Mean (sd)
Admission			
Before Wuquf	37	23.6	
After Wuquf	120	76.4	
Smoking status			
Smoker	5	3.2	
Former smoker	24	15.3	
Non smoker	128	81.5	
Status of pneumococcal vaccines			
Taken Pneumo 23	33	21.0	
Not taken	124	79.0	
Underlying diseases			
Hypertension	95	60.5	
Diabetes	44	28.0	
COPD	40	25.5	
Asthma	20	12.7	
Ischemic Heart Disease	18	11.5	
Congestive heart failure	9	5.7	
Bronchiectasis	4	2.5	
Multiple myeloma	2	1.3	
Benign prostate hypertension	1	0.6	
Neurofibromatosis	1	0.6	
Symptoms and duration			
Fever	133	84.7	
Duration of fever			3.8 (2.4)
Cough	151	96.2	
Duration of a cough			4.5 (2.4)
Breathlessness	74	47.1	
Duration of Breathlessness			1.4 (2.0)
Chest X-ray			
Bronchopneumonia	76	54.3	
Lobar pneumonia	64	45.7	
Length of hospital stay			4.17 (3.13)
Outcomes			
Discharge	153	97.5	
Transfer to Arab hospital	4	2.5	

Hajj pilgrims were after Wakuf. The overcrowding of pilgrims in confined area and close inter pilgrims contact, especially in Hajj camps of Mina is an ideal ground for the spread of respiratory diseases.<sup>26</sup> Smoking status was categorized into three different groups; smoker, former smoker and non-smoker. The percentage of smokers among the pilgrims were 3.2%, followed by 15.3% of the former smoker and 81.5% of a non-smoker. The patterns of smoking status in our study showed that the majority of Malaysian Hajj pilgrims were non-smokers. The mean age for Malaysian Hajj pilgrims was 69.4 ( $\pm$  10.0) years, smoking prevalence basically was highest in the 25-34 age group (25%) and lowest amongst

**Table 3: The laboratory findings of respondents (n=157)**

Variables	Frequency	Percentage (%)	Mean (sd)
Laboratory findings			
White blood cell (WBC) <sup>a</sup>			16.9 (13.0)
Normal	34	21.8	
High WBC	122	78.2	
Neutrophils <sup>b</sup>			81.1 (15.5)
Normal neutrophils	18	12.1	
High neutrophils	125	84.5	
Low neutrophils	5	3.4	
Lymphocytes <sup>b</sup>			10.9 (12.0)
Normal lymphocytes	9	6.1	
High lymphocytes	11	7.4	
Low lymphocytes	128	86.5	

Note: <sup>a</sup> Missing value 1 <sup>b</sup> Missing value 9.

**Table 4: Result of sputum and blood cultures (n=157)**

Cultures	Frequency	Percentage (%)
Result of sputum culture		
No pathogen isolated	150	95.4
Pathogen isolated	7	4.6
Klebsiella pneumoniae	2	28.6
Pseudomonas aeruginosa	3	42.9
Streptococcus pneumoniae	2	28.6
Result of blood culture		
Perform blood culture	5	3.2
No pathogen isolated	5	100

**Table 5: The pattern of antibiotic therapy of respondents (n=157)**

Variables	Frequency	Percentage (%)
Antibiotic therapy		
Single antibiotic	59	37.6
Combination antibiotic	98	62.4
β lactam group		
Amoxicillin+clavulanate	22	14.0
Ampicillin+sulbactam	17	10.8
Fluoroquinolones group		
Ciprofloxacin	2	1.3
Levofloxacin	86	54.8
Cephalosporins group		
Ceftriaxone	23	14.6
Cefepime	22	14.0
Cefuroxime	37	23.6
Ceftazidime	9	5.7
Macrolides group		
Azithromycin	62	39.2
Erythromycin ethyl succinate (EES)	4	2.5
Tetracycline group		
Doxycycline	7	4.5
Carbapenem group		
Meropenem	2	1.3



those aged 60 and over (11%).<sup>27</sup> To the best of our knowledge, none of the previous studies had discussed in details on pneumococcal vaccination Malaysian Hajj pilgrims. The current study found that only 21% of pilgrims were vaccinated with pneumococcal vaccines using pneumococcal polysaccharide vaccine. No-one has been vaccinated with pneumococcal conjugate vaccine. This finding indicates a low level of awareness on the importance of pneumococcal vaccination during Hajj season. Besides, in Malaysia, a meningococcal vaccine is the only compulsory vaccine for Hajj pilgrims. The importance of implementation of other important vaccines such as pneumococcal is highlighted especially among Malaysian pilgrims as to reduce the rate of pneumococcal pneumonia.

Hypertension and COPD were the commonest underlying disease identified among Malaysia Hajj pilgrims. The previous study has shown the similar finding which stated that lower respiratory tract infection was exacerbated by bronchial asthma and COPD and both were recognized as common underlying diseases in a patient admitted to hospital during Hajj (bronchial asthma-39.4%, COPD-14.4%).<sup>28</sup> Moreover, diabetes and COPD were categorized as common underlying co-morbid conditions among elderly patients.<sup>28</sup> Cough was determined as the most common symptom encountered by patients with pneumonia in the current study. This study's finding was in concordance with another study, which revealed a cough was categorized as one of the most common complaint among pilgrims as it has a very high attack rate during pilgrimage (51%).<sup>29</sup> Cough appears as one of the typical symptoms during Hajj due to overcrowding of the pilgrims from different countries around the world for a short and confined period, lead to a major public health challenge.<sup>3</sup> Fever is also another common symptom identified in Malaysia Hajj pilgrims presented with pneumonia. Fever is also a typical symptom of pneumonia.<sup>30</sup> Breathlessness was a least complained symptom among the Hajj pilgrims. It's often described as an intense tightening in the chest or feeling suffocation.

Based on chest radiograph findings, 54.3% of study patients were diagnosed as bronchopneumonia, and the rest (45.7%) was lobar pneumonia. These results have been corroborated in another study regarding the correlation between clinical and chest radiographic diagnosis of pneumonia in Nigerian children, where most of them were diagnosed as bronchopneumonia (75.6%) and followed by lobar pneumonia (21.6%).<sup>31</sup> The mean length of stay in hospitals in this study was 4.17 ( $\pm 3.13$ ) days. It was revealed that most of the pneumonia patients improve within 3 days of hospitalization with an appropriate antibiotic therapy.<sup>32</sup> It can be concluded that most of the pneumonia patients admitted to the TH medical center have an optimum length of stay. This finding was also corroborated by other study which stated that the average duration of stay for pneumonia patients at Highland Hospital in 2011 was 4.47 days.<sup>33</sup> The average length of stay for pneumonia in the USA was 5.4 days, according to the Healthcare Cost and Utilization Project Nationwide.<sup>34</sup>

The mean of WBC count of the respondents was noted to be high ( $16.9 \times 10^9/L$ ) or known as leucocytosis which indicates the presence of inflammation or infection which can be due to viral or bacterial pathogens.<sup>35</sup> High level of WBC was expected in pneumonia cases, and this was clearly shown by this study. The leucocytosis cases are represented by an increase in neutrophils, strongly suggested that the pneumonia was of the bacterial origin. Therefore, it's important to check the differential count when interpreting leucocytosis. In regards to the differential counts outcomes, mean of neutrophils had illustrated the high percentage of 81.1% (15.5). The increase of neutrophils count is known as neutrophilia where it is associated with any pathological condition that stimulates increased marrow production of neutrophils. All infection caused either by bacteria, viruses, fungi and parasites may lead to neutrophilia. However, the commonest cause is a bacterial infection. In viral infection, neutrophilia may occur in the early stage of infection.<sup>36</sup>

In our study, very low number of pathogens were isolated (4.6%) during hajj season 2012 and 2013. This finding is in agreement with a study carried out on 450 patients who developed pneumonia during hajj season in 2009 and 2010, where positive sputum culture was found in only 7% of their patients based on laboratory hospital data.<sup>25</sup> In contrast, based on a study done on 141 clinically diagnosed pneumonia in order to determine the specific pathogen isolated in sputum cultures, which was also carried out during hajj season, about half of the cases (53.9%) were confirmed by culture result.<sup>3</sup> Regarding the pattern of the organism isolated, result from sputum culture had illustrated that *P. aeruginosa* was the most frequent organism isolated (42.9%) in pneumonia patient followed by *K. pneumonia* (28.6%) and *S. pneumoniae* (28.6%). Even though, *S. pneumoniae* was considered as a leading causative bacterium responsible for CAP, our study revealed a contradict outcome where *P. aeruginosa* was detected as the commonest pathogen. Generally, it was shown that the pattern was quite different as to compare to CAP cases occurred globally and this can be due to several factors contributed, including the decrease in cell-mediated immunity due to overcrowding, exhaustion and undernourishment.<sup>5</sup>

This study findings revealed that azithromycin and levofloxacin were the most frequently prescribed antibiotics among Malaysian Hajj pilgrims. Most of the respondents were often prescribed with levofloxacin (54.8%), followed by azithromycin (39.2%). Levofloxacin is a broad spectrum antibiotic of the fluoroquinolone drug class and a levo isomer of its predecessor ofloxacin.<sup>37</sup> Levofloxacin plays a significant role in professional medical society guidelines for the treatment of pneumonia, urinary tract infection and abdominal infections, especially for gram-positive and gram-negative bacterial pathogens. It is also recommended as a first-line treatment for CAP patients together with the presence of co-morbidities such as heart, lung, or liver disease.<sup>8</sup> Azithromycin is a useful antibiotic for the treatment of bacterial infection (on specifically CAP) which is widely used alone or in combination with other antimicrobials.<sup>38-40</sup>

This study inevitably has several limitations. The sample size limitation. Initially, 169 respondents were included as an eligible participant, after going through the processes finally a total of 157 respondents was obtained. However, the total sample size still remained a suitable proportion after an additional of estimated drop-out rate of 10%. The researchers experienced some constraints in conducting this study during Hajj season particularly time, limitation and several factors which could not be avoided. Researchers have only one month and a half to collect data and only two medical center recruitment were permitted. Nonetheless, 157 of the patients were managed to be recruited during that peak season.

## CONCLUSION

The information on all variables of socio-demographic, clinical and laboratory characteristics was regarded as important valuable findings. None of the previous studies discussed the details of characteristic findings, particularly among Malaysian Hajj pilgrims who suffered from pneumonia during Hajj season. The current found that elderly males were the main sufferers of bronchopneumonia after Wuquf with an average length of stay  $4.17 \pm 3.13$ . Moreover, levofloxacin was found to be most effective antibiotic to cure Malaysian Hajj pilgrims. The current study advocated more research on this issue to safeguard the Malaysian Hajj Pilgrims.

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## CONFLICT OF INTEREST

Authors do not possess financial or any other conflict of interest.

## ABBREVIATIONS USED

**KSA:** Kingdom of Saudi Arabia; **CAP:** Community-acquired pneumonia; **FBC:** Full blood count; **TH:** Tabung Haji; **SPSS:** Statistical Package for the Social Science; **MREC:** Ministry of Health Research and Ethics Committee Malaysia; **WBC:** White blood cell count, **COPD:** Chronic obstructive pulmonary disease.

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