



Assessing the burden of pneumonia using administrative data from Malaysia, Indonesia, and the Philippines



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ARTICLE INFO

Article history:

Received 11 September 2015

Received in revised form 5 May 2016

Accepted 18 May 2016

Corresponding Editor: Eskild Petersen, Aarhus, Denmark.

Keywords:

CAP

HAP

Burden of disease

Incidence rate

LOS

Cost

SUMMARY

Objectives: To describe the incidence, mortality, cost, and length of stay (LOS) of hospitalized community-acquired pneumonia (CAP) and hospital-acquired pneumonia (HAP) in three Southeast Asian countries: Malaysia, Indonesia, and the Philippines.

Methods: Using Casemix system data from contributing hospitals, patients with International Classification of Diseases 10th revision (ICD-10) codes identifying pneumonia were categorized into CAP or HAP using a logical algorithm. The incidence among hospitalized patients, case fatality rates (CFR), mean LOS, and cost of admission were calculated. The population incidence was calculated based on Malaysian data.

Results: For every 100 000 discharges, CAP and HAP incidences were 14 245 and 5615 cases, respectively, in the Philippines, 4205 and 2187, respectively, in Malaysia, and 988 and 538, respectively, in Indonesia. The impact was greatest in the young and the elderly. The CFR varied from 1.4% to 4.2% for CAP and from 9.1% and 25.5% for HAP. The mean LOS was 6.1–8.6 days for CAP and 6.9–10.2 days for HAP. The cost of hospitalization was between USD 254 and USD 1208 for CAP and between USD 275 and USD 1482 for HAP.

Conclusions: The burden of CAP and HAP is high. Results varied between the three countries, likely due to differences in socio-economic conditions, health system differences, and ICD-coding practices.

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1. Introduction

Pneumonia is a significant problem worldwide and remains one of the major causes of death among children younger than 5 years old.^{1,2} In 2010, it was estimated that there were 120 million episodes of pneumonia globally, and 1.3 million episodes led to

death among children in this age group in 2011.^{3,4} The elderly and adults with pre-existing medical conditions are also at increased risk of pneumonia. These include people with chronic heart, lung, or liver disease, people living with HIV, and those who have had transplants or are taking immunosuppressive drugs.⁵

Hospitalizations for pneumonia may be classified based on the location of prior exposure and can be categorized as hospital-acquired or community-acquired. In contrast to community-acquired pneumonia (CAP), hospital-acquired pneumonia (HAP) occurs more than 48 h after a hospital admission without any

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antecedent signs at the time of admission.^{6,7} By pathogen, HAP and CAP differ. Pathogens causing CAP are commonly *Streptococcus pneumoniae*, *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, *Legionella pneumophila*, *Haemophilus influenzae* type B, and respiratory syncytial virus (RSV).^{8,9} In some countries in the Asia Pacific, *Klebsiella pneumoniae* is also a common CAP pathogen.⁹ Common HAP-causing pathogens include *Pseudomonas aeruginosa*, *Escherichia coli*, *K. pneumoniae*, and *Acinetobacter* species, while *Staphylococcus aureus* is an increasing problem.⁷ HAP-causing bacteria are considered to be more virulent since many are likely to be multidrug-resistant.^{5–7} The rates of morbidity and mortality also tend to differ between CAP and HAP. Hence, being able to differentiate between CAP and HAP is of interest to clinicians and researchers.

Few studies have compared the incidences of the two pneumonia types. One such study was conducted in the region of Lazio in Italy and explored the incidences of CAP, HAP, and AIDS-related pneumonia using hospital information system data.¹⁰ The annual incidence rates of the three pneumonia types were found to be 159, 75, and 7.4 per 100 000 population, respectively; meanwhile, the fatality rates were 9.4%, 29.3%, and 11.2%, respectively.

Few studies from the Asia-Pacific region have reported pneumonia incidence. Most studies have tended to focus on the causative organisms, antibiotic resistance, or risk factors.^{9,11} Furthermore, few countries have reported incidence rates.¹² Among the estimates available is one from Thailand, which reported incidence as being between 177 and 580 per 100 000 population.^{13,14} In another study performed in central Vietnam, the incidence of CAP was estimated at 0.81 per 1000 population.¹⁵ In Singapore, a national study showed that the incidence of pneumococcal pneumonia was approximately 4.5 per 100 000 in those aged 15–64 years.¹⁶ No study has explored the difference in incidence of CAP and HAP in Southeast Asian countries.

Information on cost or the economic burden is relatively limited and does not discuss these two pneumonia categories. A study of pneumonia admission costs in Singapore estimated a cost of USD 1294 for a hospital admission of 6.4 days and USD 3456 for a hospital admission of 10 days.¹⁷ In the Philippines, it was estimated that the cost of hospitalization with moderate-risk CAP was between USD 852 and 2678.¹⁸ On the other hand, the cost of pneumonia in rural Thailand was reported to be lower, varying from USD 490 to 628.¹³ Within the wider Asian region, the cost per hospital admission was reported to be USD 3221 among elderly patients in Taiwan, while the total annual burden in the elderly was USD 1 897 137.¹⁹ Also in Taiwan, a study by Wu et al. found that the cost of pneumococcal pneumonia hospitalization in older adults aged 50 years and above was between NT\$ 153 000 and 178 000 (USD 5109–5952) and the total annual cost was greater than NT\$ 3.6 billion (USD 112 023 220).²⁰

In developed countries, administrative databases have been used widely to understand disease patterns and burden of disease.

Such studies have been performed in the USA and Europe where administrative databases are readily available and are well-established.^{21–27} In Asia, research using administrative databases is less common, except in South Korea, Taiwan, and Japan.^{27,28} Although administrative data are not initially collected for research, they can provide useful information in a less resource-intensive manner by eliminating the need for primary data collection.²⁷ Two such studies exploring pneumonia are the studies mentioned above by Wu et al.,²⁰ and Low et al.,¹⁶ performed in Taiwan and Singapore, respectively.

Although research using administrative databases is still new in Southeast Asia, pockets of data exist that can be used for epidemiological research.^{27,28} One of these sources of data is the administrative system developed by the United Nations University International Institute for Global Health (UNU-IIGH) and the National University of Malaysia.^{27,29,30} The system, called Casemix, has been in use at the medical center of the National University of Malaysia since 2002 and was implemented in a second Malaysian academic center in 2012. Meanwhile, the Casemix system has been used on a larger scale in Indonesia and the Philippines,³¹ since 2008 and 2009, respectively, to support the implementation of their social insurance systems. Hospital discharge data are coded using the International Classification of Diseases 10th revision (ICD-10) and diagnosis-related groups (DRGs). The system contains costs of ambulatory services, in-patient services, daycare surgery, and other services. In Indonesia and the Philippines, it is used for hospital reimbursement by the relevant social health insurance authorities in each country. Social insurance has not been implemented in Malaysia; the Casemix system is used in two hospitals for budgeting and academic purposes in this country.

The objectives of this study were to describe the incidence, mortality, and resource utilization associated with hospitalized pneumonia in Malaysia, Indonesia, and the Philippines using Casemix data, as well as to better understand the differences between CAP and HAP. It was aimed to elucidate the incidences of CAP and HAP among hospitalized patients, as well as to ascertain the differences in cost, length of stay (LOS), and prevalence of comorbidities between CAP and HAP.

2. Methods

Casemix system data from hospitals in Malaysia, Indonesia, and the Philippines that were contributing to the dataset at the time of the study were utilized. In Indonesia, hospitals began to use the system in January 2014 to implement social insurance for citizens in the lower socio-economic groups. In the Philippines, coverage of hospitals was limited at the time of the study and was made possible through collaboration between UNU-IIGH, the National University of Malaysia, the Department of Health of the Philippines, and the Ministry of Health of Indonesia. The available dataset for this study consisted of data from 42 anonymized

Table 1
ICD-10 codes used to identify cases of pneumonia

Definition	ICD-10 code
Influenza due to identified influenza virus	J10.0, J10.1, J10.8
Influenza, virus not identified	J11.0, J11.1, J11.8
Viral pneumonia, not elsewhere classified	J12.0, J12.1, J12.2, J12.3, J12.8, J12.9
Pneumonia due to <i>Streptococcus pneumoniae</i>	J13
Pneumonia due to <i>Haemophilus influenzae</i>	J14
Bacterial pneumonia, not elsewhere classified	J15.0, J15.1, J15.2, J15.3, J15.4, J15.5, J15.6, J15.7, J15.8, J15.9
Pneumonia due to other infectious organisms, not elsewhere classified	J16.0, J16.8
Pneumonia in disease classified elsewhere	J17.0, J17.1, J17.2, J17.3, J17.8
Pneumonia, organism unspecified	J18.0, J18.1, J18.2, J18.8, J18.9

ICD, International Classification of Diseases.

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