

A HOUSEHOLD SURVEY TO ASSESS THE BURDEN OF INFLUENZA IN RURAL THAILAND

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Abstract. Little is known about the disease burden of influenza in middle-income tropical countries like Thailand. The recent outbreak of avian influenza (H5N1) and studies on influenza from neighboring countries highlight the need for data on incidence, access to care, and health care cost. In May/June 2003, we conducted a province-wide household survey using two-stage cluster sampling to determine the burden of influenza-like illness in Sa Kaeo Province. We used the total number of reported influenza that occurred in May 2003 and a prospective study of outpatient influenza in clinic patients to develop an estimate of the annualized incidence of influenza. Of 718 subjects, 16 (2.2%) suffered an episode of influenza-like illness in the preceding month; 14 sought care, of whom 7 went to a hospital facility. Fifty percent reported missing on average 3 days of work or school. The total individual cost per illness episode was 663 baht (US\$15.78). The proportion of outpatients with influenza-like illness caused by an influenza virus in May was 16% and the annualized influenza incidence was estimated to be 5,941/100,000 in Sa Kaeo Province. This survey adds to information indicating that in rural Thailand, the burden of influenza is substantial and costs associated with an illness episode are up to 20% of an average monthly income.

INTRODUCTION

In tropical countries, and Southeast Asia in particular, influenza has traditionally been viewed as a mild disease occurring at low levels year round with one to two seasonal peaks (Fitzner *et al*, 1999; Ng *et al*, 2002; Thawatsupha *et al*, 2003; Simmerman *et al*, 2004). However several recent studies in Hong Kong and Singapore have confirmed a substantial disease burden associated with influenza (Chew *et al*, 1998; Fitzner

et al, 1999; Ng *et al*, 2002). In Thailand, the outbreaks of highly pathogenic influenza A (H5N1) virus in poultry and humans have increased awareness of influenza in general and interest in better data on the burden from usual influenza viruses (CDC, 2004).

The Thai Ministry of Public Health conducts passive surveillance for clinically diagnosed influenza; laboratory confirmation of these cases is not available. Between 1997 and 2004, the average annual reported incidence for influenza was 66 cases per 100,000 persons (Anonymous, 1997-2001). The Thai National Institute of Health conducts sentinel site laboratory surveillance for influenza through its WHO-designated National Influenza Center (Thawatsupha *et al*, 2003). While these data are useful to monitor national patterns and circulating strains, they are limited in their ability to accurately estimate burden or cost of disease. We conducted a household survey to assess health care seeking behavior and expenditures for influenza-like illness in a rural Thai community and used this information

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in combination with ongoing virological studies in the province to refine estimates of the incidence of influenza in the community.

MATERIALS AND METHODS

Study population

Sa Kaeo Province, population 438,557, is located approximately 3 hours east of Bangkok and borders Cambodia. The average individual monthly wage in 2001 was 3,712 baht (US \$95) (Alpha Research Co, 2004 #25). Since 2002, Sa Kaeo has been the site of surveillance and research activities by the International Emerging Infections Program (IEIP), a collaboration between and the Thai Ministry of Public Health and the US Centers for Disease Control and Prevention (CDC) (Dowell *et al*, 2004). In addition to the pneumonia surveillance which captures severe, hospitalized chest-radiograph confirmed pneumonia caused by influenza and other pathogens, there is outpatient surveillance for influenza-like illness with systematic laboratory testing and virologic confirmation. To better ascertain access to health care and influenza-like illness that may not present to health care, we conducted a household survey in May 2003. This study was approved by the Institutional Review Board of US CDC and the Ethics Committee of the Thai Ministry of Public Health.

Study design

We used a two-stage cluster sampling design that has proved valuable in assessing disease incidence and evaluating utilization of health services (Henderson and Sundaresan, 1982; Galazka and Stroh, 1986; Turner *et al*, 1996). From the complete list of villages in the province, forty villages (clusters) were selected using probabilities proportional to the size of the village. Within each village, 5 households were then randomly selected from complete lists of village households. A trained interviewer from the province and a village volunteer familiar with the families visited each household. After obtaining informed consent of each participant, a questionnaire was administered in Thai that included questions on household composition and socio-economic status. Each household member was asked, "Have you had new fever with sore throat

and/or cough during the last four weeks?" (WHO, 1999). If the answer was 'Yes', a detailed second questionnaire about symptoms, length of illness, missed work or school days, type of health care facility visited, reasons for not seeking care, cost of care and means of payment followed. People were considered members of the household if they had slept and eaten in the house for ≥ 6 months during the past 12 months. For children ≤ 15 years old and members of the household not present, the primary caretaker was interviewed as a proxy.

Sample size

Published data on the expected rate of influenza-like illness in Southeast Asia are very limited. Using data from one Singapore study, we estimated that each Thai might suffer from up to 1 episode of influenza-like illness per year (Ng *et al*, 2002). Since the period covered by the survey was one month, the expected frequency of influenza-like illness was up to 8.3% per month. We used EpiInfo (Epi Info6; CDC, US, January 2001) to calculate the sample size for a simple random sample using either 5.6% or 11% as the worst acceptable value, the two end points of our sample confidence interval. At the 95% confidence level the upper sample size estimate needed was 401. This sample was further inflated by 1.5 to account for the design effect of case clustering and 1.2 to account for an estimated 20% non-response (Ng *et al*, 2002) yielding a total sample size of 722 persons (190 households). To reach 200 households, we interviewed 5 households in each of the 40 villages. We estimated that up to 63 people would report having had an influenza-like illness during the preceding month.

Estimating the annual incidence of influenza in Sa Kaeo

To estimate the incidence of influenza in Sa Kaeo we used 2 different surveillance systems, the National Passive Surveillance System (Bureau of Epidemiology, Thai Ministry of Public Health) and an ongoing, prospective study on the etiology of influenza-like illness in outpatients. The ongoing, prospective study on the etiology of influenza-like illness aims to identify respiratory pathogens responsible for influenza-like illness in patients visiting 5 hospital outpatient

departments in Sa Kaeo Province. Influenza-like illness is defined as acute fever $>38^{\circ}\text{C}$ and cough or sore throat in the absence of other diagnoses (WHO, 1999). Patients are invited to participate in the study if they have these symptoms and documented fever $>38^{\circ}\text{C}$. Research nurses administer a brief questionnaire, collect a nasal swab and immediately test for influenza A and B using the QuickVue[®] rapid antigen test kit (Quidel Co). Swab samples are later tested and confirmed by viral culture at the Thai National Institute of Health and by reverse transcriptase polymerase chain reaction at US CDC. For the month of May 2004, we expanded enrollment to include persons with cough or sore throat and subjective fever to match the case definition in the household survey.

To calculate an incidence for influenza, we used 2003 data from the National Passive Surveillance System to estimate the proportion of clinically diagnosed influenza that occurs in May. No influenza cases were reported in Sa Kaeo Province during the month of May in 2003, therefore we used nationwide numbers. The total number of influenza cases in Thailand reported in 2003 was 29,918, with 1,840 cases occurring in May (6%). The incidence in the household survey was divided by this proportion to calculate an annual incidence and then multiplied by the proportion of influenza-like illness caused by influenza during May as determined in the prospective outpatient study to estimate influenza incidence.

Cost calculation

In the survey, questions related to costs were answered in categories, ranging from 1-100, 101 to 200, 201-300, 301-500, 501-750, 751-1,000, and 1,001-1,500 to greater than 1,500 baht. For the analysis, we took the mean value of each category, 50.5 baht, 150.5 baht, etc. The average number for the May 2003 exchange rate was used to convert Thai baht into US Dollar (42 baht=US\$1). The total expenditure per episode of influenza-like illness and influenza was divided into direct costs, which include medical and transportation fees, and indirect costs, such as lost wages. Average daily wages were calculated using the average monthly individual wage in Sa Kaeo Province in

2001 (3,712 baht), and dividing it by 23.6, the number of work days per month (Alpha Research Co, 2004).

Statistical analyses

Data were analyzed using SPSS 12.0 (SPSS Inc, Chicago, Illinois) and EpiInfo 6 (CDC, US, January 2001). We used frequencies for the descriptive statistics and chi-square to compare proportions. A p-value of <0.05 was considered significant.

RESULTS

Between May 28 and June 30, 2003, 200 households were visited and 718 people were interviewed. Sixteen (2%) persons reported an episode of influenza-like illness during the previous month. There were no households reporting more than one case. Thirteen (81%) cases were female and the mean age was 37 years (range 1 to 79). Two cases were in children below the age of 5, and 4 cases were in persons over age 50. Persons were ill for a median of 5 days (range 2-30) and 8 (50%) cases reported having missed work or school. All 16 reported having experienced at least 3 symptoms and 13 out of 16 reported experiencing at least 5 symptoms. Clinical signs and symptoms are illustrated in Table 1.

Table 1
Clinical signs and symptoms of 16 persons with influenza-like illness in the household survey, May 2003, Sa Kaeo Province, Thailand.

Sign or symptom	N (%)
Fever ^a	16 (100)
Cough/sore throat ^a	16 (100)
Headache	14 (88)
Decreased activity	13 (81)
Runny nose	11 (69)
Muscle aches	10 (63)
Chills	7 (44)
Difficult or fast breathing	6 (38)
Nausea or vomiting	6 (38)
Wheezing	3 (19)
≥ 3 symptoms	16 (100)
≥ 5 symptoms	13 (81)

^aPart of case definition

Fourteen (88%) persons sought health care. Of the 2 persons who did not seek care one stated that the hospital was too far away and the other preferred self-care. Eleven out of sixteen people (69%) sought care at a health center, private clinic or hospital outpatient department. Among places where initial care was sought, health centers were most commonly visited (6/14, 43%), followed by hospital outpatient departments (3/14, 21%) and pharmacies and drug sellers (people who sell medications in stores not designated as pharmacies) (3/14, 21%). Health centers are small clinics which are staffed with a public health trainee or a registered nurse and are popular for initial check-ups. One case each reported seeing a private physician and a traditional healer. Eight cases (50%) reported seeking health care at more than one place. Seven (44%) persons sought care at a hospital facility at some point during their illness. One six year old girl was hospitalized. There were no deaths.

Out of the 16 persons reporting an influenza-like illness, nine (56%) had completed the survey themselves and seven were completed by proxy. Fifteen households had a caretaker whose education was at primary school level or less. Ten out of 16 case households (63%) reported having a combined household income less than 5,000 baht (\$119) per month and on average 3 people lived in one household. The mean cost per doctor's visit was 147 baht (\$3.50) and 151 baht (\$3.60) per traditional healer visit. Expenses at the pharmacy or drug seller averaged 16 baht (\$0.38). Almost half of the affected households (44%) reported having to get a personal loan to help pay for their medical expenses, and costs for only one person were entirely covered by welfare. For the 16 influenza-like illness case households, the total direct cost per illness episode was calculated using the average of individual costs associated with doctor's visits, traditional healer's visits and pharmacy visits added to the mean transportation cost. Lost income was defined as indirect cost. The total individual costs per episode of influenza-like illness are illustrated in Table 2.

The incidence for influenza-like illness for the month of May 2003 among our household

Table 2

Average household costs in Thai baht (US dollars) per episode of influenza-like illness, May 2003, Sa Kaeo Province, Thailand.

Type of cost	Cost in baht (US \$)
Out of pocket	
Medical	98 (\$2.33)
Transportation	94 (\$2.24)
Productivity	
Lost income ^a	471 ^b (\$11.21)
Total	663 (\$15.78)

^aCalculated using 157 baht (US\$3.74) as average wage per day

^bAverage missed days of work/school for 8 out of 16 cases = 3 days 157 baht

survey population in Sa Kaeo Province was 2,228/100,000 [(16/718) 100,000]. Applying this rate to the population of Sa Kaeo, we estimate there were 9,771 influenza-like illness cases in Sa Kaeo Province during May. The total number of cases reported by the national passive surveillance system for the month of May in 2003 was 1,840, which accounts for 6% of the annual number of cases. Therefore, the total number of influenza-like illness cases in Sa Kaeo in 2003 was approximately 162,850. We multiplied this number by 16, the proportion of influenza-like illness in outpatients that was actually caused by influenza viruses in May 2004 to estimate the number of these cases that were caused by influenza. The estimated total number of influenza cases in Sa Kaeo in 2003 was calculated to be 26,056 (6% of the provincial population) yielding an annual incidence of 5,941/100,000.

DISCUSSION

Our small survey adds to other recent influenza studies and provides an initial estimate of the burden of influenza in the Thai community setting (Dowell *et al*, 2004). Approximately 6% of the Sa Kaeo population suffered from an influenza infection in 2003, which caused substantial costs related to health care, transportation and work absenteeism. The annual incidence of

influenza in rural Thailand may be 1000-times greater than reported through the national passive surveillance system. Individual costs associated with an episode of influenza may be less in Thailand than in other wealthier countries because health care coverage is more comprehensive in Thailand given the national health care system which provides coverage for people without private or government insurance. This system was implemented in 2001 and requires patients to pay a fee of 30 baht (US\$0.71) for each health care visit.

Our study suggests that even in a rural province, accessibility to healthcare services is good. Only one out of 16 cases in the household survey stated that care was not sought because of the distance to the nearest hospital. Health centers, which are staffed with nurses, were the most popular choice among the study population for initial health care visit, since they provide comparatively inexpensive care. Health centers in Thailand provide routine preventative care, such as immunizations, to a defined population and could function as an appropriate venue for influenza vaccination should that be considered in the future.

Our study had several limitations. Although our sample size was relatively large, the number of persons who reported having an influenza-like illness was small, limiting our ability to further characterize these cases. When we calculated our sample size, we searched for similar studies in tropical countries, however there are very few. We based our calculations on results from a study in Singapore that detected at least one episode of influenza-like illness per person/year (Ng *et al*, 2002). It is possible that these other studies were conducted during a time of high prevalence of viruses responsible for influenza-like illness, or that May 2003 had an atypically low prevalence of influenza-like illness in Sa Kaeo Province. However, despite obtaining only a small number of cases with influenza-like illness the methodology of the survey was robust and the findings are consistent with other studies in Sa Kaeo Province (Dowell *et al*, 2004).

The survey covered illness events over a period of one month in parts of May and June, yet we now know that influenza in Thailand has

a distinct seasonality peaking between June and October (Thawatupha *et al*, 2003; Simmerman *et al*, 2004). Given the limitations in the national surveillance data, our ability to extrapolate the incidence to an annual rate using these data is restricted. We believe surveys such as this should be repeated at other times during the year. We may have also had some overrepresentation of females in our survey possibly because they were most likely to be home and answer the questionnaire. Despite these limitations, our survey provides needed initial insight into the rural community incidence of a disease of growing importance in the region.

The burden of influenza in rural Thailand, with more than 26,000 cases in 2003 in Sa Kaeo Province alone, is substantial and costs to the individual are high. Although the total direct costs per episode of only US\$5 appear small in comparison to industrialized countries, costs per influenza-like illness episode including lost wages can make up as much as 20% of the average monthly income. Nearly half of the sick residents needed a personal loan to pay for their illness related expenses.

Given the large disease burden and cost from influenza illness, as well as the recent outbreaks of influenza A (H5N1), Thailand may need to focus on ways to better survey and control influenza, and such a strategy might include use of a vaccine. Continued research to isolate and identify influenza strains circulating in Thailand will be critical in the decision making process of introducing influenza vaccination in the future. With information guiding vaccine selection, Thailand will be in a unique position to consider a vaccination demonstration project using the pre-existing immunization program that has been shown to be effective as a model for influenza.

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