

# Survey of the Prevalence of Asthma, Allergic Rhinitis and Eczema in Schoolchildren from Khon Kaen, Northeast Thailand: An ISAAC Study

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Prevalence surveys of asthma and allergic disease from various parts of the world show an increasing trend over the past three decades.<sup>1-11</sup> Since 1991, hundreds of prevalence studies using the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaires have been performed worldwide.<sup>12</sup> The general aims of ISAAC are: 1) to describe the prevalence and severity of asthma, rhinitis and eczema in children living in different areas for the purpose of comparisons within and between countries; 2) to obtain baseline measurements for the assessment of future trends in the prevalence and severity of these diseases and 3) to provide a framework for further etiological research into the genetic, lifestyle, environment and medical care factors affecting these diseases.<sup>13</sup> Using this standardized methodology, large variations in the prevalence and severity of these diseases in children between countries of the same region and even within a country have been documented.<sup>12,14</sup>

**SUMMARY** This survey of schoolchildren from Khon Kaen, Northeast Thailand used the standardized ISAAC questionnaires to estimate the prevalence of asthma and other allergic diseases and to compare the results with two previous studies. A total of 6,068 questionnaires were analyzed (2,658, 45.6% males from the 6 to 7 years old group and 3,410, 49.5% male from the 13 to 14 years old group). The three predominant cumulative and 12-month conditions discerned from the written questionnaires among the 6 to 7 vs 13 to 14 years old were: wheezing, at 18.6% and 10.2% vs 20.5% and 11.0%; rhinitis at 38.4% and 33.5% vs 59.4% and 42.5%; and eczema at 18.0% and 15.2% vs 9.9% and 7.4%, respectively. The observed prevalences in our study were similar to those found in Bangkok and slightly higher than those in Chiang Mai, except for 'exercise wheezing' in older children which was two times higher in our study than in the two previous studies. Our study showed seasonal variation of the 'nose' symptoms. The peak prevalence was in the relatively cool and dry season (between November and January), which was the same pattern as Chiang Mai but different from Bangkok (which had a perennial pattern and less climatic variation). Our results concurred with the two previous Thai ISAAC studies. There is a high prevalence of asthma and other allergic diseases among Thai children and there has been a four-fold increase in symptoms since the last decade. If the trend persists asthma and allergic disease may become a pressing health concern of the country.

The first asthma prevalence survey in Thailand was performed in Bangkok schoolchildren in 1990 using different questionnaires. The prevalence was 4.2%.<sup>15</sup> In 1995, ISAAC studies were conducted in Bangkok and Chiang Mai and these studies indicated a high prevalence of the allergic diseases targeted by the ISAAC questionnaires.<sup>16,17</sup>

Our objective was to estimate the prevalence of asthma and other allergic diseases in Khon Kaen province in comparison with the

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two previous studies conducted in Thailand. The Phase I ISAAC was conducted on schoolchildren in Khon Kaen, Northeast Thailand.

## MATERIALS AND METHODS

### Participants

The target groups were schoolchildren aged 6 to 7 years (in Grades 1 and 2) and 13 to 14 years (in Grades 7 and 8). School selection criteria were: 1) their location was in the central district of Khon Kaen province; 2) the school administrators agreed to co-operate in the study; 3) that there were more than 100 pupils and both sexes represented and 4) it was easily accessible. According to these inclusion criteria, eleven primary schools and five secondary schools participated in the study.

### ISAAC questionnaires

The written ISAAC questionnaires used in phase I of our study consisted of three one-page modules asking questions to determine the prevalence of wheezing, rhinitis and eczema, the severity of symptoms, seasonality and demographic data.<sup>13</sup> The questionnaires were translated into Thai by a panel of pediatric allergists from several academic centers in Thailand and were the same one used in the Bangkok and Chiang Mai studies.<sup>16-17</sup> The Thai-language version of the questionnaires were described by Vichyanond *et al.*<sup>16</sup>

The video questionnaires consisted of five video sequences depicting the development of a bout of wheezing from rest, during exertion, at night, while coughing at night and during severe wheezing. The video questionnaires were developed to obviate any confusion

that might occur from translation of the term "wheezing" into local languages. Details of the video were described by Shaw *et al.*<sup>18-19</sup> and Vichyanond *et al.*<sup>16</sup> The same version was used in the Bangkok and Chiang Mai studies.<sup>16-17</sup>

The parents of the 6 to 7 year old children were asked to complete the written questionnaires. The older group of students completed the written questionnaires themselves then proceeded to complete the video questionnaires.

### Sample size<sup>13</sup>

The ISAAC committee recommended a sample size of 3,000 so that the 95% confidence interval around an estimate of 30% would be 28.4 to 31.6. Centers with limited resources or small populations were included in the prevalence comparisons, ensuring there were at least 1,000 children in each age group.

### Data collection and analysis

Data were collected between October 1998 and May 1999 from eleven primary schools (three were private) and five government secondary schools. (There was no private secondary school that met the inclusion criteria). The data were entered into spreadsheets in the Epi-Info Statistical Package Version 5.<sup>20</sup> The prevalence of all symptoms were calculated in terms of the percentage of positive responses to each question divided by the number of the completed questionnaires.

## RESULTS

The number of returned questionnaires from the 6 to 7 year old group was 2,707 from 3,384

(80%) and from the 13 to 14 year old group was 3,422 from 3,971 (86%). Only questionnaires from children in the target age ranges were analyzed: 2,658, 45.6 % male in the 6 to 7 year old group and 3,410, 49.5% males in the older group. The cumulative and current prevalences of the written questionnaires for asthma, allergic rhinitis and eczema and their symptoms are shown in Tables 1, 2, and 3, respectively.

For the wheezing module (Table 1), the cumulative prevalence of "ever-wheezed" was quite similar when comparing the 6 to 7 years old and the 13 to 14 years old, 18.6% and 20.5%, respectively. The diagnosed-asthma prevalence was 15.1% in the older group and 11.6% in the younger group. The prevalence of "current wheeze",  $\geq 4$  asthmatic attacks and sleep disturbance in the past 12 months were also similar for both groups (10.2% and 11.0%, 2.8% and 3.7%, and 5.0% and 4.0%, respectively). The prevalence of severe wheezing in the past 12 months was 4.2% in the older group and only half as much in the younger group (2.4%). Exercise induced wheezing was higher in the older group (26.6%) compared with the younger group (5.2%). Night cough was frequent in both groups: 30.6% in the younger and 29.5% in the older group.

The self-reported video questionnaires of the 13 to 14 years old group revealed the prevalence of: wheezing at rest (5.2%), night wheeze (2.2%) and night cough (13.1%). These results are half the magnitude of the written questionnaires (11%, 4.0% and 29.5%, respectively). The prevalence of severe wheezing was similar between the two questionnaires (3.3% and 4.2%).

**Table 1** Percent of positive responses to questions in the wheezing module from the written questionnaires

Symptoms	6-7 years N = 2,658	M:F	13-14 years N = 3,410	M:F	Total N = 6,068	M:F
Wheeze ever	18.6 (20.1-17.1)*	1.1:1	20.5 (21.9-19.1)	1.1:1	19.7 (20.7-18.7)	1.1:1
Asthma ever	11.6 (12.8-10.4)	1.4:1	15.1 (16.3-13.9)	1.3:1	13.6 (14.5-12.7)	1.3:1
<b>Symptoms in the past 12 months</b>						
- Wheezing	10.2 (11.4-9.1)		11.0 (12.1-9.9)		10.7 (11.5-9.9)	
- $\geq 4$ attacks	2.8 (3.4-2.2)		3.7 (4.3-3.1)		3.3 (3.7-2.9)	
- Night waking	5.0 (5.8-4.2)		4.0 (4.7-3.3)		4.4 (4.9-3.9)	
- Severe wheeze	2.4 (3.0-1.8)		4.2 (4.9-3.5)		3.4 (3.9-2.9)	
- Exercise wheeze	5.2 (6.0-4.4)		26.6 (28.1-25.1)		17.2 (18.1-16.3)	
- Night cough	30.6 (32.4-28.8)		29.5 (31.0-27)		30.0 (31.2-28.8)	

\*The numbers in parenthesis indicate the 95% confidence interval

**Table 2** Percent of positive responses to questions from the rhinitis module

Symptoms	6-7 years N = 2,658	M:F	13-14 years N = 3,410	M:F	Total N = 6,068	M:F
Nose symptom ever	38.4 (40.2-36.6)*	1:1	59.4 (61.0-57.8)	1:1	50.2 (51.5-48.9)	1:1
Hay fever ever	34.8 (36.6-33.0)	1:1	35.8 (37.4-34.2)	1:1	35.3 (36.5-34.1)	1:1
<b>Symptoms in the past 12 months</b>						
- nose symptom	33.5 (35.3-31.7)		42.5 (44.2-40.8)		38.6 (39.8-37.4)	
- itchy eye	9.4 (10.5-8.3)		15.0 (16.2-13.8)		12.5 (13.3-11.7)	
- activities limited	31.2 (33.0-29.4)		34.4 (36.0-32.8)		33.0 (34.2-31.8)	

\*The numbers in parenthesis indicate the 95% confidence interval

Exercise induced wheezing as seen on the video questionnaires were one-third the response of the written questionnaires (8.7% and 26.6%) (Table 4).

The cumulative and current prevalences of 'nose' symptoms were higher in the older group (59.4% and 42.5%) than in the younger group (38.4% and 33.5%) (Table 2). Only 9.4% of the younger group and 15% of the older group reported eye symptoms associated

with rhinitis. The 'nose' symptoms interfered with both groups' daily activities (31.2% and 34.4%, respectively). One-third of each group reported allergic rhinitis (34.8% and 35.8%, respectively): the symptoms peaked from November to January (Fig. 1).

The responses to the eczema module are presented in Table 3. The cumulative and current prevalences of chronic pruritic rash were 18% and 15.2% in the young-

er group and 9.9% and 7.4% in the older group, respectively. Only 12.6% and 5.1% reported the typical site of atopic eczema. The rash was clear within 12 months for 11.5% and 4.1% of the groups, respectively. About 7.8% and 3.3% experienced sleep disturbance, respectively, because of the rash. Interestingly, the prevalence of "ever having eczema" of both groups (30.5% and 24.4%) was much higher than the reports of "having rash" (18% and 9.9%, respectively).

**Table 3** Percent of positive responses to questions from the eczema module

Symptoms	6-7 years N = 2,658	M:F	13-14 years N = 3,410	M:F	Total N = 6,068	M:F
Rash ever	18.0 (19.5-16.5)*	1:1	9.9 (10.9-8.9)	0.9:1	13.5 (14.4-12.6)	0.9:1
Eczema ever	30.5 (32.3-28.7)	0.9:1	24.4 (25.8-23.0)	1:1	27.1 (28.2-26.0)	1:1
Flexural area	12.6 (13.9-11.3)		5.1 (5.8-4.4)		8.4 (9.1-7.7)	
Symptoms in the past 12 months						
- Rash	15.2 (16.6-13.8)		7.4 (8.3-6.5)		10.8 (11.6-10.0)	
- Rash clear within 12 months	11.5 (12.7-10.3)		4.1 (4.8-3.4)		7.3 (8.0-6.6)	
- Night waking	7.8 (8.8-6.8)		3.3 (3.9-2.7)		5.3 (5.9-4.7)	

\*The numbers in parenthesis indicate the 95% confidence interval

**Table 4** Percent of positive responses to the video questionnaires for wheezing

Description of video sequences	13-14 years Cumulative	N = 3,410 12 month prevalence	M:F
Wheezing at rest	8.7 (9.6-7.8)*	5.2 (5.9-4.5)	0.9:1
Exercise wheeze	13.8 (14.9-12.6)	8.7 (9.6-7.8)	1.1:1
Night wheeze	4.2 (4.9-3.5)	2.2 (2.7-1.7)	1.2:1
Night cough	22.0 (23.4-20.6)	13.1 (14.2-12.0)	0.8:1
Severe wheeze	6.0 (6.8-5.2)	3.3 (3.9-2.7)	0.8:1

\*The numbers in parenthesis show the 95% confidence interval

**Table 5** Comparison of the wheezing module for the three centers<sup>16,17</sup>

Symptoms	6-7 years			13-14 years			Total		
	KK N=2,658	BKK N=3,628	CM N=3,828	KK N=3,410	BKK N=3,713	CM N=3,927	KK N=6,068	BKK N=7,341	CM N=7,755
Wheeze ever	18.6	17.4	8.9	20.5	19.2	18.2	19.7	18.3	13.6
Asthma ever	11.6	9.5	4.2	15.1	14.2	9.3	13.6	11.9	6.8
Symptoms in the past 12 months									
- Wheezing	10.2	11.7	5.5	11.0	13.6	12.6	10.7	12.7	8.8
- ≥ 4 attacks	2.8	-	1.5	3.7	-	3.8	3.3	-	2.7
- Night waking	5.0	5.1	0.7	4.0	4.2	1.0	4.4	4.6	0.8
- Severe wheeze	2.4	1.8	0.9	4.2	4.0	3.2	3.4	2.9	2.0
- Exercise wheeze	5.2	5.3	2.8	26.6	15.7	13.5	17.2	10.7	8.2
- Night cough	30.6	23.6	14.2	29.5	28.6	28.5	30.0	26.2	21.5

KK = Khon Kaen, BKK = Bangkok,<sup>16</sup> CM = Chiang Mai<sup>17</sup>

**Table 6** Percent of positive responses to questions in the rhinitis module of the three centers<sup>16,17</sup>

Symptoms	6-7 years			13-14 years			Total		
	KK N=2,658	BKK N=3,628	CM N=3,828	KK N=3,410	BKK N=3,713	CM N=3,927	KK N=6,068	BKK N=7,341	CM N=7,755
Nose symptom ever	38.4	37.5	20.8	59.4	50.6	47.0	50.2	44.2	34.1
Hay fever ever	34.8	29.6	17.9	35.8	30.9	24.8	35.3	30.3	21.4
Symptom in the past 12 month									
- Nose symptom	33.5	33.7	18.5	42.5	43.4	38.3	38.6	38.7	28.5
- Itchy eyes	9.4	10.4	5.7	15.0	15.6	16.9	12.5	13.1	11.4
- Activities limited	31.2	29.0	25.8	34.4	39.2	37.1	33.0	34.3	31.5

KK = Khon Kaen, BKK = Bangkok,<sup>16</sup> CM = Chiang Mai<sup>17</sup>**Table 7** Percent of positive responses to questions in the eczema module of the three centers<sup>16,17</sup>

Symptoms	6-7 years			13-14 years			Total		
	KK N=2,658	BKK N=3,628	CM N=3,828	KK N=3,410	BKK N=3,713	CM N=3,927	KK N=6,068	BKK N=7,341	CM N=7,755
Rash ever	18.0	17.5	12.5	9.9	10.5	11.7	13.5	15.4	12.1
Eczema ever	30.5	23.0	20.5	24.4	25.6	27.1	27.1	24.2	23.8
Flexural area	12.6	13.5	12.9	5.1	6.9	10.7	8.4	11.4	11.8
Symptoms in the past 12 months									
- Rash	15.2	16.0	14.9	7.4	9.1	12.8	10.8	14.0	13.8
- Rash clear	11.5	11.4	13.2	4.1	7.3	11.4	7.3	10.9	12.3
- Night waking	7.8	6.6	1.7	3.3	3.2	1.3	5.3	5.5	1.5

KK = Khon Kaen, BKK = Bangkok,<sup>16</sup> CM = Chiang Mai<sup>17</sup>

Both sexes were equally affected by most of these allergic symptoms except in the wheezing module where males reported more asthmatic symptoms.

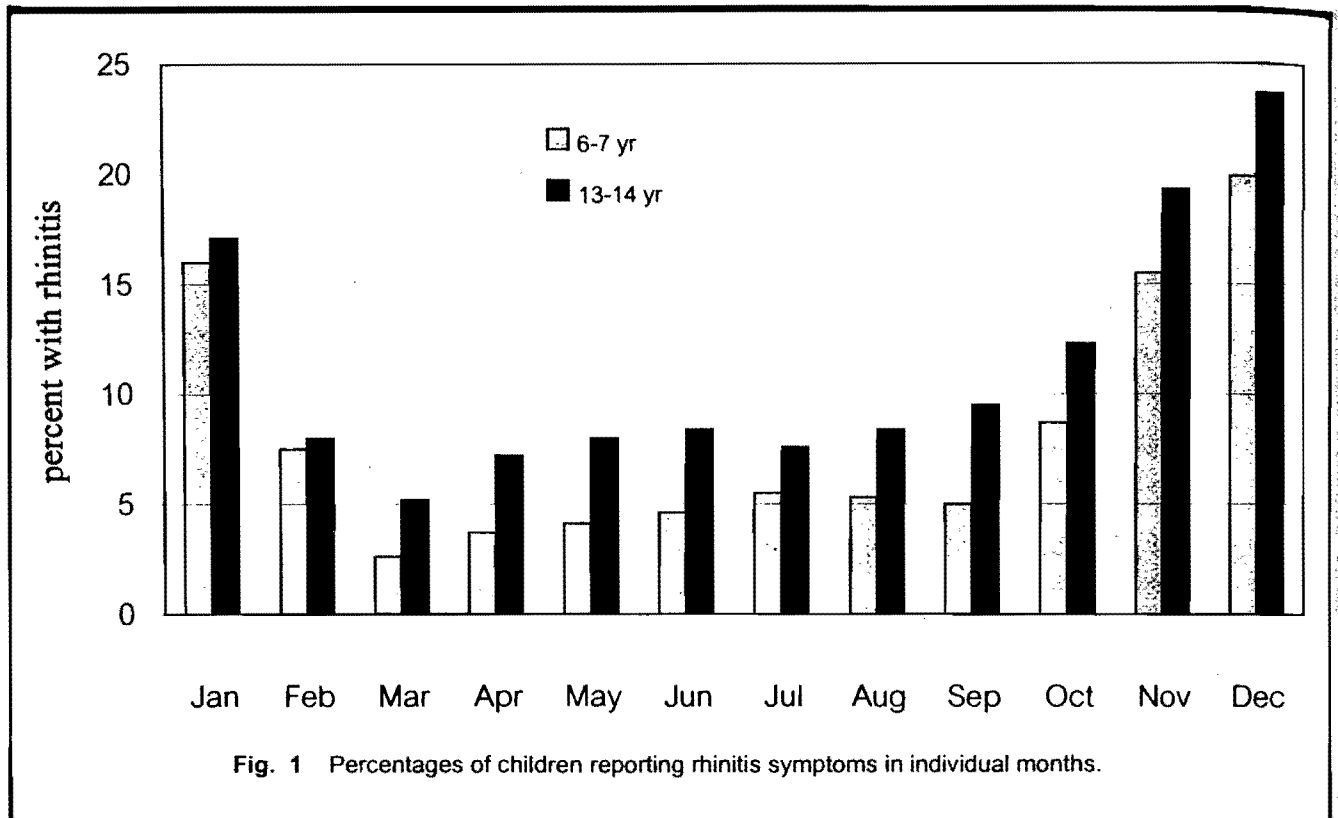
## DISCUSSION

The cumulative and 12-month prevalences of the three conditions among 6-7 year old and 13-14 year old group in this study

were: wheezing 18.6%, 10.2% and 20.5%, 11.0%; allergic rhinitis 38.4%, 33.5% and 59.4%, 42.5%; and eczema 18.0%, 15.2% and 9.9%, 7.4%, respectively. This is the first reported prevalence survey of asthma and other allergic diseases among schoolchildren in Khon Kaen, Northeast Thailand, using the same ISAAC questionnaires as the Bangkok and Chiang Mai studies. The questionnaires

were translated into Thai from English by a group of pediatric allergists.<sup>16</sup> The original ISAAC questionnaires were validated against bronchial hyperresponsiveness and was found to have an acceptable level of sensitivity and specificity for the purpose of multicenter international comparisons.<sup>21-25</sup>

The results of our study showed that both the current and



cumulative prevalence of all allergic symptoms were similar to those reported from Bangkok<sup>16</sup> and slightly higher than those reported from Chiang Mai<sup>17</sup> (Tables 5, 6, 7). Our results are about four times higher than the previous reports from Bangkok done ten years ago.<sup>15</sup> Compared to other countries in the Asia-Pacific region, the results of the prevalence surveys in Thailand are closest to those of the Philippines, Japan and Hong Kong but higher than those of Malaysia, Singapore, Taiwan and China.<sup>14</sup>

In the wheezing module, the responses to the written questionnaires of both age groups were similar except for the prevalence wheezing caused by exercise. The older children reported a higher frequency of exercise-induced wheezing which was again higher than the prevalence of current wheezing. Similar results have been

reported worldwide.<sup>14</sup> This may be a real prevalence or the result of under-reporting by the parents if not over-reporting by the adolescent themselves.<sup>14,26</sup> In contrast to the prevalence of night cough, the results were consistently high for both age groups. There may have been a higher awareness of night cough reported by parents because it disturbed their sleep.<sup>14</sup> The results from the video questionnaires were often half the frequency of the result of the written questionnaires, and exercise-induced wheezing was one-third less. This phenomenon may be because the video shows more severe symptoms than the respondents recognized.<sup>14</sup>

About one-third of the younger group and half of the older group reported the 'nose' symptoms and most (77%) were still with the suffering symptoms in the last 12 months, 85% reported that

the symptoms interfered with their daily activities. Our study showed a very high prevalence of allergic rhinitis (35.3%) while only 35.4% of these children reported itchy eyes which is usually associated with allergic rhinitis. Bunnag *et al.*<sup>27</sup> used different questionnaires, ENT examinations and skin prick test, also reported that the prevalence of allergic rhinitis in children from Khon Kaen was 24.8%, which supports the high prevalence detected by our study. The pattern of nose symptoms showed an expected seasonal variation, the peak prevalence was in winter (the cool, dry season between November and January) although there may be some effects from the recall bias relating to the time of questioning which was in winter,<sup>28</sup> unlike the pattern of the Chiang Mai study with the peak was in the rainy season<sup>17</sup> and in contrast to the Bangkok study which revealed a perennial problem.<sup>16</sup>

Some (18%) of the younger children reported having chronic pruritic rash, which was twice higher than the older group. Yet 12.6% of the younger and 5.1% of the older children reported the rash occurred in the typical area for atopic eczema. Surprisingly, a high prevalence (30.5% and 24.4%) of atopic eczema was reported in both groups. These results were similar to both the Bangkok and Chiang Mai studies.<sup>16,17</sup> Since there is no specific Thai word for eczema, the positive response to this question may have included all sorts of pruritic skin rashes. The meaning of eczema needs to be clarified in the Thai questionnaires.

The results of our study confirmed the high prevalence of asthma and other allergic diseases among Thai children in various parts of the country. Indoor and outdoor allergens as well as upper respiratory tract infections are probably responsible for this high prevalence and the increasing trend. Although asthma is more frequent in the industrialized countries, there is little evidence that air pollution is directly responsible for the increasing prevalence of asthma in these countries.<sup>29-32</sup> Khon Kaen is a big city but not as crowded as Bangkok. The prevalence of these allergic diseases is similar to Chiang Mai which is the second most populous city in Thailand. Both the Khon Kaen and Chiang Mai surveys showed a seasonal type of 'nose' symptoms, mainly in the winter and rainy seasons. Tuchinda *et al.*<sup>33</sup> reported that asthma exacerbation in Thai children usually occurred in the winter and rainy seasons. This seasonal change may be due to an increase in viral respiratory tract infections especially respiratory syncytial virus in Thai children,<sup>34,35</sup> together with the

peak incidence of grass pollens and some mold spores in the atmosphere during these seasons.<sup>36</sup>

Many studies have shown that house dust mites are the most common indoor allergen and a major cause of asthma worldwide<sup>37-39</sup> including Thailand.<sup>33,40-45</sup> The highest density of mites has been found in house dust in northern Thailand, but the dusts with the highest amount of the allergens were collected in Northeast Thailand.<sup>46</sup> The prevalence of asthma and allergic diseases was lowest in Chiang Mai, Northern Thailand and highest in both Bangkok and Khon Kaen.

Our survey confirmed the results of the two previous studies, which showed a high prevalence of asthma and other allergic diseases among Thai children. If this increasing trend is continued, Thailand might have allergy as a serious health problem, which will be a major cause of children being absent from school and parents from work. Additional epidemiological surveys from other parts of the country, both in rural and urban areas, are needed to be done to identify the major risk factors of these diseases.

#### ACKNOWLEDGEMENTS

The authors thank the directors of the schools, schoolchildren, parents and teachers who participated in the study; Mr. Tadd Clayton (Data Manager of the ISAAC International Data Center) for data analysis, Prof. Pisake Lumbiganon and Assoc. Prof. Weerachai Kowsuwon for their assistance with writing style and the format of the paper and Mr. Bryan Roderick Hamman for his assistance with the English-language presentation of the paper.

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