

Increasing Asthma Care Knowledge and Competence of Public Health Nurses after a National Asthma Education Program in Taiwan

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SUMMARY One of the responsibilities of a public health nurse is to provide asthma education to local residents. However, there have been no comprehensive education programs for public health nurses on asthma care in the past. This study aimed to determine level of competence of public health nurses on asthma care in order to improve their capability through a one-day national asthma education course. In addition to lectures on updated asthma management information, data was obtained through demonstrations and practice on inhalation techniques of various kinds of inhaled devices, including the ability to use and interpret the data of a peak flow meter. Two written examinations with the same questions were given to participants before and right after the lectures. All of the 560 public health nurses in the 392 public health bureaus were invited to join the program and 522 (93.2%) participated. Five hundred and six completed both the pre- and post-tests. Before the national education program, only 10.9% of the participants knew the purpose of the peak flow meter, while 62.6% had never heard of it. Initially, they showed less confidence on teaching patients on the use of inhaled devices (2.36 and 2.59 in 5 scales). Comparing the two tests, there was a significant increase in the public nurses' knowledge as regards: 1) the general concept of asthma, 2) prevention of trigger factors and environmental control, 3) proper medication knowledge, 4) peak flow meter (PEF) monitoring, and 5) intervention after acute exacerbation of asthma ($p < 0.001$). A well-designed course on asthma management is an efficient scheme to improve public health nurses' knowledge and confidence on asthma care.

Asthma is one of the most common chronic childhood diseases. The prevalence of asthma in Taipei increased from 1.3% in 1974 to 14.3% in 2002.^{1,2} It is one of the causes of school absence in children because of unscheduled medical visits.^{3,4} Symptoms of asthma can be controlled effectively using various medications, by monitoring the peak flows, by eliminating allergens, by avoiding possible trigger factors, and with good adherence to proper chronic maintenance therapy. One of the reasons of poor control in young children is the inappropriate

inhalation technique. However, even though children have difficulty learning the inhalation technique, they could be trained after repeated instructions.⁵

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The responsibilities of a public health nurse are to provide correct information and education on diseases to community residents in Taiwan. Their knowledge about asthma would influence their quality of care. According to government policy, there should be five nurses (including a public health nurse) in an administrative area with at least 50,000 local populations, and another public health nurse for every 15,000 increase in population. It was estimated that each public nurse had to serve 10,000 to 15,000 populations.

To promote quality of care for asthmatic schoolchildren, we conducted a national asthma education program for school nurses in the whole country under the supervision of the Department of Health, Executive Yuan in Taiwan. According to a previous survey on school nurses' asthma knowledge, 88.6% of school nurses in Taiwan experienced problems on managing asthmatic students. Only 20-30% of the participating school nurses demonstrated specific knowledge relating to the interpretation of asthma symptoms, appropriate use of the right medication in different situations, and the use of a peak flow meter.⁶ Moreover, 77% of school nurses stated that there were no asthma education programs in schools.⁷ As for the physicians' survey, 22% did not perform asthma education including inhalation techniques, and peak flow monitoring in their clinics.⁸

Good asthma care is not the responsibility of physician alone; all of the health care providers should have the capability to give patients proper and correct information. The purpose of the study was to investigate the level of general knowledge on asthma of public health nurses and to promote their management knowledge and skills through a short course education program.

MATERIALS AND METHODS

The asthma education program was designed by a team of six pediatric allergologists, a health education professor, and two nursing educators. It was evaluated by two pediatricians, and was conducted in three stages, namely: 1) the design of a suitable asthma education plan; 2) the actual conduct of asthma education activities, and 3) evaluation of the effectiveness.

Stage one: designing a suitable asthma education plan

Education needs assessment

Approximately six months before the asthma education program was initiated, an education needs assessment was conducted. This assessment served as the basis for developing the overall education program, as well as guiding the teaching materials on the care of asthmatic children at school. The National Bureau of Health Promotion, Department of Health in Taiwan, approved and sponsored the program.

Teaching materials

The teaching materials used were produced in connection with an earlier study that elicited the educational needs of school nurses. These included a comprehensive health education booklet on the care of asthmatic children, an educational video, and an illustrated presentation on proper environmental controls, the use of the peak flow meter, the proper use of different kinds of inhalational devices, and the management of asthma attacks in different situations.

Teaching components

Topics in the teaching activities included the pathogenesis of asthma, symptom-identification, the management of an acute asthmatic episode, daily health care maintenance, a review of current medications and treatment modalities, and a demonstration of applying peak flow monitoring for asthmatic patients.

Participants

One or two public health nurses in each public health bureau in Taiwan were invited to participate.

Stage two: conducting asthma education teaching activities

Administration

The public health bureau in each county and

city handled invitations and made training arrangements. Six pediatric allergologists conducted the teaching activities.

Teaching procedures

Based on lectures and demonstrations, the instructor used VCDs and other teaching materials in the educational activities. The video programs included: 1) inhalation techniques for various kinds of inhalation devices; 2) use and interpretation of peak flow meter; and 3) management of acute exacerbation. Each section is around 10 minutes long. The proper use of peak flow meters to monitor the daily symptoms was emphasized. The participants practiced using the peak flow meters and various kinds of inhalation devices, which was observed and immediately corrected by the staff. The duration of a complete education program was 6 hours. Seven daily sessions of four-hour lectures were held between December 2002 and February 2003.

Stage three: evaluating the Asthma Education Program

Evaluation tools

To evaluate the effectiveness of the program and the competence of public nurses, participants filled out an evaluation questionnaire before and after the course. It was composed of a demographics component, asthma knowledge assessment, and a case management skills assessment. A pre-test was held before the training course, and a post-test using the same questionnaire was held after. Thirty-four questions were divided into four categories as follows: 1) general knowledge about asthma, 2) appropriate asthma education and treatment modalities, 3) environmental controls and triggers of asthma attacks, and 4) identification and intervention of symptoms of acute asthma exacerbation. Generally, the participants needed about 25 minutes to complete the questionnaire.

The third component of this program evaluated the public health nurses' efficacy in managing asthma episodes. Using a Likert scale, scores ranged from one (very diffident) to five (very confident) in assessing the nurses' degree of confidence in managing an acute episode.

Reliability co-efficients for the questionnaire (Cronbach's alpha) were implanted. The resultant alpha level was 0.78 for knowledge/competence and 0.89 for asthma management efficacy.

Data analysis

The collected data were analyzed using the SPSS 10th edition statistical package. The reliability (item to scale) of the questionnaire was assessed using Cronbach's alpha. Descriptive statistics were used to describe participants' demographic characteristics. A Wilcoxon signed-rank test was used to test the changes in participants' knowledge/competence and management-efficacy for pre-training vs. post-training states. One-way Analysis of Co-variance was used to determine the influence of demographic characteristics on the participants' knowledge/competence and management-efficacy for pre-and post-intervention states. The McNemar's test was used to test the changes in knowledge of interpretation of peak flow meter.

RESULTS

Participant demographics

All of the 560 national public health nurses in Taiwan were invited to join the program and 522 (93.2%) participated. Five hundred and six completed both the pre- and post-tests, and these tests results were used for the data analysis below. Three-fourths of the participants were in their 30s or 40s. Of the total participants, 60.3% graduated from a nursing college and had more than 10 years of experience working as a public health nurse. The participants' demographic characteristics are summarized in Table 1.

Peak flow monitoring

A significant number of participants (62.6%) never heard of a peak flow meter prior to this education program. However, 25.3% had seen it but neither knew its name nor how to use it. Therefore, only 10.9% of the participants realized the purpose of using a PEF meter for monitoring daily symptoms, 16.0% knew how to use it, and 23.9% understood the meaning of personal best value of PEF. In terms of calculation of variation of PEF value, 6.7% of the

Table 1 Demographic characteristics of survey respondents

Characteristics	Number	%
Age (years)		
20-24	15	3.1
25-29	42	8.7
30-34	115	23.7
35-39	77	15.9
40-44	89	18.4
45-49	84	17.3
50-54	50	10.3
55-59	11	2.3
> 60	2	0.4
Education Level		
Senior high school	97	20.0
College	293	60.3
University	84	17.3
Master and PhD	9	2.0
Other	2	0.4
Years of service in public health		
Number	465	
Mean	13.71	
SD	8.72	
Range	0-36	

participants had the right answer. All of the items about manipulation and interpretation of the peak flow meter had statistically significant improvement after instructions and practice ($p < 0.001$) (Table 2).

Case management efficacy

The median score of each item in evaluating the case management efficacy was 2.5 (from 1 least confident to 5 extremely confident). Participants demonstrated confidence in the care of asthmatic patients with a score greater than the median as shown in Table 3. Initially, the lowest scores were on the item on teaching the asthmatic patients to use the peak flow meter appropriately (2.02 ± 1.14), but after the training, it had the highest score (4.46 ± 0.84). Their improved confidence was also reflected by the significant increase in score on teaching patients to use the metered dose inhaler (2.36 ± 1.23 to 4.28 ± 0.85) or dry powder inhaler (2.59 ± 1.29 to $4.30 \pm$

0.85). Following the asthma education program, significant improvements were noted on all items dealing with patient care. Although the scores of most items were above the median, they increased significantly after the training program (Table 3).

Nurses' knowledge/competence

The score about asthma etiology and pathophysiology were 10.69 (max 15, SD = 1.95). In this category, only 44.3% of the participants realized beforehand that inhaled anti-inflammatory agents were used as chronic maintenance therapy. Majority (89.7%; $p < 0.001$) of them had the right answer in the post-test (data not shown). The score was 0.47 (max 3; SD = 0.84) on understanding asthma caring modalities. In scenario questions, they had scores of 2.01 ± 1.51 and 3.78 ± 1.48 on the evaluation of asthma condition and management of acute exacerbation, respectively. In self-efficacy, they obtained 27.71 out of 50 marks. In general, the scores of each category increased prominently after the training (Table 4).

DISCUSSION

Good quality asthma care is not only the physicians' responsibility but should also be extended to the community and schools. The perception of an inadequate knowledge base among primary caregivers for asthmatic children at the level of academic institution seems to be a common phenomenon worldwide.⁹ After a short course seminar, the paramedics would have the confidence and improved knowledge for caring for asthmatic patients.^{10,11}

The evaluation questionnaire, containing 4 categories of 34 questions about asthma had been used in previous study.⁶ It has been tested for reliability before released. The questions were multiple choices related to clinical instead of basic immunological knowledge. Some questionnaires regarding to asthma knowledge have been developed to evaluate parents of asthmatic children or patients, and the concept of asthma was not updated.^{12,13} A questionnaire for asthma educator has been developed, though it was only for adult.¹⁴ Our evaluation tool is not only for general asthma knowledge but including scales to assess the nurses' degree of confidence on

Table 2 Rate of correct answers on PEF monitoring

	Item	Pre-test (%)	Post-test (%)	p-value ^a
PEF monitoring	Purpose of utilizing PEF meter	10.9	58.3	< 0.001
	Operation procedure	16.0	72.5	< 0.001
	Timing of PEF monitoring	24.9	94.3	< 0.001
	Calculation the variation of PEF	6.7	68.5	< 0.001
	Calculation of predictive value of PEF	23.9	77.9	< 0.001
	Interpretation of the severity of symptoms	16.4	86.0	< 0.001
	PEF for symptom interpretation and intervention-before bronchodilator	21.3	44.5	< 0.001
	Evaluation of bronchodilator effect by PEF	7.5	53.0	< 0.001
	PEF for symptom interpretation and intervention-after bronchodilator	42.1	79.1	< 0.001
	Application of PEF in a scenario	34.6	63.8	< 0.001
	PEF for self management	49.8	80.8	< 0.001

^aMcNemar's test

Table 3 Comparison of public health nurses' management-efficacy (pre-test and post-test)

	Pre-test Mean ± SD	Post-test Mean ± SD	Differences Mean ± SD	p-value
To identify asthma symptoms	2.86 ± 0.97	4.17 ± 0.81	1.31 ± 1.13	< 0.001
To instruct and assist in use of peak flow meter	2.02 ± 1.14	4.46 ± 0.84	2.44 ± 1.37	< 0.001
To manage the condition in acute exacerbation	3.01 ± 1.04	4.23 ± 0.81	1.23 ± 1.16	< 0.001
Instruct and assist in use of MDI	2.59 ± 1.29	4.30 ± 0.85	1.71 ± 1.43	< 0.001
Instruct and assist in use of DPI	2.36 ± 1.23	4.28 ± 0.85	1.91 ± 1.38	< 0.001
To consult with parents for caring of asthmatic children	2.67 ± 1.11	4.08 ± 0.78	1.39 ± 1.18	< 0.001
To build a health management plan for asthmatic children	2.60 ± 1.08	4.02 ± 0.79	1.42 ± 1.12	< 0.001
Prevention from allergen contact	3.15 ± 1.06	4.33 ± 0.79	1.17 ± 1.16	< 0.001
Concerning physical and psychological adaptation in school	3.06 ± 1.03	4.16 ± 0.79	1.09 ± 1.11	< 0.001
To explore the updated knowledge in terms of asthma	3.40 ± 1.06	4.37 ± 0.79	0.97 ± 1.12	< 0.001

*The scale is from one (very diffident) to five (very confident) in each item

asthma care.

All the participants were back to their practice settings distributed in whole country after the education program. Limitations of the study are that no communication or teaching skills were included in the program and no observational follow-up was performed, and there was no control group to com-

pare efficacy of the education course.

Although asthma care is one of the responsibilities of public health nurses, about 80% of the respondents perceived a shortage of opportunities to learn it. The high participation rate (93.2%) in this project reflects the eagerness of most public health nurses to improve their abilities to meet the health-

Table 4 Comparative scores in each category between pre- and post-tests

	Pre-test Mean \pm SD	Post-test Mean \pm SD	Differences Mean \pm SD	<i>p</i> -value ^c
Asthma etiology and pathophysiology^a (max 15)	10.69 \pm 1.95	13.48 \pm 1.37	2.79 \pm 2.02	< 0.001
Asthma caring modalities^a (max 3)	0.47 \pm 0.84	2.23 \pm 0.77	1.77 \pm 1.03	< 0.001
Evaluation of asthma condition^a (max 8)	2.01 \pm 1.51	4.94 \pm 1.43	2.91 \pm 1.82	< 0.001
Management of asthma acute exacerbation^a (max 7)	3.78 \pm 1.48	6.12 \pm 0.95	2.35 \pm 1.59	< 0.001
Self efficacy of asthma care^b (max 50)	27.71 \pm 8.51	42.46 \pm 6.96	14.80 \pm 9.48	< 0.001

^acorrect answer mark 1; wrong answer mark 0

^bscale from 1 to 5 corresponding to least confident to very confident

^cWilcoxon signed-rank test

care needs of asthmatics. As shown in the demographic data, most of the participants graduated from nursing school more than 10 years prior to the program, and wanted to renew their knowledge. As far as the efficacy of the program, there were no demographic characteristics found to make any significant difference. This could mean that the training program was generally needed and well suited to all public health nurses.

Regarding the participating nurses' knowledge/competence in appropriate asthma case management, they appeared to possess a reasonably good working knowledge of the trigger factors and irritants of asthma attacks. However, the data indicated that there was a lack of specific knowledge and management competence in terms of appropriate treatment modalities, effective asthma treatment, the use of inhaled short-acting bronchodilators when having an asthma attack, and the use of the PEF meter for monitoring daily symptoms. It seemed that a similar problem among school nurses was that only 20% of them could have the correct responses to questions pertaining to the selection of appropriate asthma medication and the application of the PEF meter.^{6,7}

The inhalation technique of using MDI/DPI and the utilization of a PEF meter for monitoring daily symptoms are not included in regular nursing training education programs in Taiwan. In an investigation of community clinical nurses in Canada, it was found that many medical personnel responsible

for monitoring and instructing patients in optimal inhaler use were lacking rudimentary skills with these devices, and even registered nurses seldom received formal instructions in using inhaled devices.¹⁵

In the section of self-efficacy evaluation, the two lowest scores among all items were the skills in using the peak flow meter and inhalation devices in the pre-test. The scores of these two items, however, became the two highest ones after the participants undertook the practice designed in this education program ($p < 0.001$). This indicated that the skills can easily be taught in a short course program if nurses have the chance to learn it. It is therefore important not only to emphasize the importance of asthmatic management training for public health nurses, but also to advocate the inclusion of these practical skills and related information in regular nursing education curricula.

Although the observed ability of nurses to perform their duties improved effectively after they participated in the asthma education program, the study still disclosed a general deficiency in their ability to apply PEF data in any situation. Interestingly, some participants requested that the program be extended, as they found a six-hour session too short. This suggests that more detailed instruction and practices would constitute an improved platform for future training activities.

All the parameters showed significant im-

provement after the program, although the participants were tested right after the program and they could have benefited from having a good short-term memory. It was believed that such a course still has long-term effects of up to two years in terms of the quality of care given, and on the patient satisfaction and use of health services for the asthma care, even after taking a short course program.^{10,16} It might be worthy to revise the training a few months later in order to review the knowledge and to gain expected experience. Follow-up and review of participants' competence and practices might be necessary to assure that nurses remain familiar with the application of PEF monitoring and maintain the effects of the training program on asthma case management. In practice, public health nurses were encouraged to renew their caring skills and knowledge frequently after the education program.

At the end of each training session, participants were given the teaching materials adopted in this program, including an asthma education VCD, a printed booklet, and a peak flow meter. It is hoped that this education program would provide the initial spark for the development of an appropriate and effective asthma management education program and an associated comprehensive care plan in Taiwan, so that all of the people who suffer from asthma will benefit. The public health nurses received the correct knowledge about the asthma care, especially the concept of using inhaled corticosteroids as the first line treatment, to enable them to teach the asthmatic patients in communities the right concept. Once the public nurses gained the correct training in asthma therapy, it is hoped that they could spread out the concept to other paramedics and parents, to improve the long-term maintenance therapy of asthma. Further study is needed to evaluate the outcome of asthmatic patients after the active intervention of public health nurses who had received a short course on asthma education.

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REFERENCES

1. Kao CC, Huang JL, Ou LS, See LC. The prevalence, severity and seasonal variation of asthma, rhinitis and eczema in Taiwan schoolchildren. *Pediatr Allergy Immunol* 2005; 16: 408-15.
2. Yan DC, Ou LS, Tsai TL, Wu WF, Huang JL. Increasing prevalence of asthma, rhinitis and atopic dermatitis among 13 to 14-year-old children in Taipei city: An ISAAC phase three study. *Ann Allergy Asthma Immunol* 2005; 95: 579-85.
3. Persaud DI, Barnett SE, Weller SC, Baldwin CD, Niebuhr V, McCormick DP. An asthma self-management program for children, including instruction in peak flow monitoring by school nurses. *J Asthma* 1996; 33: 37-43.
4. Meng A. A school-based asthma clinic: a partnership model for managing childhood asthma. *Nurs Practitioner Forum* 2000; 11: 38-47.
5. Chen SH, Yin TJ, Huang JL. Exploring of the skills for inhalation therapy in school children with asthma in Taiwan. *Ann Allergy Asthma Immunol* 2002; 89: 311-5.
6. Chao SY, Yan DC, Ou LS, *et al.* Primary school nurses' knowledge/competence pertaining to childhood asthma and its management prior to and following a national asthma education program in Taiwan. *J Asthma* 2003; 40: 927-34.
7. Bucher L, Dryer C, Hendrix E, N Wong. Statewide assessment of school-age children with asthma in Delaware. *J School Health* 1998; 68: 276-81.
8. Yeh KW, Chen SH, Chiang LC, Chen LC, Huang JL. Survey of asthma care in Taiwan: comparison of asthma specialists and general practitioners. *Ann Allergy Asthma Immunol* 2006; 96: 593-9.
9. Eisenberg JD, Moe EL, CF Stillger. Educating school personnel about asthma. *J Asthma* 1993; 30: 351-8.
10. Norzila MZ, Hasanah I, Deng CT, BH Azizi. Asthma education: how much does it improve knowledge of childhood asthma amongst medical students and paramedics? *Med J Malaysia* 2000; 55: 324-30.
11. Henry RL, Hazell J, JA Halliday. Two hour seminar improves knowledge about childhood asthma in school staff. *J Paediatr Child Health* 1994; 30: 403-5.
12. Fitzclarence CA, Henry RL. Validation of an asthma knowledge questionnaire. *J Paediatr Child Health* 1990; 26: 200-4.
13. Brook U, Mendelberg A, Heim M. increasing parental knowledge of asthma decreases the hospitalization of the child: a pilot study. *J Asthma* 1993; 30: 45-9.
14. Allen RM, Abdulwadud OA, Jones MP, Abramson M, Walters H. A reliable and valid asthma knowledge questionnaire useful in the training of asthma educators. *Patient Educ Couns* 2000; 39: 237-42.
15. Hanania NA, Wittman R, Kesten S, KR Chapman. Medical personnel's knowledge and ability to use inhaling devices: Meter-dose inhalers, spacing chambers, and breath-actuated dry power inhalers. *Chest* 1994; 105: 111-6.
16. Clark NM, Gong M, Schork MA *et al.* Long-term effects of asthma education for physicians on patient satisfaction and use of health services. *Eur Respir J* 2000; 16: 15-21.