



Knowledge, attitude and practice of nurses toward peak expiratory flow meter in primary health care centers in Kuwait

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Abstract *Background:* Peak expiratory flow meter (PEFM) is an easy to use, relatively cheap device that can be used for guiding management of bronchial asthma by the patients at home according to a preset plan by health care workers.

Objective: The aim of the study is to reveal the extent of knowledge and perception of nurses about PEFM and factors affecting their knowledge.

Methods: Out of the total primary health care centers in Kuwait, 50% were randomly selected. Out of 699 nurses currently working in the selected centers, 516 nurses were interviewed for this study with an overall response rate of 73.8%.

Results: The results of this study showed that nurses had a relatively low total knowledge score percent of $64.7 \pm 7.3\%$. The lowest individual mean percent score was that of procedures and steps

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of measuring peak expiratory flow rate ($39.0 \pm 24.1\%$). The highest percent knowledge score was that of benefits of use and content instructions for teaching patients ($78.3 \pm 19.5\%$ and $78.1 \pm 12.0\%$, respectively). Sociodemographic factors did not affect the total knowledge score. Receiving training, availability of PRFM in the health center and being responsible about taking the measurements for patients proved to significantly affect the level of knowledge of nurses.

Conclusion: Training nurses about use of PEFM and providing primary health care centers with the devices would plan an important role to improve knowledge of nurses and hence improve domestic health care of patients with obstructive lung diseases.

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1. Introduction

Chronic obstructive pulmonary disease (COPD) is a major public health problem. It is currently the fourth leading cause of death worldwide and is predicted to be the third leading cause by 2020.¹ To identify and target patients with silent COPD for treatment, especially through smoking cessation, the National Lung Health Education Program (NLHEP) has recommended that all smokers age 45 years and older should have screening lung function measured by simple spirometry.²⁻⁵ In addition, the NLHEP advocates more widespread use of diagnostic office spirometry for patients with respiratory symptoms, and to provide a global assessment of health.³⁻⁵

For asthmatic patients, it is often desirable to make frequent objective assessments of peak expiratory flow (PEF), usually more than once a day. Daily, or circadian, variations in PEF reflect the severity of asthma.⁶ This statement from the International Consensus Report on Diagnosis and Treatment of Asthma has made PEF measurement as one of the mainstays of asthma management. Peak flow measurement is a tool for guiding treatment by the physician, and especially a tool of self-management by the patient. Peak expiratory flow meter (PEFM) generally is an inexpensive device that can be provided for personal use, for every individual patient.

The PEFM was first introduced about 50 years ago as a simple and convenient measure to aid the diagnosis and management of patients with airflow obstruction.⁷ Its clinical use has waxed and waned in the intervening years and now its role in asthma management and other obstructive lung diseases is better defined. Currently used PEFMs are easy to be used and handled by patients at home. They help patients to make simple correct decisions about management of bronchial asthma or COPD.⁸⁻¹⁰ The present study is aiming at identifying the prevailing knowledge and attitudes of nurses toward PEFM and reveal factors affecting knowledge of nurses about the device.

1.1. Subjects and methods

An observational cross-sectional study design was adopted for this study. The study was carried out in the primary health care centers in Kuwait. A list of all primary health care centers of Kuwait (78 centers) was prepared and classified by health district (five districts). Half the centers were randomly selected from each district. All nurses available during the field work of the study in the selected centers were the target population of this study. All nurses on long vacation were excluded from the study (11 nurses). Out of a total number of 699 nurses, only

516 agreed to share in the study with a response rate of 73.8%. The direct structured interview method was adopted for this study. This method allows for direct interview of the target individuals and explaining any ambiguities of the questions. Although it is a time consuming method yet, it allows more interaction and better accuracy. The study covered the period December 2009 to July 2010. Data were collected over three months starting from April to July, 2010.

Data of this study were collected through a specially designed questionnaire. This questionnaire consisted of several sections. The first section dealt with sociodemographic characteristics, including age, sex, number of years in practice, educational qualification, current job, years at current work and family history of bronchial asthma. Another section dealt with perception of nurses about prevalence of patients suffering from bronchial asthma or COPD, proportion of those who need or own PEFM as well as the proportion of smokers among patients attending the center. Three questions dealt with advising patients to use PEF device and its ease of use at home as well as extent of its need in the health center. Another section dealt with practice on PEF measurement. This part included receiving training about the use of the device, taking measurements and its availability in the center. The knowledge section consisted of seven domains with a total of 41 questions covering benefits of PEFM use (six questions), instructions for using the device by patients (eight questions), defining normal level of PEF rate (PEFR) (five questions), concepts of measurements (six questions), indication of use of PEFM (four questions), general concepts about PEFM (six questions), and instructions for teaching patients about the device (six questions).

A pilot study, before starting the field work, was carried out on 10 nurses (not included in the final study). The necessary modifications according to the results obtained were done, so some statements were reworded. The average interviewing time was 20 minutes.

A pre-coded sheet was used. All questions were coded before data collection. This facilitates both data entry and verification as well as reduces the probability of errors during data entry. Data were fed to the computer directly from the questionnaire without an intermediate data transfer sheets. The Excel program was used for data entry. A file for data entry was prepared and structured according to the variables in the questionnaire. After data were fed to the Excel program; several methods were used to verify data entry. These methods included simple frequency, cross-tabulation, as well as manual revision of entered data. Percent score was calculated for the total knowledge score as well as for each domain of knowledge. Before calculating the sum of score; the score of negative

questions was reversed. The percent score was calculated as "sum of score multiplied by 100/number of items". Each item was scored as either 0 or 1 value. All the necessary approvals for carrying out the research were obtained. The Ethical Committee of the Kuwaiti Ministry of Health approved the research. A written format explaining the purpose and importance of the research was prepared and signed by the nurse before starting the interview.

1.2. Statistical analysis

Before analysis; data were imported to the Statistical Package for Social Sciences (SPSS) which was used for both data analysis and tabular presentation. Descriptive Measures (count, percentage, minimum, maximum, arithmetic mean, median and standard deviation) as well as analytic measures (Mann Whitney Z test and Spearman correlation coefficient) were used. The level of significance selected for this study was $P \leq 0.05$.

1.3. Results

Table 1 demonstrates sociodemographic characteristics of studied nurses. Age ranged from 20 to 60 years with a mean of 35.2 ± 7.8 years. The majority of nurses were females (78.7%). Kuwaitis constituted only 7.6% of the total studied nurses. Married nurses formed 84.9%, while the rest were currently single (15.1%). Those holding a bachelor degree of nursing were 462 nurses (89.5%). About two thirds (67.7%) were nursing staff while the rest (32.3%) were nurses. On average, nurses spent 11.0 ± 7.5 years in the current job. The vast

majority (92.8%) had a salary less than 1000 KD. Only 15.5% of nurses admitted that they themselves or a family member suffered from bronchial asthma.

Table 2 shows the opinion and practice of nurses toward PEFmetry. Nurses stated that on average, $55.4 \pm 21.8\%$ of the patients attending the health center are suffering from either bronchial asthma or COPD. They also stated that $45.3 \pm 26.7\%$ of patients are in need of PEFM. They also felt that $14.8 \pm 16.6\%$ are having and using the device at home. Enquiring nurses about the percent of smokers among their patients, they stated that on average $60.9 \pm 25.8\%$ of them are smokers. Only 22.1% of nurses advised their patients to use PEFM, while 74.4% admitted that the device can be easily used at home. Only 21.1% of nurses stated that there is a bad need for PEFM in the health care center. Those having the devices available in their center constituted only 22.7% of the studied nurses and a similar proportion (21.1%) received training about it. Slightly more than one tenth (13.8%) of nurses were responsible for taking the measurements of PEFM for patients attending the health center.

Table 3 depicts knowledge of nurses about PEFM. Overall, nurses have got an overall mean percent score of $64.7 \pm 7.3\%$. The highest mean percent knowledge domain score was that dealing with the indication of use of PEFM (82.1 \pm 20.5%) while the lowest score was that dealing with steps of use of the device (39.0 \pm 24.4%). Benefits of PEFM use and knowledge about the instructions for learning patients about it had similar mean percent score (78.3 \pm 19.5% and 78.1 \pm

Table 1 Sociodemographic characteristics of nurses.

Character	Number (<i>n</i> = 516)	%
<i>Age</i>		
Min-max	20-60	
Mean \pm SD	35.2 ± 7.8	
<i>Sex</i>		
Male	110	21.3
Female	406	78.7
<i>Nationality</i>		
Kuwaiti	39	7.6
Non-Kuwaiti	477	92.4
<i>Marital status</i>		
Single	58	11.2
Married	438	84.9
Divorced/widowed	20	3.9
<i>Qualification</i>		
Bachelor degree	462	89.5
Master/Ph.D.	54	10.5
<i>Job</i>		
Nurse	167	32.3
Staff nurse	349	67.7
<i>Years at work</i>		
Min-max	1-33	
Mean \pm SD	11.0 ± 7.5	
<i>Income</i>		
< 1000 KD	479	92.8
> 1000 KD	37	7.2
<i>Family history of asthma</i>		
Yes	80	15.5
No	436	84.5

Table 2 Opinion and practice of nurses toward peak expiratory flowmetry.

Opinion and practice	Number	%
<i>Opinion</i>		
<i>Approximate percentage of suffering from BA or COPD</i>		
Min-max	6-95	
Mean \pm SD	55.4 ± 21.8	
Median	57.5	
<i>Percent of those in need of PEFM</i>		
Min-max	0-100	
Mean \pm SD	45.3 ± 26.7	
Median	40.0	
<i>Percent of those having PEFM at home</i>		
Min-max	0-90	
Mean \pm SD	14.8 ± 16.6	
Median	10.0	
<i>Approximate percentage of smokers</i>		
Min-max	0-100	
Mean \pm SD	60.9 ± 25.8	
Median	70.0	
Advising patients to use PEFM	114	22.1
There is a bad need for PEFM in the health center	204	39.1
It is easy to use PEFM correctly at home	384	74.4
<i>Practice</i>		
There is a PEFM in the center	117	22.7
Receiving training about use of PEFM	109	21.1
Measuring PEF of patients at the health center	71	13.8

Table 3 Knowledge of nurses about peak expiratory flowmetry.

Knowledge	Number (<i>n</i> = 516)	%
<i>Benefits of PEFM use</i>		
Indicates degree of treatment success	465	90.1
Indicates when to add or stop a medicine	365	70.7
Indicates the urgent need to go to a hospital	392	76.0
It can diagnose precipitating factors	313	60.7
Helps spread knowledge about BA	420	81.4
Helps to diagnose exercise asthma	468	90.7
Mean ± SD (Median)	78.3 ± 19.5 (83.3)	
<i>Steps of use</i>		
Put the indicator at the base of the scale	65	12.6
Stand up	16	3.1
Take a deep breath	173	33.5
Tightly encircle your lips around the device	185	35.9
Expire air as fast and deep as you can	362	70.2
Write down the reading	315	61.0
Repeat the previous steps twice	225	43.6
Register the largest reading you got of the here trials	269	52.1
Mean ± SD (Median)	39.0 ± 24.4 (25.0)	
<i>Defining normal level of PEFM</i>		
It is better to define PEFM using age, height and sex	58	11.2
It is better to define PEFM for each person in particular	486	94.2
To estimate PEFM, take measurements for two weeks	253	49.0
To estimate PEFM, take measurements for day and night	272	52.7
To estimate PEFM, take measurements before and after bronchodilator	451	87.4
Mean ± SD (median)	58.9 ± 17.3 (60.0)	
<i>Concepts of measurements</i>		
If reading to = 100% of normal there is no need to change treatment	428	82.9
If reading = 90% of normal; treatment may be insufficient	284	55.0
If reading less than 90%, consult your physician immediately	204	39.5
The device can be used during an asthma attack	160	31.0
There should be a registration board	479	92.8
Registration chart is graded from 5–300	351	68.0
Mean ± SD (median)	55.6 ± 15.4 (50.0)	
<i>Indicators for use of PEFM</i>		
Bronchial asthma	514	99.6
COPD	479	92.8
Chronic bronchitis	417	80.8
Emphysema	284	55.0
Mean ± SD (median)	82.1 ± 20.5 (75.0)	
<i>General concepts about PEFM</i>		
Proper management is better than the reading itself	476	92.2
Plan of therapy is directly defined according to the registered reading	443	85.9
It is enough to wash the device with water to clean it	287	55.6
Generally speaking, it is very easy to use PEFM	423	82.0
There is no contraindications to use PEFM	272	52.7
Adults and children use the same PEFM	402	77.9
Mean ± SD (median)	74.4 ± 17.3 (66.7)	
<i>Instructions for learning of patients about PEFM</i>		
Using the device	513	99.4
Cleaning and storing the device	502	97.3
Recording in the registration chart	487	94.4
Contraindications of use of the device	462	89.5
Changing plan of therapy	388	75.2
Advising others about the device	451	87.4
Mean ± SD (median)	78.1 ± 12.0 (83.3)	
Total Mean ± SD (median)	64.7 ± 7.3 (65.9)	

12.0%, respectively). Defining the normal level of PEFM (58.9 ± 17.3%) and knowledge about the general concepts

of PEFM (55.6 ± 15.4%) occupied intermediate ranks among the individual knowledge domains of nurses about it.

Table 4 Factors affecting domains of knowledge about PEF among nurses.

Character	K1	K2	K3	K4	K5	K6	K7	Total
<i>Sex</i>								
Male	78.8 ± 20.3	45.3 ± 27.4	58.6 ± 17.9	55.2 ± 17.5	83.2 ± 22.0	73.8 ± 15.6	79.4 ± 8.4	66.1 ± 7.7
Female	78.1 ± 19.3	37.3 ± 23.3	59.0 ± 17.1	55.7 ± 14.8	81.8 ± 20.1	74.6 ± 17.8	77.7 ± 12.8	64.3 ± 7.2
P	0.69	0.008*	0.92	0.56	0.28	0.62	0.56	0.07
<i>Nationality</i>								
Kuwaiti	75.6 ± 17.9	49.4 ± 24.7	56.9 ± 17.5	53.4 ± 14.4	76.9 ± 23.9	69.2 ± 18.6	78.2 ± 12.2	64.5 ± 7.5
Non Kuwaiti	78.5 ± 19.6	38.2 ± 24.2	59.1 ± 17.3	55.7 ± 15.5	82.5 ± 20.2	74.8 ± 17.2	78.1 ± 12.0	64.7 ± 7.3
P	0.26	0.005*	0.41	0.37	0.17	0.06	0.96	0.94
<i>Qualification</i>								
Bachelor	77.9 ± 19.2	38.0 ± 24.7	58.6 ± 17.2	55.6 ± 15.2	82.0 ± 20.3	74.8 ± 17.4	78.0 ± 12.4	64.4 ± 7.4
Higher	81.2 ± 21.7	47.7 ± 19.6	61.5 ± 18.2	55.6 ± 17.4	82.4 ± 22.1	71.0 ± 16.6	79.0 ± 7.4	66.8 ± 6.5
P	0.12	0.001*	0.31	0.93	0.71	0.14	0.68	0.07
<i>Job</i>								
Nurse	76.5 ± 21.1	41.7 ± 25.8	59.0 ± 18.9	58.4 ± 17.1	81.0 ± 24.6	71.7 ± 15.8	77.2 ± 12.2	64.7 ± 8.2
Staff nurse	79.1 ± 18.7	37.7 ± 23.7	58.9 ± 16.5	54.2 ± 14.4	82.6 ± 18.3	75.7 ± 17.9	78.5 ± 11.9	64.7 ± 6.9
P	0.25	0.13	0.80	0.02*	0.66	0.006*	0.07	0.53
<i>PEFM in center</i>								
Yes	80.7 ± 18.3	41.8 ± 22.2	60.0 ± 16.6	60.7 ± 13.4	83.0 ± 20.2	75.9 ± 17.4	78.2 ± 11.6	65.1 ± 7.2
No	69.9 ± 21.2	38.2 ± 25.0	55.2 ± 19.1	54.1 ± 15.6	78.9 ± 21.4	69.1 ± 16.1	78.1 ± 13.3	63.2 ± 7.6
P	<0.001*	0.04*	0.005*	<0.001*	0.05	<0.001*	0.83	0.02*
<i>Training</i>								
Yes	81.1 ± 19.3	38.0 ± 24.2	59.5 ± 17.9	56.7 ± 16.6	83.3 ± 19.9	74.5 ± 17.2	82.4 ± 5.9	65.1 ± 7.7
No	67.9 ± 16.3	42.8 ± 25.1	56.7 ± 14.8	51.4 ± 8.5	77.5 ± 22.3	73.9 ± 17.8	76.9 ± 12.9	63.1 ± 5.5
P	<0.001*	0.09	0.10	<0.001*	0.01*	0.44	<0.001*	0.001*
<i>Measuring</i>								
Yes	80.5 ± 15.2	40.2 ± 24.9	63.9 ± 17.8	56.6 ± 13.9	82.0 ± 22.0	80.5 ± 15.9	81.0 ± 7.1	65.6 ± 4.4
No	77.9 ± 20.1	31.3 ± 19.5	58.1 ± 17.2	55.4 ± 15.6	82.1 ± 20.3	73.4 ± 17.4	77.6 ± 12.6	64.6 ± 7.7
P	0.50	0.006*	0.01*	0.58	0.81	0.001*	0.04*	0.19

P: of Mann-Whitney $Z < 0.05$.

K1 to K7: Knowledge domains.

* Significant.

Table 4 shows the factors affecting domains of knowledge about PEFM among nurses. Generally speaking, sex, nationality and educational qualifications did not affect either the total knowledge score or the individual knowledge domain except for domain 2 (instructions for using the PEFM device by patients), where males (45.3 ± 27.4 compared with 37.3 ± 23.3 , $P = 0.008$), Kuwaitis (49.4 ± 24.7 compared with 38.2 ± 24.2 , $P = 0.005$) and those having educational qualifications higher than the bachelor degree (47.7 ± 19.6 compared with 38.0 ± 24.7 , $P = 0.001$) had higher mean percent scores. Nurses had a significantly higher score of domain 4 (concepts of measurements) than staff nurses (58.4 ± 17.1 compared with 54.2 ± 14.4 , $P = 0.02$). However, the latter had a significantly higher score for domain 5 (indications of PEF device use) than the nurses (75.7 ± 17.9 compared with 71.7 ± 15.8). Nurses having a PEF device in their health centers tended to have significantly higher scores of the total knowledge score (65.1 ± 7.2 compared with 63.2 ± 7.6 , $P = 0.02$) and the individual knowledge domains except for domain 5 (indications for PEFM use) and domain 7 (instructions for patient learning about PEFM). Also receiving PEFM training improved the total knowledge score (65.1 ± 7.7 compared with 63.1 ± 5.5 , $P = 0.001$). The improved knowledge domains included domain 1 (benefits of PEFM use), domain 4

(concepts of measurements), domain 5 (indications of PEFM use), and domain 7 (instructions of learning patients about the device). Taking the PEF measurements by the nurse herself (practicing) did not improve the overall knowledge score, Yet, it improved some domains. The improved domains were (instructions of using PEFM by the patient), (defining the normal level of PEFM), (general concepts about PEFM), and (instructions for patient learning about the device).

No significant correlation was found between age and years of experience from one side and the different domains of knowledge of nurses about PEFM on the other side.

2. Discussion

PEFM provides a simple, quantitative, reproducible, and objective measurement of large airway function. The purpose of using PEFMs is to monitor lung function, help identify asthma triggers, and help asthmatics to recognize signs and symptoms of decreased lung function. Clinical studies have shown that the routine use of a PEFM, along with a self-management plan and education program, can lead to a better control of asthma.¹¹ Serial PEF determination is currently considered a valuable tool for monitoring asthma and

detecting exacerbation, and it has been advocated in asthma management plans.^{12,13} One advantage is that this method of monitoring makes use of instruments that are portable and inexpensive. PEFM is also easy to perform.

The results of the study revealed that nurses were aware about the extent of the obstructive lung diseases. They stated that bronchial asthma and or COPD were prevalent among $55.36 \pm 21.844\%$ of their patients and almost half of those patients were in need of a PEFM. However, only $14.82 \pm 16.6\%$ of them owned the device at home. In spite of the high perception of nurses about COPD, yet, only 22.1% of them advised the patients in need to use PEFM and 39.1% of them felt the bad need for the availability of the device at the health center they are working in. This might reflect their doubtful benefit of carrying out PEFM at home by the patients. Several studies showed controversial outcome of using PEFM at home.¹⁴⁻¹⁶ One study revealed that PEFM measured twice daily at home correlates well with clinical indices of asthma and rescue bronchodilator consumption in those with more severe disease but poorly in those with mild asthma. In most subjects, measurements made at intervals of 2 weeks in the laboratory do not reflect the mean symptom scores, rescue bronchodilator consumption or PEFM values in the previous 2 weeks.¹⁶ What adds to the complexity of the problem are the findings of the current study that revealed only 22.7% of the nurses stated that there is an available PEFM in the health center and only 21.1% of them received training on how to use it, while 13.8% of them admitted that they are responsible for taking the PEFM measurement. These findings might have reflected on the knowledge of nurses about PEFM concepts, definitions and indication of use of it.

Nurses tended to have a lower percent score for the domain dealing with procedures and steps of measuring PEFM by patients ($39.0 \pm 24.1\%$). This might reveal both the insufficient training and non availability of a spirometer or PEFM in the health center as stated previously. As for the theoretical domains dealing with benefits of PEFM use and content instructions for learning patients, the studied nurses had mean percent scores of $78.26 \pm 19.503\%$ and $78.07 \pm 12.012\%$, respectively.

Studying the factors responsible for quality of knowledge of nurses revealed that generally speaking, sociodemographic factors including age, sex, nationality, and educational qualifications did not affect the mean percent score of knowledge. Receiving training about PEFM or having the device available at the center significantly improved the knowledge of nurses including both the overall and individual domain percent scores.

In view of the results of this study, it can be concluded that, nurses are aware about the extent of COPD problem among the patients. The knowledge of nurses about PEFM needs improvement through providing especially tailored training

programs. A survey about need assessment of PEFM in all the health centers in Kuwait is required to determine the number of the devices needed and guidelines for use whether for nurses or patients.

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