



Knowledge Level of Pharmacy Workers about Chronic Airway Diseases and Inhaler Devices

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Authors' contributions

This work was carried out in collaboration between all authors. Authors SAB, FY and MK designed the study and wrote the protocol. Authors SAB and FY wrote the first draft of the manuscript. Authors SY and OT organized data collection and training meetings. Author TO managed the literature searches and collection of data. Authors IB and HB prepared and analyzed of data. Authors SAB, TO and IB wrote manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Pharmacy workers have an important role on 'patient self-management' and 'medication use'. The aim of this study was to evaluate the awareness of chronic airway diseases and knowledge level of inhaler devices usage in pharmacy workers.

Study Design: A questionnaire for assessment the knowledge of COPD, asthma and inhaler device in pharmacy workers before and after the education seminar was performed.

Results: There were 112 (59.9%) female, 75 (40.1%) male and mean age was 32.4±9.9 years. The knowledge level about the COPD as a lung disease (98%), smoking as the most important etiological agent (95.1%) and smoking cessation as the most important option in prevention and

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treatment of the disease (98.9%) were quite high. However, before education knowledge level about long-term oxygen treatment and prophylactic influenza vaccination was lower which was increased with education seminar. The knowledge level about asthma may observe in all age groups (98.2%) and it is not an infectious disease (98.2%) was quite high. However knowledge level about the hereditary feature of asthma and non-addictive effects of asthma medication was lower which was increased with the education seminar. Before seminar 114 (70.8%) participants claimed that they know the demonstration of inhaler device, this ratio increased to 98.1% after the seminar. It is suggested that increase the knowledge level of pharmacy workers about chronic airway disease and inhaler devices would increase treatment success.

Conclusion: It is suggested that increase the knowledge of pharmacy workers about chronic airway disease and inhaler devices would increase treatment success.

Keywords: Asthma; COPD; pharmacy workers; inhaler device; knowledge level.

1. INTRODUCTION

Chronic diseases are related with increased mortality and morbidity worldwide. The most cause of deaths (71%) is chronic diseases in Turkey. Chronic airway diseases including asthma and chronic obstructive pulmonary disease (COPD) are important part (65%) of the chronic respiratory diseases and they are associated with increased mortality, morbidity and economic burden [1]. However, the risk factors and treatment algorithms of chronic airway diseases are not well known by patients, relatives, and also health professionals. It results under diagnosis and inadequate treatment of chronic airway diseases.

Chronic diseases need long term therapies. But the prevalence of non-adherence to therapies is high [2]. The adherence to medications is associated with lack of knowledge about the disease and treatment; negative beliefs about medications and inadequate information about medication use [2-4]. Inhaler treatment is first line therapy of airway diseases. Each type of inhaler devices requires a different inhalation technique and breathing pattern to achieve optimal delivery of drug to the lungs [5]. Also education about self management and correct use of inhaler devices are really important for increasing the adherence. Asthma guidelines recommend individualizing inhaled therapy for each patient, taking into consideration patient preference, in conjunction with training and regular monitoring of inhaler technique [6].

Pharmacists and pharmacy technicians are important components of the healthcare team. A Cochrane Database review revealed that pharmacist provided services may improve quality of life in patients with chronic diseases such as asthma, hypertension or diabetes

mellitus. Also it is suggested that pharmacist services may reduce the visits to general practitioners and hospitalization rates [7]. Pharmacy workers have an important role on 'patient self-management' and 'medication use'.

It is thought that the knowledge and awareness of pharmacy workers about chronic airway diseases and inhaler devices techniques could affect the management and treatment adherence of the patients. The aim of this study was to evaluate the awareness of COPD and asthma and knowledge level of inhaler devices usage in pharmacy workers.

2. MATERIALS AND METHODS

This study organized by Kocaeli University School of Medicine and Kocaeli Directory of Health. A questionnaire of 'Knowledge Level of Asthma and COPD' prepared by Turkish Ministry of Health was used for evaluating the knowledge levels of pharmacy workers about chronic airway diseases. Both the questionnaires included 10 questions about etiologic factors, clinic and treatment options of these diseases. The answers were; a) yes, b) no, c) no idea. This questionnaire was related with the chronic diseases prevention program of Turkish Ministry of Health.

One hundred ninety pharmacy workers were invited to training program about the diagnosis and treatment of chronic airway diseases including asthma and COPD. Informed consent was taken from all participants. The demographic characteristics of the participants were recorded. The questionnaires and educational program were performed at same day. As first, questionnaire was performed as a pre-test. Training program consisted by both theoretical lecture and practical classes. After oral

presentation with visual materials about chronic airway diseases, the use of all inhaler devices was demonstrated in practical classes by pulmonologist. This practical education also included demonstration of each inhaler devices by all participants in person. After training programme the questionnaire was repeated.

2.1 Statistical Analysis

Statistical Package for Social Sciences (SPSS.16) had been used for the statistical analysis of the study. The categorical variables were presented as percentages. Chi square test (X^2) test was used for comparing categorical variables. A p value of < 0.05 was considered significant.

3. RESULTS

There were 112 (59.9%) female, 75 (40.1%) male, totally 187 participants. The mean age was 32.4±9.9 years. Forty-four (23.1%) of participants were pharmacist and 146 of them (76.8%) were pharmacy technician. Nearly ten percent of the participants had a history of attendance to education seminar about airway disease. Demographic characteristics of the participants were shown in Table 1.

The knowledge level about the COPD as a lung disease (98%), smoking as the most important etiological agent (95.1%) and smoking cessation as the most important option in prevention and treatment of the disease (98.9%) were quite high. However, knowledge level about long-term oxygen treatment and prophylactic influenza

vaccination was lower before education which was increased with education seminar. The differences were statistically significant and the p values were respectively 0,04 and 0,03 (Table 2).

The knowledge level about asthma may observe in all age groups (98.2%) and it is not an infectious disease (98.2%) were quite high. On the other hand, knowledge levels about the hereditary feature (p=0,04) and non-addictive effects of asthma medication (p=0,02) were lower which were increased with the education seminar (Table 3).

It was reported that the most difficult described devices were as follows; turbuhaler (41.3%), inhaler capsule (15,9%) and metered dose inhaler (9,3%) (Fig. 1). Before seminar 114 (70.8%) participants claimed that they know the demonstration of inhaler device, this ratio increased to 98.1% after the seminar (Table 4).

4. DISCUSSION

It was found that the knowledge level about the COPD and smoking was quite high while long-term oxygen treatment and prophylactic influenza vaccination were low. The knowledge level about asthma may observe in all age groups and it is not an infectious disease was quite high. However knowledge level about the hereditary feature of asthma and non-addictive effects of asthma medication was low in pharmacy workers. It was also found that knowledge level was increased after the education seminars in both COPD and asthma questionnaires.

Table 1. Demographic characteristics of the participants

		n(%)
Gender	Female	112 (59.9)
	Male	75 (40.1)
Education	Primary school	6 (3.2)
	Secondary school	25 (13.2)
	High school	77 (40.7)
	University	74 (39.2)
	Doctorate	7 (3.7)
Job	Pharmacist	44 (23.4)
	Pharmacy worker	144 (76.6)
How long have you been doing this job?	<1 year	4 (2.1)
	1-5 years	44 (23.3)
	5-10 years	60 (31.7)
	10-15 years	30 (15.9)
	15-20 years	14 (7.4)
	>20 years	37 (19.6)

Table 2. Knowledge level of the pharmacy workers about COPD

		Pretest, n (%)	Posttest, n (%)	p
COPD is a disease of lung.	Yes	182 (98)	181 (100)	0,6
	No	1 (0.5)	0	
	No idea	3 (1.5)	0	
COPD include emphysema and chronic bronchitis.	Yes	153 (90)	155 (89.1)	0,23
	No	9 (5.3)	17 (9.8)	
	No idea	8 (4.7)	2 (1.1)	
The most important etiologic factor of COPD is smoking.	Yes	176 (95.1)	181 (100)	0,42
	No	6 (3.2)	0	
	No idea	3 (1.7)	0	
Exposure to occupational dusts, fuel for heating and air pollution are also etiologic factors of COPD.	Yes	162 (89.0)	174 (97.2)	0,06
	No	9 (5)	4 (2.2)	
	No idea	11 (6.0)	1 (0.6)	
COPD is common in	Childhood	1 (0.5)	1 (0.6)	0,03
	Adult	8 (4.3)	5 (2.8)	
	>40 years old	110 (59.8)	148(82.7)	
	All age groups	65 (35.3)	25 (14)	
What are the symptoms of COPD?	Cough	3 (1.7)	4 (2.2)	0,04
	Sputum	0	0	
	Dyspnea	71 (39.2)	32 (17.8)	
	All	107 (59.1)	144 (80)	
The first step of the treatment and prevention of disease is smoking cessation.	Yes	178 (98.9)	179(99.4)	0,3
	No	2 (1.1)	0	
	No idea	0	1 (0.6)	
COPD patients should have influenza vaccination in each year.	Yes	151 (83.9)	175(98.3)	0,03
	No	4 (2.2)	0	
	No idea	25 (13.9)	3 (1.7)	
COPD patients may require long term oxygen treatment.	Yes	97 (54.2)	133(76.4)	0,04
	No	45 (25.1)	31 (17.8)	
	No idea	37 (20.7)	10 (5.7)	
What are the diagnostic tests of COPD?	Pulmonary function test	157 (87.7)	174(97.8)	0,07
	Chest x-ray	20 (11.2)	4 (2.2)	
	Sputum culture	2 (1.1)	0	

Chronic obstructive pulmonary disease is a treatable and preventable chronic disease characterized by irreversible airflow limitation [8]. Although high prevalence of dyspnea and increased risk of COPD in population, awareness and knowledge level of COPD are limited [9,10]. The risk factors and treatment options of COPD are not well known by patients and health professionals. It results under diagnosis and inadequate treatment. Some questionnaires are used for assessment of knowledge level of COPD [11,12]. But these questionnaires are not satisfactory for measuring the level of knowledge and assess results of the education. Bristol COPD Knowledge Questionnaire (BCKQ) is an appropriate tool for individual assessment of COPD patients and it is enable to assessment of the effectiveness of education [13].

There is a lack of knowledge about COPD. Although, 24% of the participants reported

having at least one chronic respiratory symptom, the term COPD was identified only by 8.6% of the participants in Miravittles et al.'s study [14]. It was difficult to assessing knowledge about COPD because most of the participants were not aware of the disease terminology 'COPD' or 'chronic obstructive pulmonary disease'. Approximately two-fifths of the participants knew about the disease by any of its three names (chronic bronchitis, emphysema and COPD), but the remaining 60% of participants knew very little to nothing about the disease [15]. Awareness of COPD was found to be as low as 17% among Canadians when compared with awareness of other major diseases such as breast cancer (95%), HIV/AIDS (95%) and Alzheimer's disease (94%) in a Canadian COPD awareness assessment completed in 2005 [16]. In a study evaluating the awareness of COPD in Turkey, nearly half of the population reported that they knew COPD as a lung disease while others

reported that they have no idea about COPD [17]. In our study, the knowledge level of COPD as a lung disease was extremely high (97.8%). It is suggested that high rate is related with the study population including pharmacy workers.

Smoking is the most significant etiologic factor of COPD [8]. Nearly half of the population knew that smoking was the most important etiological agent of COPD in Turkey, while this rate was 69% in Canada [15]. In our study, this rate was extremely high (95.1%).

Other risk factors related with development of COPD are occupational exposures, biomass fuel

for heating, air pollution and airway hyperresponsiveness [1]. Especially exposure to passive smoking and biomass fuel for heating are discriminative for women in non-smoker COPD patients [18]. But, it is not known well in the population. It is reported that study participants were less aware of the etiologic factors such as wood smoke, dust and chemicals in Walker et al's study [15]. Approximately fifty percent of the population knew occupational exposures, air pollution and biomass exposure were risk factors of COPD [17]. The role of occupational exposures, air pollution and biomass exposure on development of COPD was known 89% of the participants in our study.

Table 3. Knowledge level of the pharmacy workers about asthma

		Pre-test n (%)	Post-test n (%)	p
Is asthma an infectious disease?	Yes	2 (1.2)	7 (4.0)	0,4
	No	167 (98.2)	166 (95.4)	
	No idea	1 (0.6)	1 (0.6)	
Is asthma a hereditary disease?	Yes	120 (72.3)	163 (95.3)	0,04
	No	31 (18.7)	6 (3.5)	
	No idea	15 (9.0)	2 (1.2)	
What are the symptoms of asthma?	Cough	3 (1.8)	3 (1.7)	0,06
	Dyspnea	31 (18.2)	11 (6.4)	
	Wheezing	14 (8.2)	13 (7.6)	
	All	122 (71.8)	145 (84.3)	
Asthma can be seen in	Childhood	2 (1.2)	6 (3.5)	0,3
	Adult	1 (0.6)	2 (1.2)	
	All age groups	166 (98.2)	163 (95.3)	
What are the application forms of asthma medications?	Injection	0	0	0,64
	Pill	9 (5.4)	5 (2.9)	
	Inhaler	159 (94.6)	169 (97.1)	
Do the medications of asthma have additive effects?	Yes	15 (9.0)	3 (1.8)	0,02
	No	112 (67.5)	160 (95.2)	
Is asthma a treatable disease?	No idea	39 (23.5)	5 (3.0)	0,01
	Yes	67 (40.4)	21 (12.2)	
	No	73 (44.0)	150 (87.2)	
Can asthmatic patients have a normal life?	No idea	26 (15.7)	1 (0.6)	0,63
	Yes	150 (89.3)	160 (91.4)	
	No	15 (8.9)	15 (8.6)	
	No idea	3 (1.8)	0	

Table 4. Attitudes about use of inhaler devices

	Answer	n (%)
Did you ever have an education about use of inhaler devices?	Yes	13 (6.9)
	No	176 (93.1)
Do you demonstrate the use of inhaler device to the patients?	Yes	162 (87.1)
	No	24 (12,9)
Is your demonstration of inhaler devices true?	Yes	114 (70.8)
	No	13 (8.1)
	No idea	34 (21.1)
What do you think about the demonstration of inhaler devices after education? Can you do it now?	Yes	159 (98.1)
	No	3 (1,9)

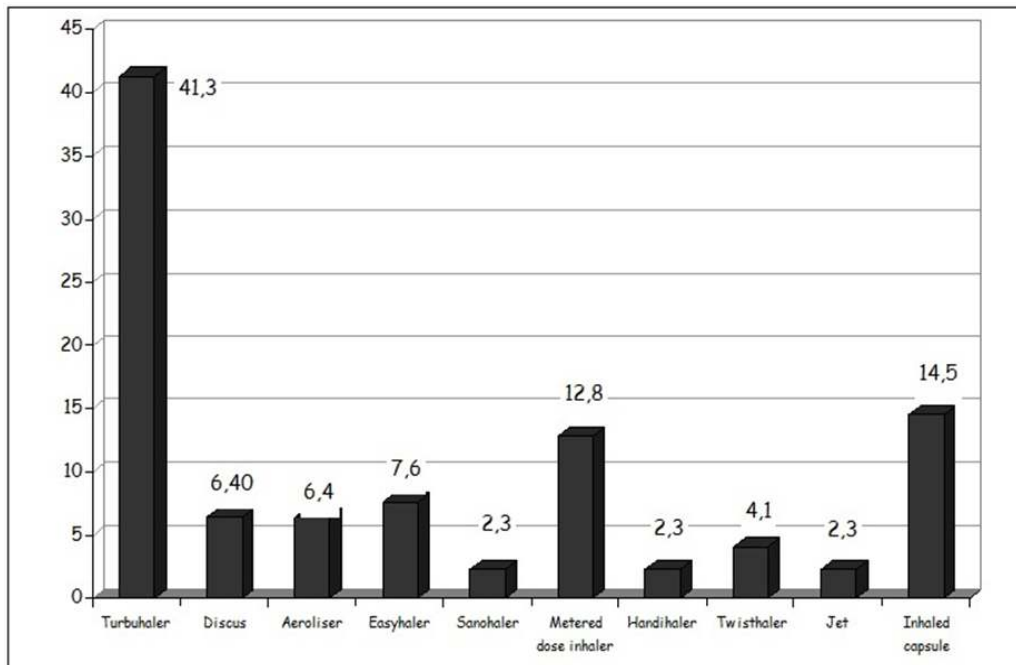


Fig. 1. Answers to "Which inhaler device is most difficult to describe?"

The first step of the treatment and prevention of disease is smoking cessation. Smoking cessation is the most effective method of reducing the risk of developing the disease or slowing its progression [15]. Smoking cessation, especially early in the follow up period, decreased the risk of developing COPD substantially compared with continuous smoking [19,20]. The knowledge about the role of smoking cessation on prevention and treatment of COPD are not well known in general population. Nearly half of the population (48%) knew that smoking was the most important etiological agent of COPD in Turkey. Also Canadians were aware of the adverse role of tobacco smoke on their health but they were less sure about the benefits of smoking cessation [15]. Smoking cessation as the most important option in prevention and treatment of the disease (98.9%) were extremely high in our study.

Asthma is a chronic airway disease characterized by reversible airflow limitation. Assessment of knowledge level about asthma is first step of the management [6]. There are some questionnaires evaluating the awareness of asthma. Asthma general knowledge questionnaire for adults (AGKQA) is developed as one of the outcome measures for a randomized controlled effectiveness trial of an asthma education program [21-23].

Asthma is observed in all age groups [6]. The knowledge level about asthma may observe in all age groups and it is not an infectious disease was higher in our study than population based study completed in Turkey (Respectively 98.2% etc 80% and 98.2% etc 58%). However knowledge level about the hereditary feature of asthma was low. As similar, nearly fifty percent of the participants reported that they have no idea about the hereditary feature of asthma in Yildiz et al' study [17].

It is known that adherence to medications is associated with lack of knowledge about the disease and treatment; negative beliefs about medications and inadequate information about medication use [2-4]. Fifty five percent of the participants had no idea about the non-additive effects of asthma medication in Turkey. Beliefs about additive effects of asthma medication was highest in Brazil (70%) [23]. In our study, the beliefs about addictive effects of asthma medication was low.

Inhaler devices are the major component of the treatment in patients with asthma or COPD. Each type of inhaler devices requires a different inhalation technique and breathing pattern to achieve optimal delivery of drug to the lungs [5]. Incorrect inhaler use has been estimated to be very widespread; one systematic literature review

concluded that incorrect inhaler use is very variable depending on the device but can be as high as 94% [24]. Healthcare providers may not know all the key features of inhalers and their operation, and patients often make mistakes in using their inhaler [5]. It is important that patients be provided with adequate education and reeducation to ensure a correct inhalation technique [4].

Pharmacy workers have an important role on 'patient self-management' and 'medication use'. Cochrane Database review revealed that pharmacist provided services may improve quality of life in patients with chronic diseases such as asthma, hypertension or diabetes mellitus. Also it is suggested that pharmacist services may reduce the visits to general practitioners and hospitalization rates [7]. Pharmacists are uniquely qualified to address barriers to improve adherence. The newly developed framework provides a patient centered approach to facilitate and improve pharmacist-patient conversations regarding medication adherence [25]. In a study evaluating the role of pharmacist-led interventions on inhalation techniques in asthma and COPD patients, it is shown that there is an improvement in all patients regardless of their former training experiences [26]. The patients prefer to learning use of drugs from pharmacy workers so pharmacy workers have an important role for reaching to patients in our country.

Educational seminars for the self management of asthma improve lung function and feelings of self control, number of visits to an emergency department, and possibly number of disturbed nights. Educational seminars should be considered a part of the routine care of people with asthma [27]. The level of knowledge about chronic airway diseases and use of inhaler devices characteristics were lower which was increased with the education seminar. Before seminar 114 (70.8%) participants claimed that they know the demonstration of inhaler device, this ratio increased to 98.1% after the seminar.

5. LIMITATIONS OF THE STUDY

First, it was not possible to evaluate the p values for practical classes since we did not score the correct usage of inhalers by formal checklist evaluation form. Instead we accepted self declaration of participants about their qualifications. Second; the role of education about chronic diseases and usage of inhaler

devices in pharmacy workers on patient's treatment adherence was not assessed. So we do not have information about if the patients benefit from the course of the pharmacy workers. In Turkey, physician explain the patient about their disease and describe the use of inhaler but patients still think that he/she has an option to ask the pharmacist. Since patients asked several questions about their disease and medications to pharmacy workers; we thought that their knowledge about the chronic respiratory disease and usage of inhaler devices may improve patient's adherence to their medications although pharmacists do not have such responsibility in legal frame.

6. CONCLUSION

Chronic airway diseases are an important cause of mortality, morbidity and economic burden. The increase of knowledge level about these diseases has a great importance for early diagnosis, effective treatment, prevention of disease progression and complications. As a healthcare team, pharmacy workers have an important role on 'patient self-management' and 'medication use'. There is a lack of knowledge about treatment options of COPD and asthma in pharmacy workers. Also knowledge of using inhaler devices is quite low. It is suggested that educational seminars about managements of chronic airway diseases and correct use of inhaler devices can increase the treatment adherence and success.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Bourbeau J, Tan WC, Benedetti A, Aaron SD, Chapman KR, Coxson HO, et al. Cancold study group. Canadian Cohort Obstructive Lung Disease (CanCOLD): Fulfilling the need for longitudinal observational studies in COPD. COPD. 2014;11(2):125-32.
2. Alheviti A. Adherence to long-term therapies and beliefs about medications. Int J Family Med. 2014;479596.

3. Menckeberg TT, Hugtenburg JG, Lammers JW, Raaijmakers JA, Bouvy ML. Knowledge of actions of inhaled corticosteroids in patients who did not persist drug treatment early. *Int J Clin Pharm.* 2012;34(2):277-81.
4. Bjermer L. The importance of continuity in inhaler device choice for asthma and chronic obstructive pulmonary disease. *Respiration.* 2014;88(4):346-52.
5. Haughney J, Price D, Barnes NC, Virchow JC, Roche N, Chrystyn H. Choosing inhaler devices for people with asthma: Current knowledge and outstanding research needs. *Respir Med.* 2010;104(9):1237-45.
6. Global initiative for asthma. Global strategy for asthma management and prevention. Bethesda: National Institutes of Health, National Heart, Lung, and Blood Institute; 2007.
7. Pande S, Hiller JE, Nkansah N, Bero L. The effect of pharmacist-provided non-dispensing services on patient outcomes, health service utilisation and costs in low- and middle-income countries. *Cochrane Database Syst Rev.* 2013;28(2):CD010398.
8. Global initiative for chronic obstructive lung disease. Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease, Update; 2013.
9. Roche N, Perez T, Neukirch F, Carré P, Terrioux P, Pouchain D, et al. The gap between the high impact and low awareness of COPD in the population. *Rev Mal Respir.* 2009;26(5):521-9.
10. Roche N, Perez T, Neukirch F, Carré P, Terrioux P, Pouchain D, et al. High prevalence of COPD symptoms in the general population contrasting with low awareness of the disease. *Rev Mal Respir.* 2011;28(7):58-65.
11. Stewart DG, Drake DF, Robertson C, Marwitz JH, Kreutzer JS, Cifu DX. Benefits of an inpatient pulmonary rehabilitation programme. *Arch Phys Med Rehabil.* 2001;82:347-52.
12. Netzer N, Werner P, Petro W, Matthys H. 'Open-word' questions: An effective tool in gauging education of patients with COPD. *Monaldi Arch Chest Dis.* 1996;51:74-6.
13. White R, Walker P, Roberts S, Kalisky S, White P. Bristol COPD knowledge questionnaire (BCKQ): Testing what we teach patients about COPD. *Chronic Respir Dis.* 2006;3:123-31.
14. Miravittles M, de la Roza C, Morera J, Montemayor T, Gobartt E, Martín A, et al. Chronic respiratory symptoms, spirometry and knowledge of COPD among general population. *Respir Med.* 2006;100(11):1973-80.
15. Walker SL, Saltman D, Colucci R, Martin L. For the Canadian lung association advisory committee. Awareness of risk factors among persons at risk for lung cancer, chronic obstructive pulmonary disease and sleep apnea: A Canadian population-based study. *Can Respir J.* 2010;17(6):287-94.
16. National COPD Report Card; 2005. Available:<www.lung.ca/resources/2005_copd_reportcard.pdf> (Accessed on October 29, 2010).
17. Yıldız F, Bingöl Karakoç G, Ersu Hamutçu R, Yardım N, Ekıncı B, Yorgancıoğlu A. The evaluation of asthma and COPD awareness in Turkey (GARD Turkey project-national control program of chronic airway diseases). *Tuberk Toraks.* 2013;61(3):175-82.
18. Vaidya V, Hufstader-Gabriel M, Gangan N, Shah S, Bechtol R. Utilization of smoking-cessation pharmacotherapy among chronic obstructive pulmonary disease (COPD) and lung cancer patients. *Current Medical Research & Opinion.* 2014;30(6):1043-50.
19. Løkke A, Lange P, Scharling H, Fabricius P, Vestbo J. Developing COPD: A 25-year follow-up study of the general population. *Thorax.* 2006;61:935-9.
20. Rabe KF, Hurd S, Anzueto A, Barnes PJ, Buist SA, Calverley P, et al. Global initiative for chronic obstructive lung disease. Global strategy for the diagnosis, management and prevention of chronic obstructive pulmonary disease: Gold Executive Summary. *Am J Respir Crit Care Med.* 2007;176:532-55.
21. Allen RM, Jones MP. The validity and reliability of an asthma knowledge questionnaire used in the evaluation of a group asthma education self-management program for adults with asthma. *J Asthma.* 1998;35(7):537-45.
22. Báez Saldaña AR, Chapela Mendoza R, Herrera Kiengelher L, Ortiz Siordia R, Salas Hernández J. Development of a questionnaire to measure asthmatic patients' knowledge of their disease. *Arch Bronconeumol.* 2007;43(5):248-55.

23. Borges MC, Ferraz É, Pontes SMR, Cetlin Ade C, Caldeira RD, Silva CS, et al. Development and validation of an asthma knowledge questionnaire for use in Brazil. *J Bras Pneumol.* 2010;36(1):8-13.
24. Lavorini F, Magnan A, Dubus JC, Voshaar T, Corbetta L, Broeders M, et al. Effect of incorrect use of dry powder inhalers on management of patients with asthma and COPD. *Respir Med.* 2008;102:593-604.
25. Wiener ES, Mullins CD, Pincus KJ. A framework for pharmacist-assisted medication adherence in hard-to-reach patients. *Res Social Adm Pharm.* 2014;16. pii: S1551-7411(14)00398-2.
26. Hämmerlein A, Müller U, Schulz M. Pharmacist-led intervention study to improve inhalation technique in asthma and COPD patients. *Journal of Evaluation in Clinical Practice.* 2011;17(1):61-70.
27. Guevara JP, Wolf FM, Grum CM, Clark NM. Effects of educational interventions for self management of asthma in children and adolescents: Systematic review and meta-analysis. *BMJ.* 2003;326(7402): 1308-9.

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