



## International Journal of Research in Pharmacology & Pharmacotherapeutics



ISSN Print: 2278-2648

IJRPP |Vol.7 | Issue 2 | Apr - Jun - 2018

ISSN Online: 2278-2656

Journal Home page: [www.ijrpp.com](http://www.ijrpp.com)

Research article

Open Access

### Assessment of patterns of use of Dry powder inhaler (DPI), pressurized Metered dose inhaler (MDI), Nebulizer, DPI with MDI, DPI with Nebulizer, MDI with Nebulizer and the combination of DPI, MDI and Nebulizer, in patients with Asthma, Chronic obstructive pulmonary disease or other pulmonary diseases: A prospective study

Sumaya Fatima<sup>1\*</sup>, Dr. Mohammed Aleem Uddin Naveed<sup>2</sup>, Afroz Begum<sup>3</sup>, Naseha Fatima<sup>4</sup>, Dr. Radha Krishna. K<sup>5</sup>, Dr. Fahad Abdullah<sup>6</sup>

<sup>1,3</sup>Pharm-D, Department of Pharmacy Practice, Deccan School of Pharmacy, Darussalam, Aghapura, Hyderabad, Telangana, 500001, India.

<sup>2</sup>MBBS, M.D., Department Of Pulmonology, Princess ESRA Hospital, Shalibanda, Hyderabad, Telangana, 500065 India

<sup>4</sup>Bachelor of Pharmacy, Bojjam Narasimhulu Pharmacy College for Women, Vinay Nagar, Saidabad, Hyderabad – 500059, Telangana, India.

<sup>5</sup>MBBS, M.S. M.Ch., Assistant Professor, Department of Surgical Gastroenterology, Owaisi Hospital And Research Center, DMRL 'X' Road, Santoshnagar, Kanchan Bagh, Hyderabad, Telangana, 500058, India.

<sup>6</sup>MBBS, M.D., Assistant professor, Department of Pulmonology, Owaisi Hospital and Research Center, DMRL 'X' road, Santoshnagar, Kanchan Bagh, Hyderabad, Telangana, 500058, India

\*Corresponding author: Sumaya Fatima

Email: [fatima\\_sumaya@yahoo.com](mailto:fatima_sumaya@yahoo.com)

#### ABSTRACT

**Asthma** is a common long-term inflammatory disease of the airways of the lungs characterized by episodic reversible airway obstruction, increased bronchial reactivity, and airway inflammation. **COPD** is a progressive lung disease condition that leads to chronically poor airflow, and if not treated properly, may eventually lead to premature death. Inhaled medication is the cornerstone of the pharmacological treatment of patients with **asthma and COPD**. Majority of patients with Asthma and COPD do not use their inhalers/ nebulizer correctly, and develop side effects with decreasing quality of life. The present study was conducted to assess the patterns of use of DPI, Pressurized MDI, nebulizer and their combinations in patients with Asthma, COPD or other pulmonary diseases. It was aimed to provide counseling to patients using inhalers and nebulizer regarding its proper use. Over a period of 4 months, 137 questionnaires were filled. Majority of patients (17.5% out of 42.7%) were aged above 60 years and were using nebulizers. Most of the techniques for the use of inhaler were not properly implemented. Before the use of inhaler, majority of the patients (36.8%) inhaled air first; during the use of inhaler, patients (58.5%) instantly pressed the

canister of inhaler; and after the use of inhaler, most of the patients (59.1%) did not gargle their mouth with water. Almost all patients (94.1%) found the technique of the use of inhaler/ nebulizer to be easy and a higher number of patients (61.3%) were counseled for the proper use of inhaler/ nebulizer. 62.0% of patients did not develop side effects, where as 26.2% and 11.6% of patients respectively developed oral thrush and salivation of mouth or swollen tongue, after the use of inhaler/ nebulizer. Thus education should be provided by health care providers regarding proper use of devices so as to improve patient quality of life.

**Keywords:** DPI, MDI, Nebulizer, COPD, Asthma

## INTRODUCTION

Bronchial asthma and Chronic obstructive pulmonary disease (COPD) are the most common types of chronic respiratory diseases. [1] Asthma is a chronic inflammatory disorder of airways characterized by reversibility of airflow obstruction, either spontaneously or following bronchodilator therapy which is associated with symptoms of episodic wheezing, difficulty in breathing, chest tightness, and cough associated with sputum production. [2] Whereas, Chronic obstructive pulmonary disease (COPD) is characterized by obstruction of airflow that is not fully reversible, is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases, primarily due to cigarette smoking. It can be associated with symptoms of exertional dyspnea, chronic cough, expectoration of sputum, and wheeze. Inhaled bronchodilators are generally recommended to provide symptomatic management. [3] There is an increase in global burden of these diseases and is estimated that more than 500 million people suffer from it. [4] It is estimated by World Health Organization (WHO) that chronic respiratory diseases represent 5% of total disease burden and 8.3% of chronic disease burden worldwide, accounting for more than 4 million deaths each year. [5] In order to increase prevention and optimize treatment of such diseases, more efforts should be made. [6] Moreover, the communication between the health-care professional and the patient regarding joint treatment decisions, taken by the asthma patient and the clinician together, seems to have a positive effect on adherence as well. [9]

To achieve optimal efficacy and safety, and for direct delivery of the medication to the lungs, inhaled therapy is the mainstay of asthma treatment. [7] Commonly used delivery systems include pressured Metered dose inhaler (MDI) with or without spacer, Dry powder inhaler (DPI) and nebulizer. [8]

However, up to 94% of patients with COPD and asthma do not use their inhalers correctly, and they require multiple education sessions to maintain their technique. [7] The effectiveness of drugs for inhalation such as anticholinergic agents,  $\beta_2$ - agonists or corticosteroids, can be influenced by many factors including sex, age and education of the patient, duration of disease, type of inhaler used, proper inhalation technique or use of several inhalers. [10-14] Many elderly people have poor inhalation technique because of medical problems such as weakness, arthritis or impaired dexterity or vision. [15] Although patients may prefer use of an inhaler alone to be more convenient than that of nebulizer, the combination of treatment modalities offers potential advantages. Such a regime could provide the benefits of additional symptom relief offered by the nebulizer, as well as the greater amenity of allowing the inhaler to be used when patients are away from home during the day. [3]

Because of inconsistency in results between various studies conducted worldwide, the present study was conducted to explore and assess the patterns of use of DPI (Accuhaler, Disk haler, Hand haler and Turbuhaler), Pressurized MDI, nebulizers, DPI versus pressurized MDI, DPI versus nebulizers, Pressurized MDI versus nebulizers and the comparison of all the three (DPI, Pressurized MDI and nebulizer). It was also aimed to provide counseling to all the patients using inhalers and nebulizer regarding its proper use in order to prevent and minimize side effects so as to improve patients' quality of life.

## MATERIALS AND METHODS

### Setting and design

A prospective observational study was performed in Pulmonology Department at Princess Esra Hospital, Owaisi Hospital and Research Center for a period of 4 months (September 2017- December

2017). A well-defined questionnaire form was developed and patients were inquired about their pattern of use of Inhalers. An Informed consent form was signed up by patients prior to filling the questionnaire form. Patients were counseled about the correct way of using and handling Inhalers if any error was observed.

### Inclusion/ Exclusion criteria

Patients diagnosed with Bronchial Asthma, COPD or other pulmonary ailments, for which they were prescribed DPI, MDI or Nebulizer were enrolled in the study irrespective of their ages. Patients undergoing other treatment apart from DPI, MDI or Nebulizer were excluded from the study.

### Sources of data

The questionnaire form comprised of Demographic data (Gender, Age), educational level, diagnosed condition, diagnosis time, Severity of disease; techniques before, during and after use of inhaler, ease of using inhaler/ nebulizer, counseled by a professional about the use of inhaler/ nebulizer; and the side effects post use of inhaler or nebulizer.

Patients were enlisted based on the use of DPI, MDI, Nebulizer, DPI and MDI, DPI and Nebulizer, MDI and Nebulizer; DPI, MDI and Nebulizer (all three simultaneously). Questions not applicable to patients using nebulizers were excluded from the calculations and were tagged as N.A. as shown in Table-1.

### Statistical analysis

Data analysis was performed using Microsoft Excel Software and percentages were calculated using electronic calculator.

## RESULTS

- A total of 137 patients were enrolled in the study, out of which 23 patients were using DPIs; 34 were using MDIs; 40 were using Nebulizer; 3 were using both DPI and MDI; 10 were using both DPI and Nebulizer; 24 were using both MDI and Nebulizer; and 3 were using all of them (DPI, MDI and Nebulizer) simultaneously. A total of 52 (37.9%) male and 85 (62.0%) female patients were taken into study.
- Majority of patients using DPI (7.2%) were

observed in the age group of 41-60 years, Majority of MDI users (8.0%) were in the age group of 31-40 years and that of nebulizer (17.5%) were above 60 years of age. Among the pattern of combined use of inhalers, maximum patients (8.7%) were observed to be using MDI with nebulizer. Highest number of patients (29.1%, n=40) were observed to be using nebulizer when compared to other groups. Majority of patients were suffering from bronchial asthma (84%) while 7.8% patients had COPD and 7.1% patients had other pulmonary problems.

- Most of the patients in this study (29%) had respiratory problems since 1 to 5 years. The disease activity was severe in 61.6% and moderate in 37.8%.
- Most of the techniques for the use of inhaler were not properly implemented. Before the use of inhaler, majority of the patients (36.8%) inhaled air first; during the use of inhaler, patients (58.5%) instantly pressed the canister of inhaler; and after the use of inhaler, most of the patients (59.1%) did not gargle their mouth with water.
- Few correctly used inhalation techniques were proper holding of canister of inhaler in the mouth (95.8%), holding the breath for 10 seconds after inhaling the drug (60.8%) and exhaling the air slowly from mouth after the use of inhaler (57.7%).
- Almost all patients (94.1%) found the technique of the use of inhaler/ nebulizer to be easy and a higher number of patients (61.3%) were counseled for the proper use of inhaler/ nebulizer.
- 62.0% of patients did not develop side effects, where as 26.2% and 11.6% of patients respectively developed oral thrush and salivation of mouth or swelled tongue, after the use of inhaler/ nebulizer.
- Most of the patients in the present study were uneducated (54.3%) when compared with those of high schooling and above qualifications in education (45.3%).
- Patients in the current study were inquired about the counselling provided by the health care providers. It was noted that counselling was provided only during the initial use of device.

As their duration of disease progressed, patients started using the devices in a less organized

manner, which lead to inefficient management of their condition.

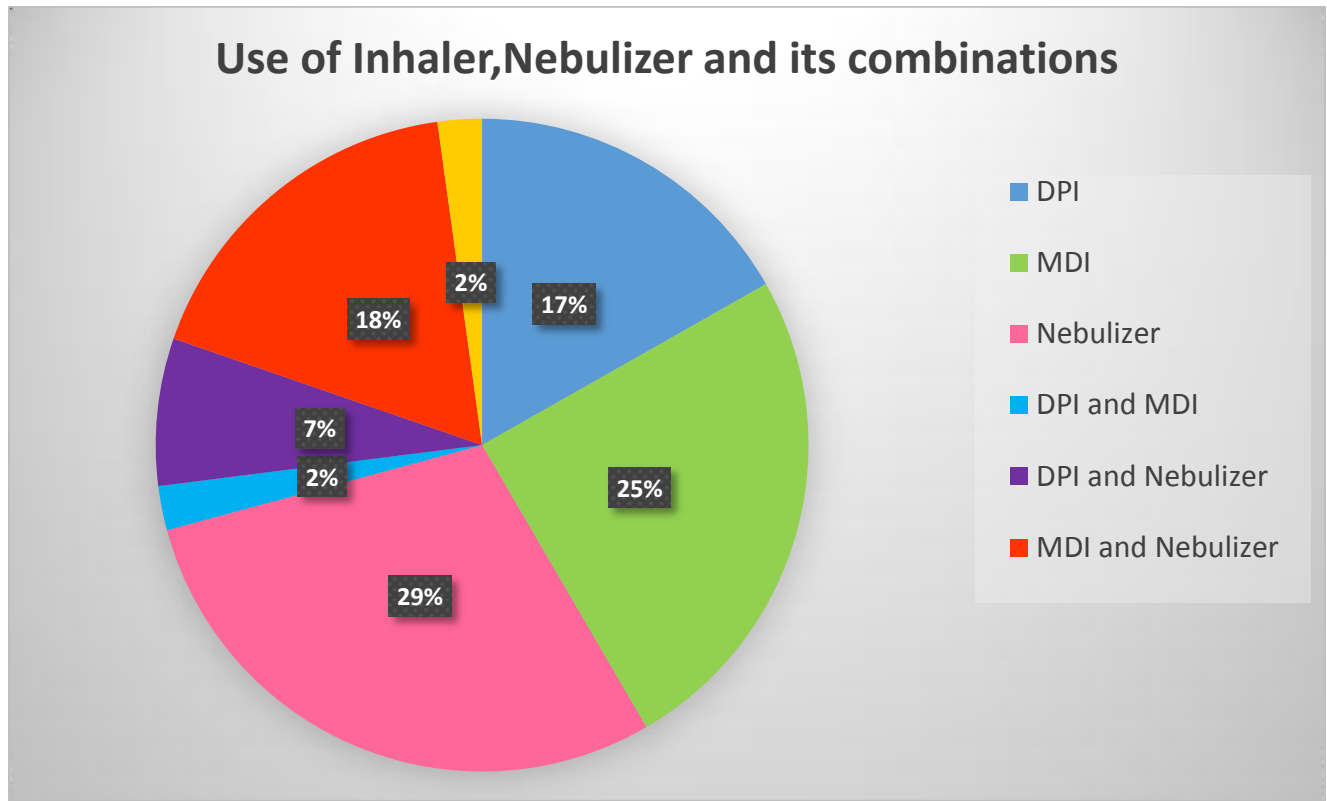


Figure-1: Overview of the use of inhaler, nebulizer and its combinations

Table-1: Statistical analysis of results of patients using Inhalers and Nebulizer

Characteristics		DPI (N=23)	MDI (N= 34)	Neb. (N=40)	DPI,MDI (N=3)	DPI,Neb (N=10)	MDI,Neb. (N=24)	DPI,MDI,Neb. (N=3)
Gender	Male	8.0%	9.4%	9.4%	0.7%	2.1%	8.0%	0%
	Female	8.7%	15.3%	19.7%	1.4%	5.1%	9.4%	2.1%
Age (Years)	1-17	0%	0.7%	0%	0.7%	0%	0%	0%
	18-30	2.9%	2.1%	1.4%	0%	2.1%	0%	0%
	31-40	2.1%	8.0%	5.8%	0%	0%	2.1%	0%
	41-60	7.2%	6.5%	4.3%	0.7%	1.4%	6.5%	1.4%
	>60	4.3%	7.2%	17.5%	0.7%	3.6%	8.7%	0.7%
Educational level	No School	13.4%	15.4%		3.0%	4.1%	15.4%	3.0%
	High school/ less	6.1%	10.3%		0%	4.1%	6.1%	0%
	College	0%	4.1%	N.A.	0%	2.0%	2.0%	0%
	College graduate	4.1%	5.5%		0%	0%	1.0%	0%
Diagnosed	Asthma	10.9%	22.6%	24.0%	2.1%	6.5%	16.0%	2.1%
	COPD	3.6%	0.7%	2.1%	0%	0.7%	0.7%	0%

condition	Others	2.1%	1.4%	2.9%	0%	0%	0.7%	0%
Diagnosis time	< 1 month	2.9%	1.4%	8.0%	0%	0%	0%	0%
	1 month- 1 year	5.8%	8.7%	6.5%	0%	0%	2.1%	0%
	1-5 year	3.6%	8.0%	8.0%	0%	2.9%	5.1%	1.4%
	6-10 year	1.4%	2.1%	1.4%	0.7%	2.1%	6.5%	0.7%
	>10 year	2.9%	4.3%	5.1%	1.4%	1.4%	3.6%	0%
Severity of disease	Moderate	10.3%	16.4%		1.0%	2.0%	6.1%	2.0%
	Severe	13.4%	18.5%	N.A.	2.0%	8.2%	18.5%	1.0%
Before use of inhaler	Inhale air	12.3%	11.3%		2.0%	6.1%	5.1%	0%
	Exhale air	5.1%	13.4%	N.A.	0%	4.1%	11.3%	1.0%
	Breath in and out	6.1%	10.3%		1.0%	0%	8.2%	2.0%
During use of inhaler	Press canister and wait	6.1%	15.4%		2.0%	8.2%	7.2%	2.0%
	Press again immediately	17.5%	19.5%	N.A.	1.0%	2.0%	17.5%	1.0%
	Hold the mouth piece properly	22.6%	32.9%		3.0%	10.3%	23.7%	3.0%
After use of inhaler	Did not hold the mouth piece properly	1.0%	2.0%	N.A.	0%	0%	1.0%	0%
	Inhale drug Slowly	13.4%	38.0%		1.0%	6.1%	16.4%	3.0%
	Inhale drug quickly	10.3%	29.4%	N.A.	2.0%	4.1%	8.2%	0%
	Breath out immediately	12.3%	26.3%		1.0%	4.1%	11.3%	0%
	Hold breath for 10 secs.	11.3%	40.6%	N.A.	2.0%	6.1%	13.4%	3.0%
	Exhale air slowly	10.3%	24.7%		1.0%	7.2%	11.3%	3.0%
	Exhale air quickly	13.4%	10.3%	N.A.	2.0%	3.0%	13.4%	0%
	Gargle with water after use	5.8%	8.7%	8.0%	0.7%	3.6%	5.1%	0.7%
	Do not gargle with water after use	10.9%	14.5%	16.0%	1.4%	2.9%	11.6%	1.4%
	Gargle with water sometimes only	0%	1.4%	5.1%	0%	0.7%	0.7%	0%
Ease of using inhaler/ nebulizer	Easy	16.0%	22.6%	27.0%	2.1%	7.2%	16.7%	2.1%
	Difficult	0.7%	2.1%	2.1%	0%	0%	0.7%	0%
Counseled about use of inhaler/	Yes	5.8%	12.4%	26.2%	0.7%	4.3%	10.9%	0.7%
	No	10.9%	12.4%	2.9%	1.4%	2.9%	6.5%	1.4%

nebulizer

Side effects after using inhaler/ nebulizer	No Side effects	10.2%	18.9%	17.5%	2.1%	3.6%	8.0%	1.4%
	Oral thrush	1.4%	3.6%	10.9%	0%	2.1%	7.2%	0.7%
	Salivation of mouth and Swollen tongue	5.1%	2.1%	0.7%	0%	1.4%	2.1%	0%

Neb. - Nebulizer, N.A. - Not applicable, Secs. – Seconds.

## DISCUSSION

A higher number of patients (N=40) were observed to be using Nebulizers when compared to the use of DPIs or MDIs. Use of nebulizers improved the patient quality of life when compared to the use of inhalers alone. This finding complies with Mudde AN, et al. whose study surveying patients' views of home nebulizer therapy for chronic lung diseases found that patients receiving such therapy reported overwhelmingly (98% vs. 2%) that perceived benefits from using a nebulizer over an inhaler (Eg., Improved breathing, less need to contact health care providers, greater self-confidence, outweighed perceived disadvantages (Eg, longer time required for nebulizer treatment and cleaning the device). [16]

Most of the patients in the present study were using Nebulizers and were above 60 years of age. Less preference and inefficiency in using inhalers may be the factor affecting it as found in a study by Gibson et al, which shows that as with younger patients, older patients may also exhibit non-intentional poor adherence due to comorbidities or a combination of cognitive and physical decline; for instance, musculoskeletal conditions or impaired vision may affect their ability to use an inhaler correctly. [17]

In the present study, it was noticed that majority of patients (36.8%) inhaled air before use of inhalers leading to ineffectiveness of the drugs in pulmonary system. This complies with study by Newman SP, which explains that one of the most important factor for the correct use of DPIs is the generation of a forceful and deep inhalation through the device. However, many patients are unable to generate sufficient inspiratory airflow to use their DPIs correctly, resulting in poor drug release and low pulmonary deposition. [18]

Though most of the patients (59.1%) in our study did not gargle their mouth after use of inhalers/

Nebulizer, majority of patients (62.0%) had no side effects like oral thrush of mouth, salivation or swollen tongue. This may be due to improper use of the device. This finding concords with A. Magnan which shows that common errors made by a significant proportion of patients were incorrect positioning of the inhaler, failure to exhale before inhaling through the device, incorrect loading and positioning of the device, failure to forcefully and deeply inhale through the device and patients' failure to hold their breathe hold after inhalation. All these errors may lead to insufficient drug delivery, which adversely influences drug efficacy and may contribute to inadequate control of asthma and COPD. [19]

Patients in the current study were inquired about the counselling provided by the health care providers. It was noted that counselling was provided only during the initial use of device. As their duration of disease progressed, patients started using the devices in a less organized manner, which lead to inefficient management of their condition. This is found to be consistent with the study by Lia Jahedi, et al. which shows that none of the patients in their study specifically reported ever having received follow-up inhaler device education (only initial instruction), possibly explaining their poor technique, and highlighting the need in both patients and health professionals for a greater recognition of the benefit of follow-up assessment in maintaining correct inhalation technique, which could, in turn lead to improved asthma management. [7]

## CONCLUSION

The present study indicates the preference of patients towards the use of nebulizers due to its ease in handling. Despite initial counseling provided by the health care providers, patients improperly use/handle inhalers which lead to insufficient drug delivery, which adversely influences drug efficacy



and contributes to inadequate control of disease. Hence care should be taken by the health care providers/ counselors that patients are investigated and counseled for the inhaler/ nebulizer using technique and adhere to the therapy, each time they come for follow ups, thus attaining improved quality of patient life.

## REFERENCES

- [1]. Waleed M Sweileh<sup>1\*</sup>, Samah W Al-Jabi<sup>2</sup>, Sa'ed H Zyoud<sup>2</sup> and Ansam F Sawalha<sup>1</sup>. Bronchial asthma and chronic obstructive pulmonary disease: research activity in Arab countries. Sweileh et al. *Multidisciplinary Respiratory Medicine* 9, 2014, 38
- [2]. Maxine A. Paadakis, Stehen J. McPHEE, Associate editor Michael W. Rabow. *Text book of Current Medical Diagnosis and Treatment*. 2016
- [3]. Donald P. Tashkin, MD,<sup>a</sup> Gerald L. Klein, MD,<sup>b,c</sup> Shoshana S. Colman, PhD,<sup>d</sup> Hany Zayed, PhD,<sup>d</sup> Warren H. Schonfeld, PhD. Comparing COPD Treatment: Nebulizer, Metered Dose Inhaler, and Concomitant Therapy *The American Journal of Medicine* 120, 2007, 435-441
- [4]. Halbert R, Natoli J, Gano A, Badamgarav E, Buist A, Mannino DM. Global burden of COPD: systematic review and meta-analysis. *Eur Respir J*. 28, 2006, 523–532.
- [5]. Mika J. Ma'kela' a,<sup>\*</sup>, Vibeke Backer b, Morten Hedegaard c, Kjell Larsson d. Adherence to inhaled therapies, health outcomes and costs in patients with asthma and COPD. *Respiratory Medicine* 107, 2013, 1481e1490
- [6]. Wijdan H Ramadan<sup>1</sup> and Aline T Sarkis<sup>2</sup>. Patterns of use of dry powder inhalers versus pressurized metered-dose inhalers devices in adult patients with chronic obstructive pulmonary disease or asthma: An observational comparative study. *Chronic Respiratory Disease* 14(3), 2017, 309–320 <sup>a</sup> The Author(s) 2017
- [7]. Lia Jahedi, MSc, Sue R. Downie, PhD, Bandana Saini, PhD, Hak-Kim Chan, PhD, and Sinthia Bosnic-Anticevich, PhD Inhaler Technique in Asthma: How Does It Relate to Patients' Preferences and Attitudes Toward Their Inhalers? *Journal of aerosol medicine and pulmonary drug delivery* 30, 2017, Mary Ann Liebert, Inc. 42–52
- [8]. Jose O.\*, Sunil Daniel, Minu Krishnan. Comparison of clinical efficacy of nebulised salbutamol and salbutamol metered dose inhaler in children with mild or moderate exacerbation of bronchial asthma. *International Journal of Contemporary Pediatrics* Jose O et al. *Int J Contemp Pediatr*. 4(3), 2017, 741-744
- [9]. Malin Axelsson,<sup>1</sup> Linda Ekerljung,<sup>2</sup> and Bo Lundbäck<sup>2</sup> The Significance of Asthma Follow-Up Consultations for Adherence to Asthma Medication, Asthma Medication Beliefs, and Asthma Control Hindawi Publishing Corporation *Nursing Research and Practice* 2015, 139070, 7
- [10]. Hesselink AE, Penninx BWJH, Wijnhoven HAH, et al. Determinants of an incorrect inhalation technique in patients with asthma or COPD. *Scan J Prim Health Care* 19, 2001, 255–60.
- [11]. Pedersen S, Frost L, Arnfred T. Errors in inhalation technique and efficiency in inhaler use in asthmatic children. *Allergy* 41, 1986, 118–24.
- [12]. Goren A, Noviski N, Avital A, et al. Assessment of the ability of young children to use a powder inhaler device (Turbuhaler). *Pediatr Pulmonol* 18, 1994, 77–80.
- [13]. Brocklebank D, Wright J, Cates C. Systematic review of clinical effectiveness of pressurized metered dose inhalers versus other hand held inhaler devices for delivering corticosteroids in asthma. *BMJ* 323, 2001, 1–7.
- [14]. Van der Palen J, Klein JJ, van Herwaarden CLA, et al. Multiple inhalers confuse asthma patients. *Eur Respir J* 14, 1999, 1034–7.
- [15]. Franks M, Briggs P. Use of a cognitive ergonomics approach to compare usability of a multidose dry powder inhaler and a capsule dry powder inhaler: an open-label, randomized, controlled study. *Clin Ther* 26, 2004, 1791–9.
- [16]. Van Beerendonk I, Mesters I, Mudde AN, et al. Assessment of the inhalation technique in outpatients with asthma or chronic obstructive pulmonary disease using a metered-dose inhaler or dry powder device. *J Asthma*. 35, 1998, 273-279.
- [17]. Gibson PG, McDonald VM, Marks GB. Asthma in older adults. *Lancet* 376, 2010, 803e13.

- [18]. Newman SP, Busse WW. Evolution of dry powder inhaler design, formulation, and performance. *Respir Med* 96, 2002, 293–304.
- [19]. Federico Lavorinia, Antoine Magnanb,c,d,\_, Jean Christophe Dubuse,f, Thomas Voshaarg, Lorenzo Corbettaa, Marielle Broedersh, Richard Dekhuijzenh, Joaquin Sanchisi, Jose L. Viejoj, Peter Barnesk, Chris Corriganl, Mark Levym, Graham K. Cromptonn Effect of incorrect use of dry powder inhalers on management of patients with asthma and COPD *Respiratory Medicine* 102, 2008, 593–604.