

Online Supplement

Prevalence of Critical Errors and Insufficient Peak Inspiratory Flow in Patients Hospitalized with COPD in a Department of General Internal Medicine: A Cross-Sectional Study

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Figure S1: Checklist for inhaler technique evaluation

	pMDI	pMDI with spacer	BAMDI	Respimat®	Diskus®	Ellipta®	Turbuhaler®	Handihaler®	Breezhaler®	Genuair®
Remove cap	Critical error									
Open lid and mouthpiece and place capsule in chamber	Critical error									
Check dose counter (if applicable)	Critical error									
Turn the transparent base of the inhaler until click is heard				Critical error						
Slide lever until click heard and keep the inhaler upright					Critical error	Critical error				
Pierce the capsule once and release the piercing								Critical error	Critical error	
Close mouthpiece, ensuring click is heard								Non-critical error	Non-critical error	
Shake pMDI well	Critical error		Critical error							
Flip the red lever on the top up until it flicks into place			Critical error							
Turn coloured wheel one way, then back until click is heard and keep the inhaler upright							Critical error			
Insert pMDI well into spacer		Critical error								
Hold the inhaler horizontally with the coloured button on the top										Non-critical error
Press the button all the way down and release it										Critical error
Check that the control window changed to green										Critical error
Breathe out normally away from the inhaler	Non-critical error	Non-critical error	Non-critical error	Non-critical error	Critical error	Critical error	Critical error	Critical error	Critical error	Critical error
Hold the inhaler upright (do not cover the air vents at the bottom for BA-pMDI)	Non-critical error		Non-critical error							
Keep head upright or slightly tilted	Non-critical error		Non-critical error							
Seal lips around mouthpiece	Critical error	Critical error	Critical error	Critical error	Critical error	Critical error	Critical error	Critical error	Critical error	Critical error
Activate pMDI		Critical error								
Inhale slowly and deeply through the mouth, actuating once during first half of inhalation	Critical error			Critical error						
Inhale slowly and deeply through the mouth. Keep breathing in after hearing the click			Critical error							
Inhale slowly and deeply through the mouth minimum 3 times or hold breath for 5 seconds		Critical error								
Inhale forcefully and deeply through the mouth					Critical error	Critical error	Critical error	Critical error	Critical error	Critical error
Continue slow and deep inhalation				Critical error						
Hold breath for at least 5 seconds	Critical error		Critical error	Critical error	Critical error	Critical error	Critical error	Critical error	Critical error	Critical error
Breathe out gently, away from your inhaler			Non-critical error		Non-critical error	Non-critical error	Non-critical error	Non-critical error	Non-critical error	Non-critical error
Push red lever down			Non-critical error							
Check if capsule is empty, if not, repeat steps								Critical error	Critical error	
Check the control window has changed back to red, if not, repeat steps										Critical error

pMDIs, pressurized metered-dose inhalers; BAMDI, breath-actuated metered-dose inhalers.

Table S1. Inhalers included in the analysis

Type of inhaler	Inhalers, n (%)
pMDI	22 (13.8)
pMDI + spacer	26 (16.3)
BAMDI	1 (0.6)
Respimat ®	28 (17.5)
Diskus ®	9 (5.6)
Ellipta ®	27 (16.9)
Turbuhaler ®	13 (8.1)
Handihaler ®	17 (10.6)
Breezhaler ®	17 (10.6)

pMDI, pressurized metered-dose inhalers; BAMDI, breath-actuated metered-dose inhalers.

Table S2. Frequency of specific critical errors in inhaler technique

	pMDI (n=22)	pMDI with spacer (n=26)	BAMDI (n=1)	Respimat® (n=28)	Diskus® (n=9)	Elpita® (n=27)	Turbuhaler® (n=13)	Handihaler® (n=17)	Breezhaler® (n=17)
	Number of errors (%)								
Remove cap	1 (5)*	1 (4)*	0 (0)*	1 (4)*			0 (0)*		
Open lid and mouthpiece and place capsule in chamber								0 (0)*	1 (6)*
Check dose counter (if applicable)	9 (41)*	8 (31)*	0 (0)*	9 (35)*	2 (22)*	7 (26)*	4 (31)*		
Turn the transparent base of the inhaler until click is heard				1 (4)					
Slide lever until click heard and keep the inhaler upright					2 (22)*	0 (0)*			
Pierce the capsule once and release the piercing								2 (12)*	2 (12)*
Close mouthpiece, ensuring click is heard								0 (0)	2 (12)
Shake pMDI well	13 (59)*	12 (46)*	1 (100)*						
Flip the red lever on the top up until it flicks into place			0 (0)*						
Turn coloured wheel one way, then back until click is heard and keep the inhaler upright							2 (15)*		
Insert pMDI well into spacer		4 (15)*							
Breathe out normally away from the inhaler	3 (14)	2 (8)	0 (0)	3 (12)	1 (11)*	4 (15)*	1 (8)*	2 (12)*	2 (12)*
Hold the inhaler upright (do not cover the air vents at the bottom for BA-pMDI)	0 (0)		0 (0)						
Keep head upright or slightly tilted	0 (0)		0 (0)						
Seal lips around mouthpiece	1 (5)*	2 (8)*	0 (0)*	0 (0)*	1 (11)*	0 (0)*	0 (0)*	0 (0)*	1 (6)*
Activate pMDI		1 (4)*							
Inhale slowly and deeply through the mouth, actuating once during first half of inhalation	12 (55)*			9 (35)*					
Inhale slowly and deeply through the mouth. Keep breathing in after hearing the click			0 (0)*						
Inhale slowly and deeply through the mouth minimum 3 times or hold breath for 5 seconds		11 (42)*							
Inhale forcefully and deeply through the mouth					3 (33)*	6 (22)*	3 (23)*	0 (0)*	1 (6)*
Continue slow and deep inhalation				8 (31)*					
Hold breath for at least 5 seconds	6 (27)*		1 (100)*	10 (38)*	4 (44)*	8 (30)*	6 (46)*	6 (35)*	7 (41)*

Breath out gently, away from your inhaler			0 (0)		0 (0)	3 (11)	3 (25)	4 (24)	2 (12)
Push red lever down			0 (0)						
Check if capsule is empty, if not, repeat steps								12 (71)*	7 (41)*

* Steps considered as critical error. pMDIs, pressurized metered-dose inhalers; BAMDI, breath-actuated metered-dose inhalers.

Table S3. Subgroup analysis for inhalers used with a critical error

	Critical error		p value
	n (%)	95% CI	
Male (n=97)	67 (69.1)	57.2- 80.9	0.328
Female (n=63)	38 (60.3)	47.5 – 73.1	
Age < 65 years (n=36)	21 (58.3)	36.3 – 80.4	0.428
Age ≥ 65 years (n=124)	84 (67.7)	58.4 – 77.1	
Absence of exacerbation of COPD (n=49)	41 (83.7)	72.7 – 94.7	0.005
Presence of exacerbation of COPD (n=111)	64 (57.7)	46.4 – 69.0	
Absence of respiratory complaint (n=34)	28 (82.4)	69.9 – 94.8	0.027
Presence of respiratory complaint (n=126)	77 (61.1)	50.7 – 71.6	
Total (n=160)	105 (65.6)	57.7 – 72.9	

The widths of the confidence intervals were adjusted to take into account the cluster analysis at the level of patient.

COPD, chronic obstructive pulmonary disease; CI, confidence interval.

Table S4. Misused inhaler, critical error, insufficient peak inspiratory flow, non-teachable and unsuitable inhaler by type of inhaler

	Misused inhaler n (%)	Critical error n (%)	Insufficient PIF n (%)	Not teachable n (%)	Unsuitable n (%)
pMDI (n=22)	17 (77.2)	17 (77.2)	0 (0)	2 (9.1)	2 (9.1)
pMDI+spacer (n=26)	20 (76.9)	20 (76.9)	0 (0)	1 (3.8)	1 (3.8)
BAMDI (n=1)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)
Respimat ® (n=28)	21 (75.0)	21 (75.0)	0 (0)	1 (3.6)	1 (3.6)
Diskus ® (n=9)	7 (77.8)	6 (66.7)	5 (55.6)	1 (11.1)	5 (55.6)
Ellipta ® (n=27)	19 (70.4)	17 (63.0)	8 (29.6)	1 (3.8)	8 (29.6)
Turbuhaler ® (n=13)	10 (76.9)	7 (53.8)	7 (53.8)	2 (15.4)	7 (53.8)
Handihaler ® (n=17)	7 (41.2)	7 (41.2)	0 (0)	1 (5.9)	1 (5.9)
Breezhaler ® (n=17)	9 (52.9)	9 (52.9)	2 (11.8)	0 (0)	2 (11.8)

pMDI, pressurized metered-dose inhalers; BAMDI, breath-actuated metered-dose inhalers; PIF, peak inspiratory flow.