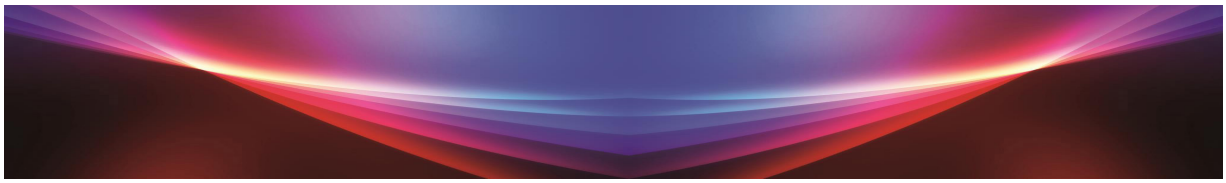

SUPPLEMENTARY MATERIAL

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Hospital staff practical skills and theoretical knowledge in inhaled aerosol therapy: a single centre cross-sectional observational study.

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Supplementary Table 1. Devices used in clinical practice by participants and devices employed for personal use or by relatives. For this multiple testing Bonferroni correction was used, as appropriate.

Inhalers declared to use in clinical practice	Total (n=305)	Respiratory physiotherapists (n=14)	Nurses (n=150)	Physicians (n=115)	Residents (n=26)
Devices used, median (IQR)	2 (1-3)	5 (3-6)$^{N\ M\ R}$	2 (1-3)	2 (1-4)	2 (1-3)
pMDI, n (%)	280 (92)	11 (79)	138 (92)	105 (91)	26 (100)
pMDI + IC, n (%)	85 (28)	14 (100)$^{N\ M\ R}$	30 (20)	38 (33)	3 (11)
Breezhaler®, n (%)	54 (18)	9 (64)$^{N\ M\ R}$	19 (13)	22 (19)	4 (15)
Handihaler®, n (%)	117 (38)	9 (64)^{M}	72 (48) ^{M}	28 (24)	8 (31)
Diskus®, n (%)	162 (53)	13 (93)$^{N\ M\ R}$	73 (49)	62 (54)	14 (54)
Turbohaler®, n (%)	41 (13)	6 (43)$^{N\ R}$	11 (7)	23 (20)^{N}	1 (4)
Twisthaler®, n (%)	18 (6)	1 (7)	6 (4)	9 (8)	2 (8)
Genuair®, n (%)	36 (12)	2 (14)	8 (5)	20 (17)^{N}	6 (23)^{N}
Respimat®, n (%)	39 (13)	5 (36)^{N}	10 (7)	21 (18)^{N}	3 (11)
Inhalers used by the interviewed or a familiar					
pMDI, n (%)	103 (34)	4 (29)	54 (36)	37 (32)	8 (31)
pMDI + IC, n (%)	27 (9)	3 (21)	12 (8)	12 (10)	0 (0)
Breezhaler®, n (%)	5 (2)	0 (0)	3 (2)	2 (2)	0 (0)
Handihaler®, n (%)	22 (7)	1 (7)	14 (9)	6 (5)	1 (4)
Diskus®, n (%)	40 (13)	1 (7)	26 (17)	11 (10)	2 (8)
Turbohaler®, n (%)	14 (5)	2 (14)	5 (3)	7 (6)	0 (0)
Twisthaler®, n (%)	2 (1)	0 (0)	0 (0)	2 (2)	0 (0)
Genuair®, n (%)	2 (1)	0 (0)	1 (1)	2 (2)	0 (0)
Respimat®, n (%)	3 (1)	0 (0)	2 (1)	1 (1)	0 (0)

N, significant difference with the nurses group; M, significant difference with the physicians group; R, Significant difference with the residents group; IC, inhalation chamber; DPI, dry powder inhaler; pMDI, pressurized metered dose inhalers.

Supplementary Table 2. Devices used in clinical practice among nurses and physicians. Subgroups of nurses working or not inside the Pneumology Unit and subgroups of pneumologists and other specialists were compared.

Inhalers declared to use in clinical practice	Nurses		Physicians	
	Pneumology Unit (n=12)	Other units (n=138)	Pneumologists (n= 16)	Other specialists (n= 99)
Devices used, median (IQR)	3 (2-4)	2 (1-3)	8 (7-8)*	2 (1-3)
pMDI, n (%)	11 (92)	127 (92)	15 (94)	90 (91)
pMDI + IC, n (%)	3 (25)	27 (20)	12 (75)*	26 (26)
Breezhaler®, n (%)	4 (33)*	15 (11)	13 (81)*	9 (9)
Handihaler®, n (%)	8 (67)	64 (46)	12 (75)*	16 (16)
Diskus®, n (%)	8 (67)	65 (47)	15 (94)*	47 (47)
Turbohaler®, n (%)	1 (8)	10 (7)	12 (75)*	11 (11)
Twisthaler®, n (%)	0 (0)	6 (4)	2 (13)	7 (7)
Genuair®, n (%)	1 (8)	7 (5)	11 (69)*	9 (9)
Respimat®, n (%)	0 (0)	10 (7)	13 (81)*	8(8)

pMDI, pressurized metered dose inhalers; IC, inhalation chamber; *p≤0.05.

Supplementary Table 3. Theoretical knowledge on inhaled therapy measured by the questionnaire among nurses and physicians. Subgroups of nurses working or not inside the Pneumology Unit and subgroups of pneumologists and other specialists were compared.

Theoretical knowledge	Nurses		Physicians	
	Pneumology Unit (n=12)	Other units (n=138)	Pneumologists (n= 16)	Other specialists (n= 99)
Total score, mean (SD)	10.2 (2.4)	8.9 (3.0)	14.7 (2.0)*	9.6 (3.4)
pMDI, n correct (%)				
1- It is important to shake the pMDI canister before every puff (True)	7 (58)	95 (69)	11 (69)	63 (64)
2- When inhaling a puff from a pMDI you should breathe deeply and fast (False)	2 (17)	20 (15)	6 (38)	18 (18)
3- It is not necessary to rinse the mouth after inhalation of a corticosteroid (False)	5 (42)	64 (46)	16 (100)*	57 (58)
4- When using a new canister or a canister that has not been used for some days, it is not necessary to release one or more sprays into the air (False)	7 (58)	81 (59)	13 (81)	66 (67)
IC, n correct (%)				
5- Using IC with pMDI reduces oropharyngeal deposition of the drug (True)	4 (33)	39 (28)	15 (94)*	50 (51)
6- If multiple puffs should be administrated, all puffs should be fired into the device before inhalation (False)	7 (58)	48 (35)	14 (88)*	42 (42)
7- It is possible to scrub the inner part of the IC to clean it properly (False)	4 (33)	19 (14)	5 (31)	29 (29)
8- Inhalation could be performed hours after drug nebulization into the spacer (False)	10 (83)	78 (57)	16 (100)*	75 (76)

Theoretical knowledge	Nurses		Physicians	
	Pneumology Unit (n=12)	Other units (n=138)	Pneumologists (n= 16)	Other specialists (n= 99)
9- Deposition of a white powder into the holding chamber is normal (True)	5 (42)	39 (28)	7 (44)	30 (30)
10- Depending on the material, IC can have electrostatic charge (True)	2 (17)	14 (10)	8 (50)	36 (36)
DPIs, n correct (%)				
11- When using a DPI is important to breathe deeply and slowly (False)	1 (8)	9 (7)	3 (19)	11 (11)
12- When using a DPI is important not to exhale into the device (True)	11 (92)	96 (70)	12 (75)	67 (68)
13- It is possible to use a DPI when the inspiratory flow peak of the patient is less than 30 l/min (False)	0 (0)	8 (6)	10 (63)*	18 (18)
14- When using a DPI it is not important to hold the breath at the end of inspiration (False)	6 (50)	67 (49)	16 (100)*	50 (51)
15- Strong reduction in vital capacity can affect the amount of drug delivered to the lung (True)	7 (58)	87 (63)	15 (94)*	63 (64)
Nebulizer, n correct (%)				
16- It is not important how much time occurs between the preparation of the medication and nebulization (False)	10 (83)	112 (81)	14 (88)	81 (82)
17- It is correct to use a humidifier during aerosol nebulization (False)	8 (67)	63 (46)	8 (50)*	24 (24)

Theoretical knowledge	Nurses		Physicians	
	Pneumology Unit (n=12)	Other units (n=138)	Pneumologists (n= 16)	Other specialists (n= 99)
18- With cooperative patients, it is correct to use mouthpiece instead of face mask to deliver aerosol (True)	12 (100)*	90 (65)	15 (94)*	51 (52)
19- Using a jet nebulizer with compressed gas flow, it is necessary to use a maximum gas flow of 5 l/min (False)	4 (33)	55 (40)	9 (56)*	29 (29)
20- When preparing the medication for nebulization it is important to consider dead volume of the jet nebulizer (True)	7 (58)	73 (53)	13 (81)*	46 (46)
21- When using a face mask with a jet nebulizer it is necessary to inhale through the mouth (True)	3 (25)	67 (49)	9 (56)	40 (40)

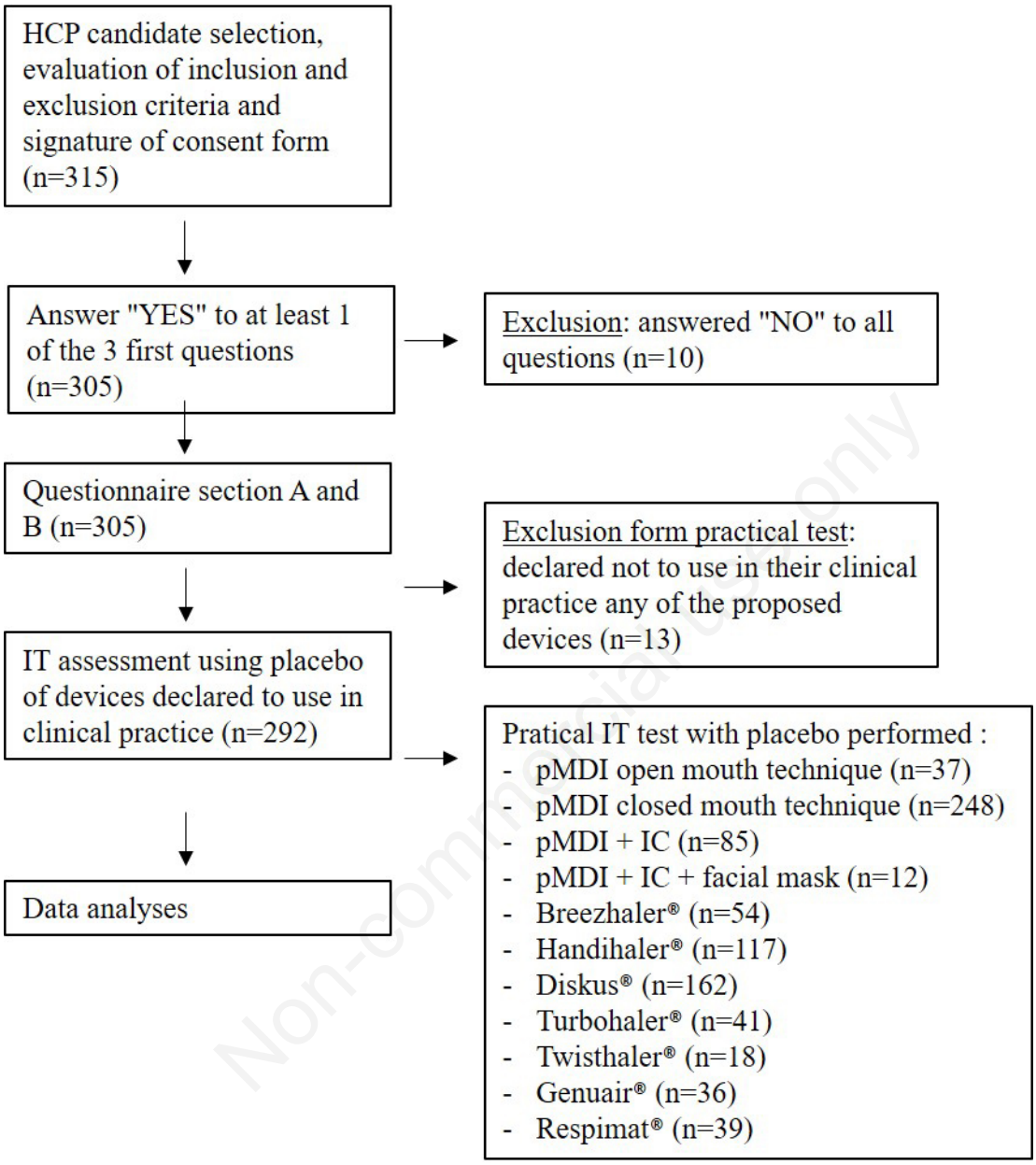
IC, inhalation chamber; pMDI, pressurized metered dose inhalers; *p≤ 0.05.

Supplementary Table 4. Practical skills in inhaled therapy measured by simulation with placebo devices. Results are represented in terms of number of participants that performed a demonstration without errors in the critical steps for drug deposition into the lung among nurses and physicians. Subgroups of nurses working or not inside the Pneumology Unit and subgroups of pneumologists and other specialists were compared.

Practical skills	Nurses		Physicians	
	Pneumology Unit	Other Units	Pneumologists	Other specialists
pMDI open mouth technique, n (%)	-	3/19 (16)	2/3 (67)	2/8 (25)
pMDI closed mouth technique, n (%)	0/11 (0)	13/109 (12)	5/13 (38)*	11/84 (13)
pMDI + IC, n (%)	0/3 (0)	7/26 (27)	3/13 (23)	6/26 (23)
pMDI + IC + facial mask, n (%)	-	2/4 (50)	-	2/4 (50)
Breezhaler®, n (%)	0/4 (0)	1/15 (7)	6/13 (46)	3/9 (33)
Handihaler®, n (%)	0/8 (0)	4/64 (6)	11/12 (92)*	0/16 (0)
Diskus®, n (%)	1/8 (13)	8/65 (12)	9/15 (60)*	9/47 (19)
Turbohaler®, n (%)	0/1 (0)	1/10 (10)	10/12 (83)*	4/11 (36)
Twisthaler®, n (%)	-	0/6 (0)	1/2 (50)	1/7 (14)
Genuair®, n (%)	0/1 (0)	0/7 (0)	8/11 (73)	3/9 (33)
Respimat®, n (%)	-	0/10 (0)	7/13 (54)	1/8 (13)

IC, inhalation chamber; pMDI, pressurized metered dose inhalers; *p≤0.05.

Supplementary Figure 1. Flow chart of the study protocol. HCPs, health care professionals; IT, inhalation technique; IC, inhalation chamber; pMDI, pressurized metered dose inhalers.



Supplementary Figure 2. Most common errors observed during practical simulation with the different aerosol devices tested: (A) pMDI; (B) pMDI + IC; (C) pMDI + IC + facial mask; (D) single-dose DPIs; (E) multiple-dose DPIs; (F) Soft-mist. IC, inhalation chamber; IT, inhalation technique; DPI, dry powder inhaler; pMDI, pressurized metered dose inhalers.