The Importance of Inter-patient Peak Inspiratory Flow Variance in Simplifying DPI Prescribing in COPD: A Meta-Analysis

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Introduction

- Peak inspiratory flow (PIF) is an important metric for asthma and COPD patients to assess their ability to inhale successfully through a dry powder inhaler (DPI)
- Whether a patient can achieve the required PIF for a given DPI depends on not only several patient factors, but, critically, the intrinsic airflow resistance (AR) of the inhaler device
- Currently, there are no guideline recommendations for the inhalation requirements and impact of AR of delivery devices in specific COPD patient populations[1]
- Studies have reported minimum and optimal DPI-specific PIF values from 20-50 L/min and from 30-65 L/ min[2-3]. Most reports are for single devices, and in low patient numbers.

Therefore, we undertook a meta-analysis of PIF reports in COPD patients to assess:

(1) Can patient PIF be studied based on AR categorization, agnostic to specific device design?

(2) Is inter-patient variability in PIF sensitive to device AR and should this feature in prescribing guidance?

Methodology

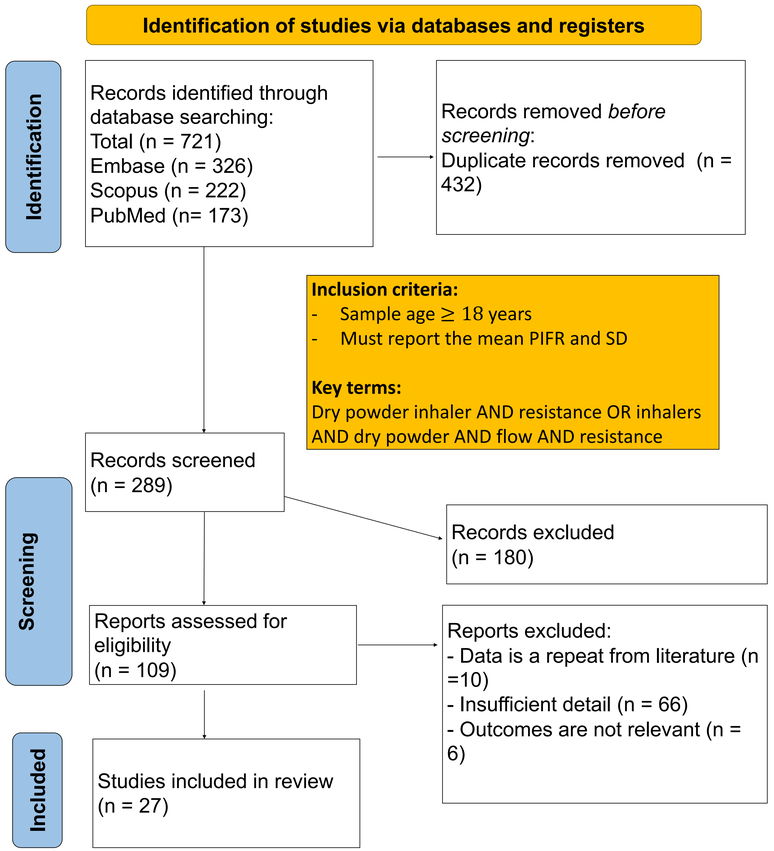

Figure 1. PRISMA flowchart of the study selection procedure

Results

Mean peak flow rate achieved by COPD patients against varying DPI resistance

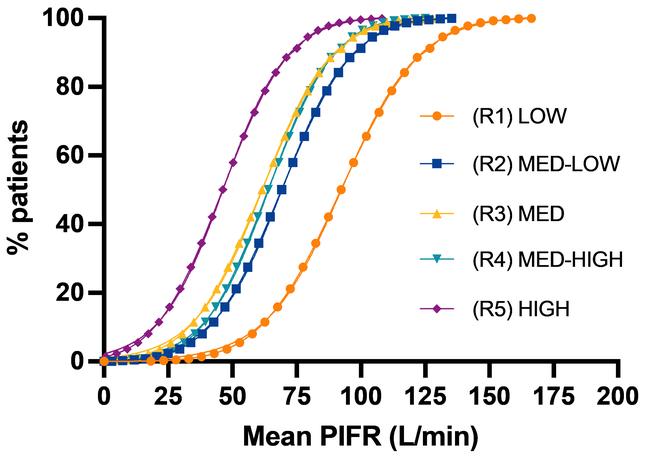

Table 1. Summary of PIF data for all 5 AR categories

DPI AR	Median PIF (L/min)	PIF variance, *K* [95% CI]	Total patient records (n)
(R1) low	92.4	0.068 [0.066, 0.069]	468
(R2) med-low	69.2	0.076 [0.074, 0.077]	1979
(R3) med	61.6	0.076 [0.074, 0.077]	1042
(R4) med-high	64.1	0.082 [0.080, 0.084]	429
(R5) high	46.3	0.081[0.079, 0.083]	1402

Figure 2. The mean PIFR (L/min) achieved by COPD patients (n=2525) included in the meta-analysis. This is expressed as a logistic curve fit to the PIF data with the percentage of patients within ± 3SD that can achieve the mean PIFR. The slope, *k*, of the logistic fit indicates the width (i.e., variance) of the PIF distribution. DPI-AR is reported for 5 AR categories – low, med-low, med, med-high and high.

- The mean PIFs and the variances (variability) of the PIF distributions (*k* value, $p<0.0001$) were significantly different ($p<0.0001$) between all 5 DPI-AR groups
- The greatest variance was reported for (R1) low DPI-AR with *k*=0.068, the lowest variance was reported for (R4) med-high DPI-AR with k = 0.082
- DPI-AR could be simply classified into 3 clusters -R1, R2&R3, R4&R5-, based on the patient's PIF variance (variability)

Conclusion

- **Greater variability in PIF is observed with low DPI-AR devices which may be clinically relevant, since a large proportion of patients will achieve flow rates below the median, optimal value**
- **PIF variance could be used to inform DPI prescribing (using just three AR groups), whilst maintaining COPD patients' ability to achieve adequate inhalation flow**

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