

# Development and validation of a novel measure of inhaler technique: The Portsmouth Inhaler Technique (PIT) Score

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## Background

-Despite decades of inhaler use, poor inhaler technique remains a major barrier to effective respiratory disease management, directly contributing to poor clinical outcomes and a significant global economic burden.

-Whilst scoring systems are commonly used in healthcare to evaluate outcomes, no validated tool exists in the UK to assess and quantify inhaler technique across device types.

## Objective

To develop and validate a novel scoring system to evaluate and measure inhaler technique across device types in adults and children.

## Methods

Two stages of scale development were carried out :

### 1. Scale development (item generation):

This stage identified a comprehensive set of inhaler technique assessment steps (items) across device types in adults and children.

-A systematic review of literature identified 418 published inhaler technique checklists (figure 1).



Figure 2. Items identified in the item generation stage, mapped around 5 dimensions within an inhaler technique assessment

-From these checklists, 72 device-agnostic items (44 items & 28 terminology variants) were extracted to create an item pool (figure 2).

### 2. Judgement quantification (Item reduction and refinement):

This iterative stage involved inhaler subject matter experts (SMEs), non-specialists and inhaler users assessing each item in the pool for essentiality, relevancy and clarity.

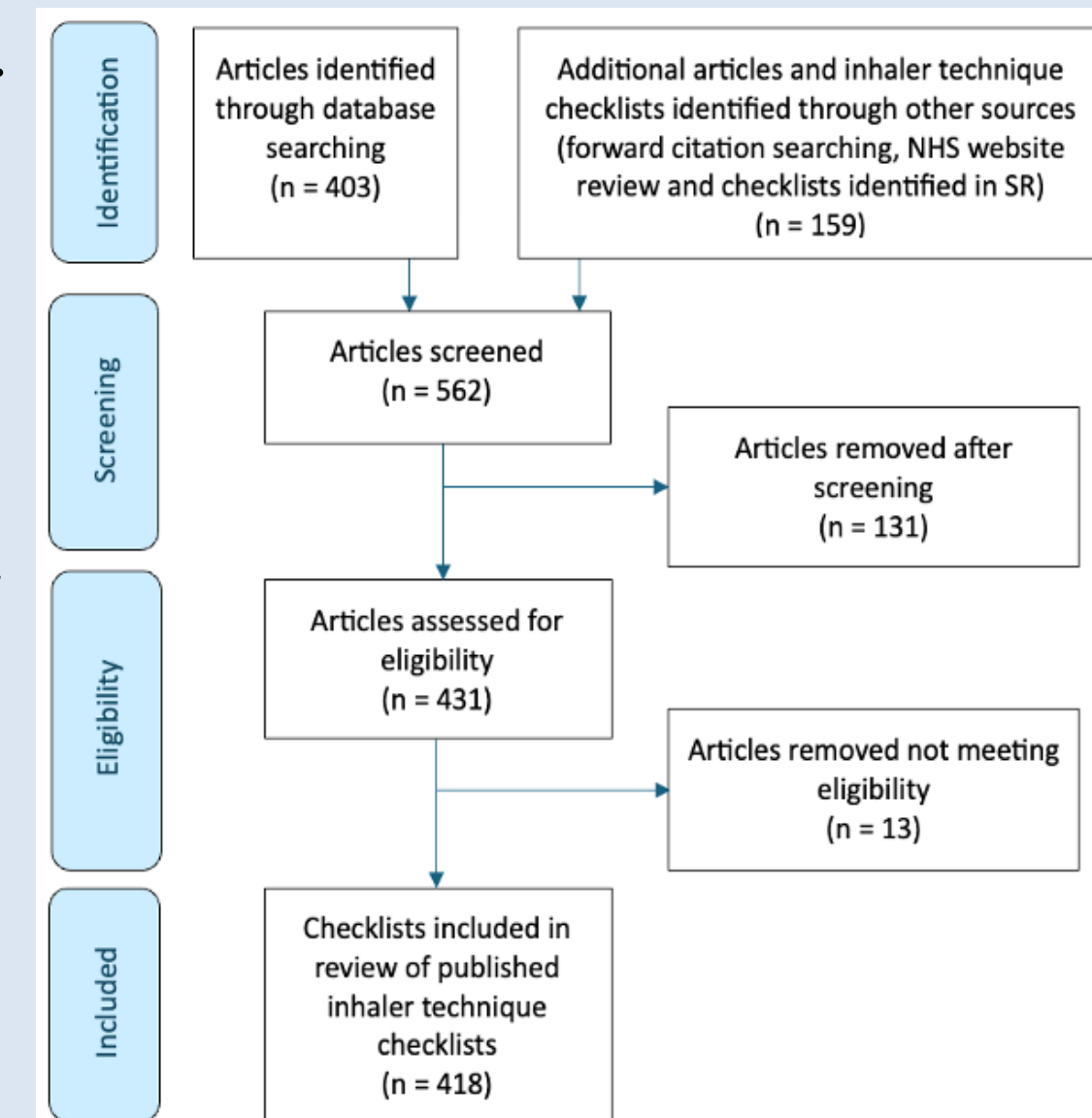


Figure 1.

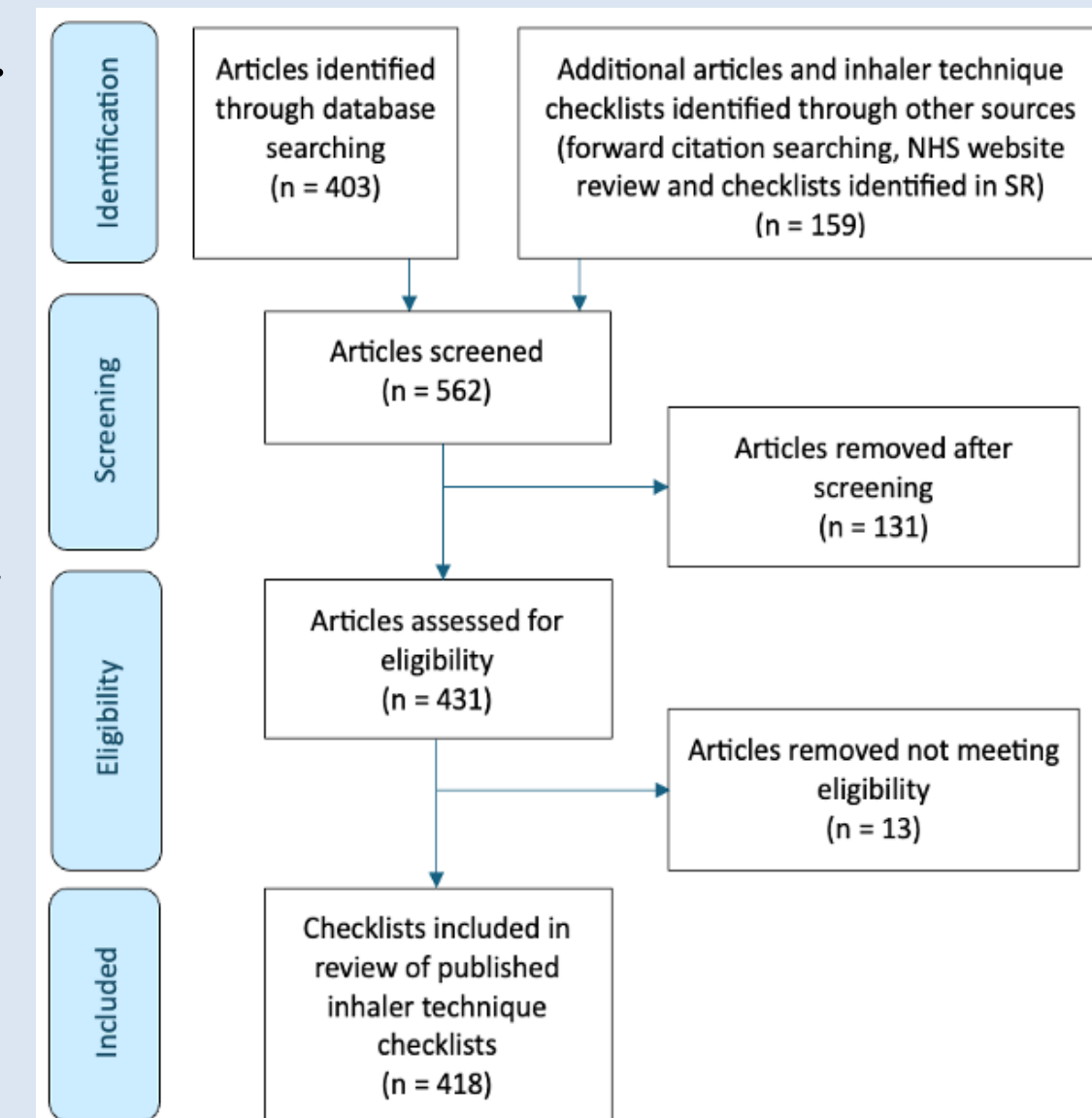
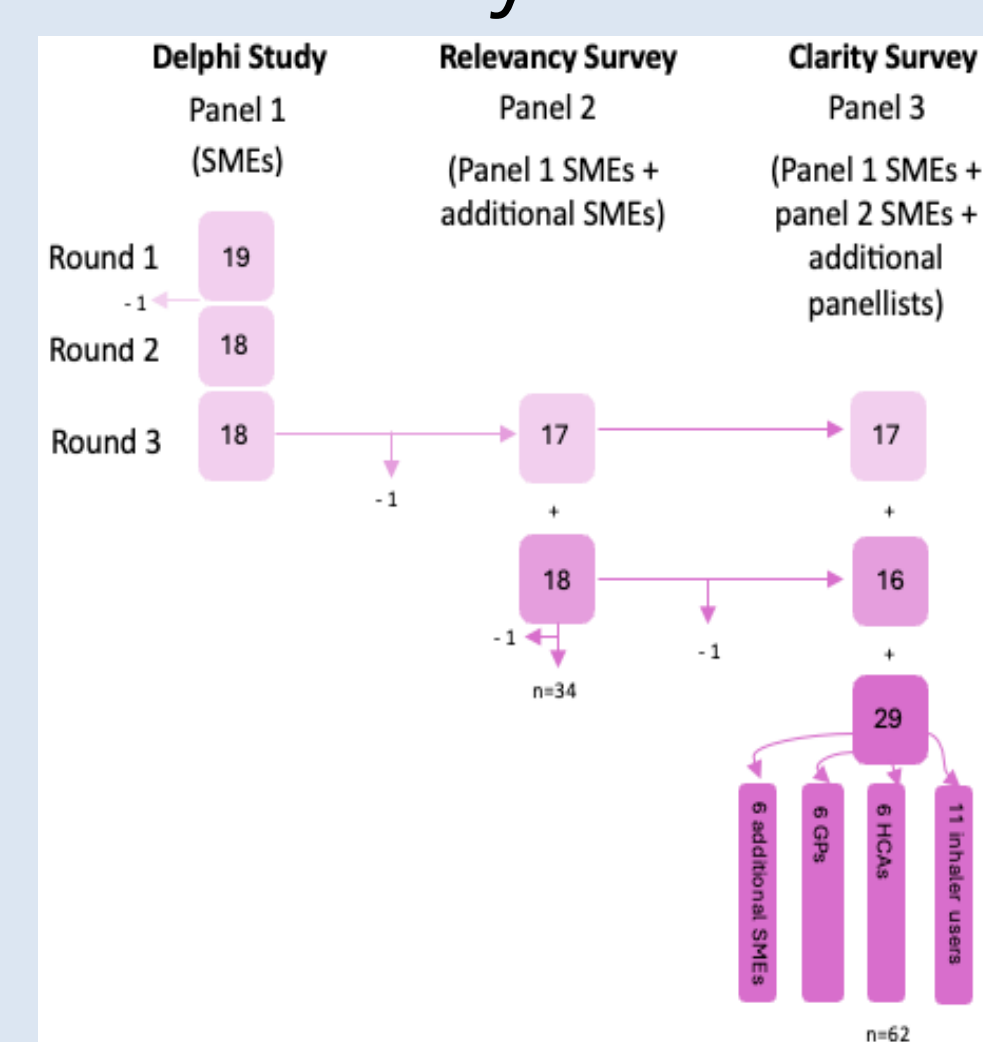


Figure 3.



-To evaluate item essentiality, SMEs (n=18) participated in a Delphi study. The Content Validity Ratio (CVR) was applied, and sub-threshold items of  $\leq 0.444$ <sup>1</sup> eliminated or refined.

-Remaining items were then assessed for relevancy by a second panel of inhaler SMEs (n=34) using the Content Validity Index (CVI)<sup>2</sup>.

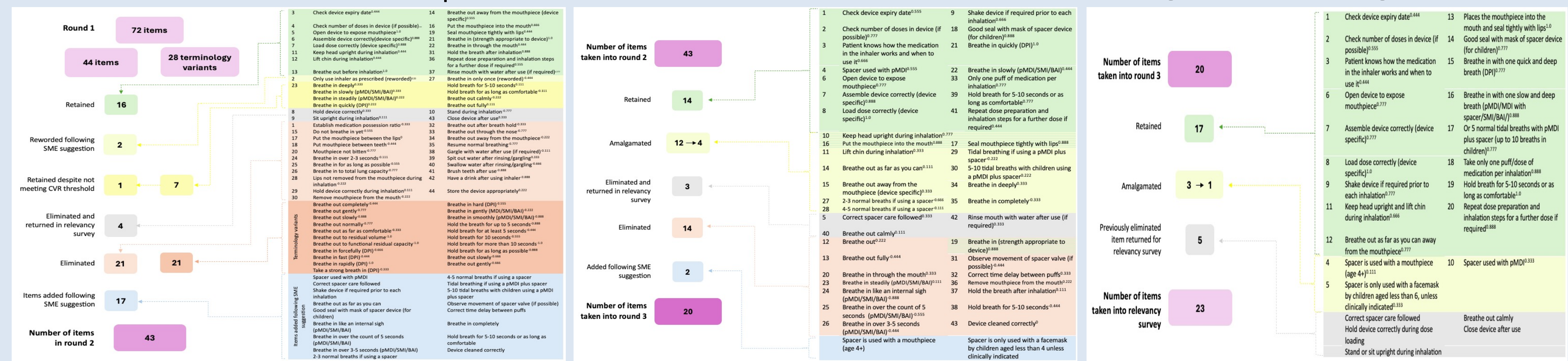
-Lastly, a third panel including SMEs, non respiratory experts and inhaler users (n=62), assessed the final items for their clarity, again using the CVI (figure 3).

## Results

-SMEs representing key respiratory stakeholders took part in the Delphi study.



-Over 3 rounds, the item pool was reduced from 72 to 23 items using the CVR (figures 4a-c).



a. Delphi study results: round 1

b. Delphi study results: round 2

c. Delphi study results: round 3

Figures 4a-c. Summary of retained, eliminated and modified items following each of the 3 Delphi study rounds (CVR results)

-These 23 items were assessed for relevancy, and all exceeded the CVI threshold of  $\geq 0.78$  and modified kappa ( $k^*$ ) of  $\geq 0.74$ .

-Related items were then amalgamated and 17 items assessed for clarity.

-16 items exceeded the CVI threshold of  $\geq 0.78$  with an excellent scale level average CVI (S-CVI-Ave) of 0.8

-The dichotomous and summative scoring method of the PIT Score was applied to 10 items across 3 key dimensions directly related to medication delivery: 'inhaler preparation', 'body positioning' and 'inhalation' (figure 5).

-These essential core dimensions can be simplified into '3P's' of inhaler technique optimisation: prepare, position and puff.

Figure 5: The Portsmouth Inhaler Technique (PIT) Score

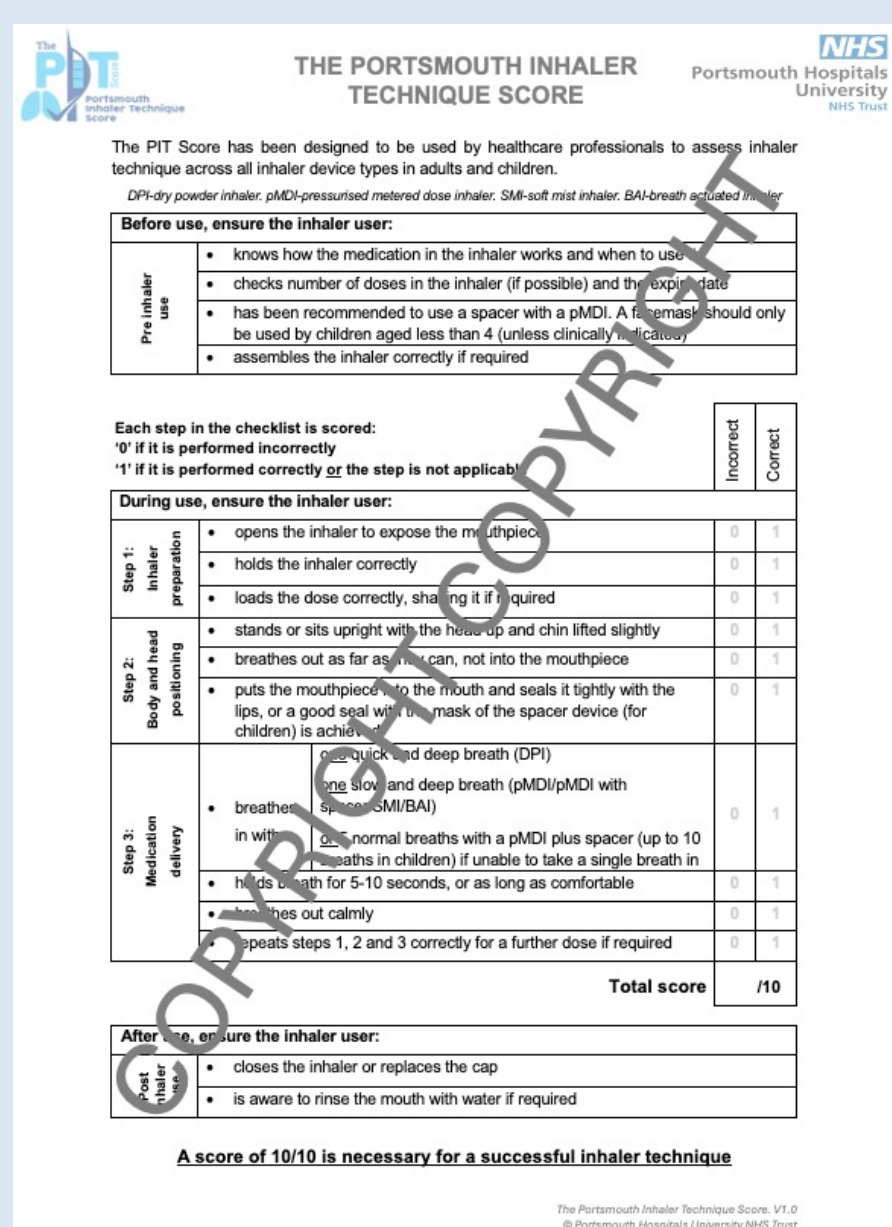
## Conclusions

-The PIT Score is the first validated tool in the UK to quantitatively measure inhaler technique across device types and age groups using a standardised checklist.

-Developed through a collaborative, iterative and expert-led process involving key respiratory stakeholders, core competencies and critical skills for effective inhaler use have been established.

-With a Flesch-Kincaid reading age of 11-14, the PIT Score enables healthcare professionals to identify errors and optimise inhaler use.

-The PIT Score addresses a critical gap in respiratory care by streamlining the evaluation of inhaler technique. This will improve the quality of patient care and support clinical decision making.



<sup>1</sup>Critical values for Lawshe's content validity ratio: Revisiting the original methods of calculation. Ayre and Scally (2014). Measurement and Evaluation in Counseling and Development;47(1):79-86 <sup>2</sup>Is the CVI an Acceptable Indicator of Content Validity? Appraisal and Recommendations. Polit et al. Research in Nursing Health (2007);30:459-467