

Method Comparison of Digital vs Mechanical Peak Flow Meters in an *in vivo* and Real-World Setting

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1 INTRODUCTION

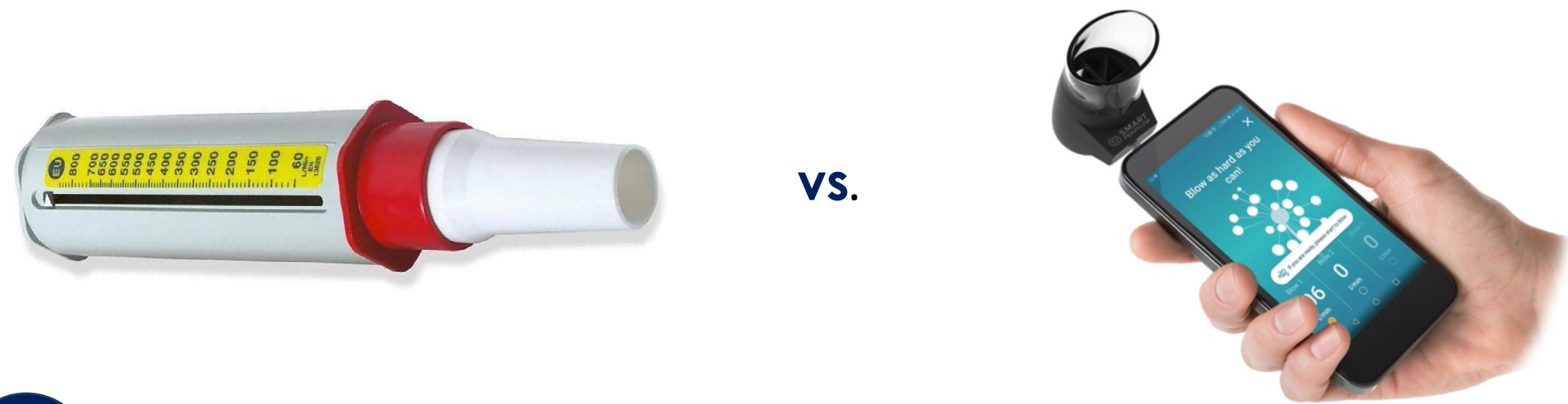
• Background:

Peak flow meters (PFMs) are used in clinical practice to measure peak expiratory flow rate (PEF) for the monitoring and diagnosis of asthma. PEF depends on several factors such as sex, height, weight and age. The degree of airway obstruction can be quantified by comparing PEF values as a % of predicted values.

The most widely-used mechanical PFM in the NHS is the Mini-Wright. There is a new, digital PFM (Smart Peak Flow) available for purchase which records results on an app and can be shared with healthcare professionals.

• Our aims:

To compare accuracy and repeatability between the Smart Peak Flow and Mini-Wright peak flow devices in participants with and without asthma.



2 METHODS

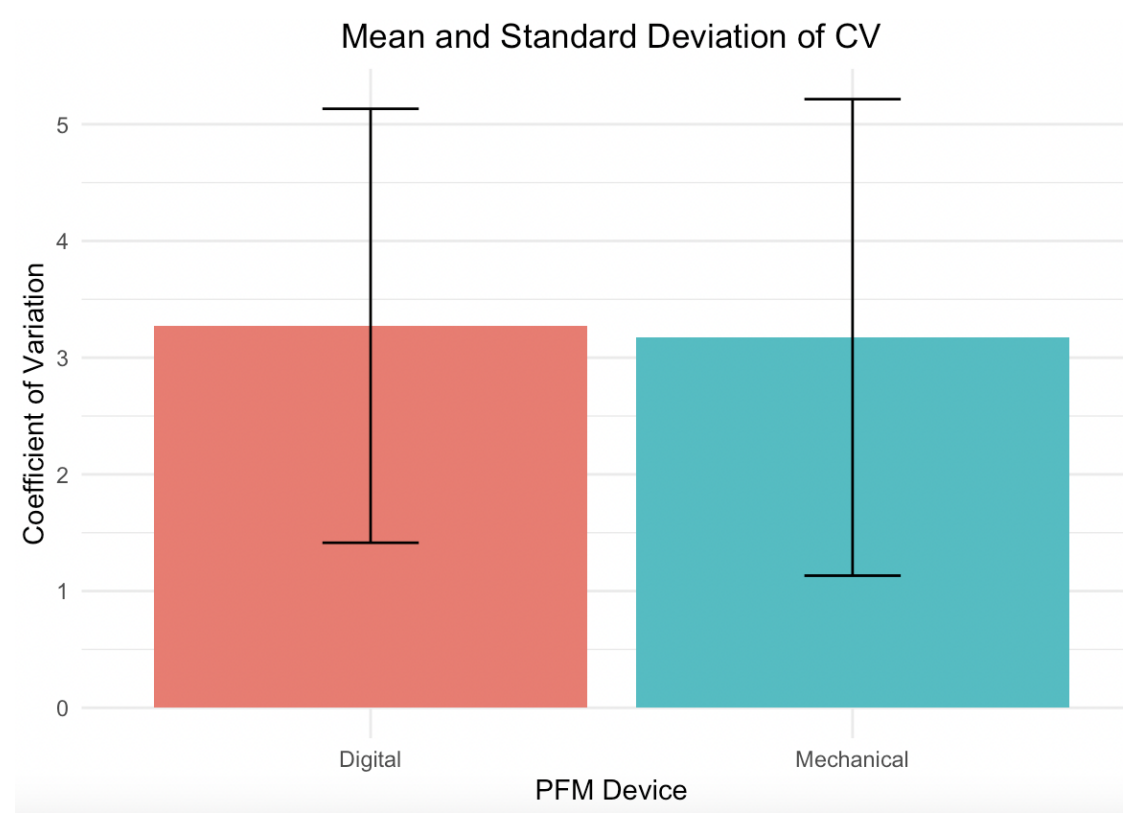
- Before recording began, participants underwent demonstration to confirm correct technique when performing PEF.
- Participant undertook 9 successive PEFs with devices connected in series, with 30 sec pauses between every 3 PEFs. Values were recorded in real-time using the reading from the manual PFM (to the nearest 5 L/min) and the smartphone reading from the digital PFM.
- Predicted PEF was calculated using age, sex and reported height, using standard formulae.
- Bland-Altman plots and paired t-test were used to assess accuracy and co-efficient of variation (CV) to assess repeatability.



2. Main Analysis:



PEF readings were higher by an average of 27.22 L/min (95% CI 26.29-28.15) on the digital PFM compared to the mechanical PFM. Limits of agreement were 0.59 – 53.86 L/min. When considering predicted PEF, this translates to an average difference of 5.5%.



Repeatability measured was similar between devices:
Mechanical CV (SD): 3.17 (2.04)
Digital CV (SD): 3.27 (1.85)
P=0.36



3 RESULTS

1. Summary of participant characteristics:

Participant Characteristics (N=91)		n (%)
Sex (Assigned at Birth)	Male	38 (41.8)
	Female	53 (58.2)
Age	18-20	8 (8.8)
	20-30	47 (51.6)
	31-40	16 (17.6)
	41-50	11 (12.0)
	51-60	7 (7.7)
	61-70	2 (2.2)
Ethnicity	White	62 (68.1)
	Asian/Asian British	11 (12.1)
	Black/Black British/Caribbean African	8 (8.8)
	Mixed/Multiple Ethnic Groups	1 (1.1)
	Other	9 (9.9)
Asthma Diagnosis	Yes	5 (5.5)
	No	86 (94.5)

4 DISCUSSION

- Summary:**
 - Digital PEF values read higher on average by 27.22 L/min (p<0.001)
 - Within-person variability was similar for both devices (p=0.36)
- Strengths/Limitations:**
 - Final analysis considered 819 paired PEF values – large sample size.
 - First study to research this in non-laboratory settings but real-life: more useful for applicability for clinical practice.
 - Conducted independently of the manufacturer (they provided the devices free-of-charge for the study but had no role in the analysis or interpretation).
 - Difference in PEF values between digital and mechanical PFMs may be due to the paired set-up used in our study design.
- Implications for practice:**
 - Device is currently available online for retail price: £50.
 - If patients choose to buy this device as an alternative to a mechanical PFM we can be confident that it is sufficiently accurate and repeatable to rely on results.
 - A paired study is underway to assess acceptability to asthma patients using it for monitoring.
 - Further studies are needed on utility for diagnosis and monitoring, including adherence, and whether use of the device is clinically and cost-effective to support wider NHS implementation.