

MEASURING PEAK COUGH FLOW IN THE CLINICAL SETTING: AN EVALUATION OF DEVICES AND INTERFACES



Thomas Wilson¹⁻⁴, Sarah Retica⁵, Luke McDonald⁴⁻⁶, Krisha Saravanan^{4,7}, Marlena Ahrens^{5,8}, Charissa Zaga^{2,4,9,10}, Anna Miles¹¹, Mark Howard^{4,8,12}, David Berlowitz^{4,5,6}, Nicole Sheers^{4,6}

1 Melbourne Academic Centre for Health (MACH), University of Melbourne, North Melbourne, VIC, Australia 2 Tracheostomy Review and Management Service (TRAMS), Austin Health, Heidelberg, VIC, Australia 3 Speech Pathology Department, Austin Health, Heidelberg, VIC, Australia 4 Institute for Breathing and Sleep, Austin Health, Heidelberg, VIC, Australia 5 Physiotherapy Department, Austin Health, Heidelberg, VIC, Australia 6 School of Health Sciences, The University of Melbourne, Parkville, VIC, Australia 7 Respiratory Department, Austin Health, Heidelberg, VIC, Australia 8 Department of Spinal Cord Injuries, BG Unfallklinik Murnau, Germany 9 Department of Critical Care, University of Melbourne 10 School of Allied Health, Human Service & Sport, La Trobe University, Bundoora, VIC, Australia 11 Speech Science, The University of Auckland, Auckland, New Zealand 12 Department of Medicine, University of Melbourne, Parkville, VIC, Australia

BACKGROUND

- Peak cough flow (PCF) is a widely used measure of cough function
- The degree of agreement between PCF measured between different devices and interfaces is unclear

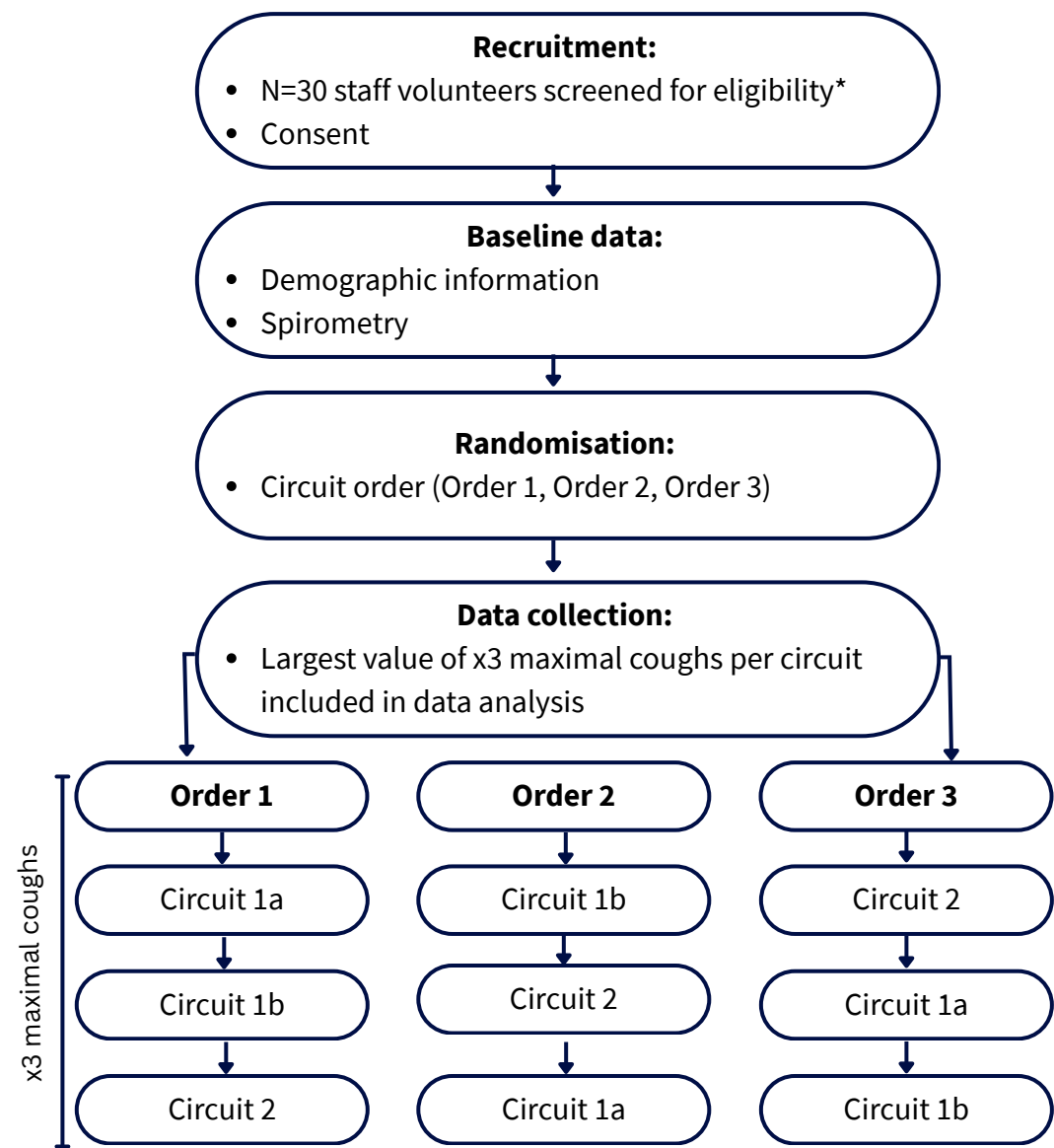
AIMS

- To examine the agreement between PCF measured by a:
- Peak flow meter vs. pneumotachometer vs. portable spirometer in healthy people
 - Mask vs. mouthpiece in healthy people and people with neuromuscular disease (PwNMD)

METHODS

- Two prospective, repeated measure experiments were conducted
- Ethical approval granted by the Austin Health Research and Ethics Committee (LNR/18/Austin/264)

Fig 1: Study Procedure for Experiment 1 (Between-Device Agreement)



*Eligibility included healthy adults, without disease or known respiratory conditions

Fig 2: Experiment 1 Circuit Configurations

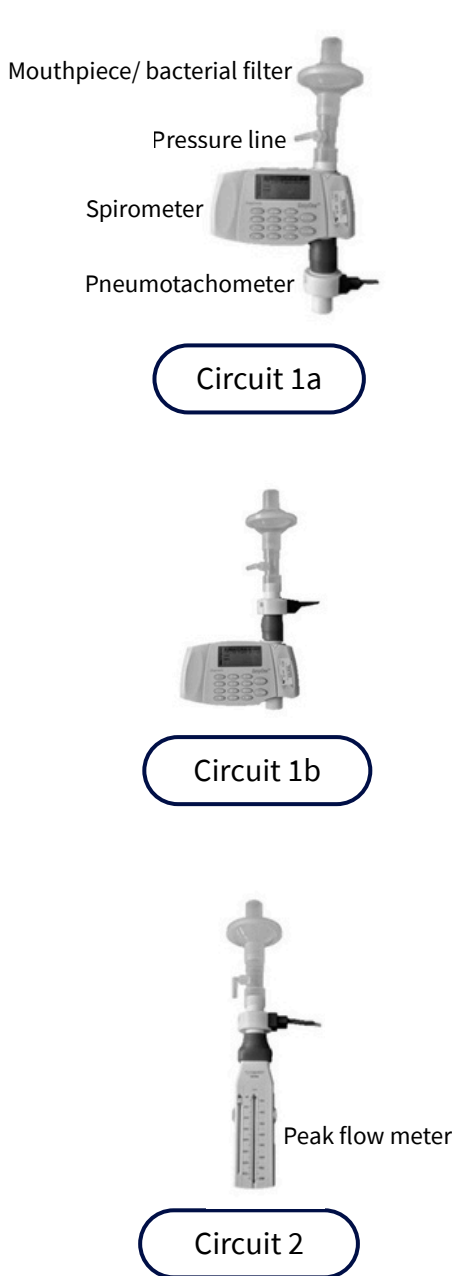
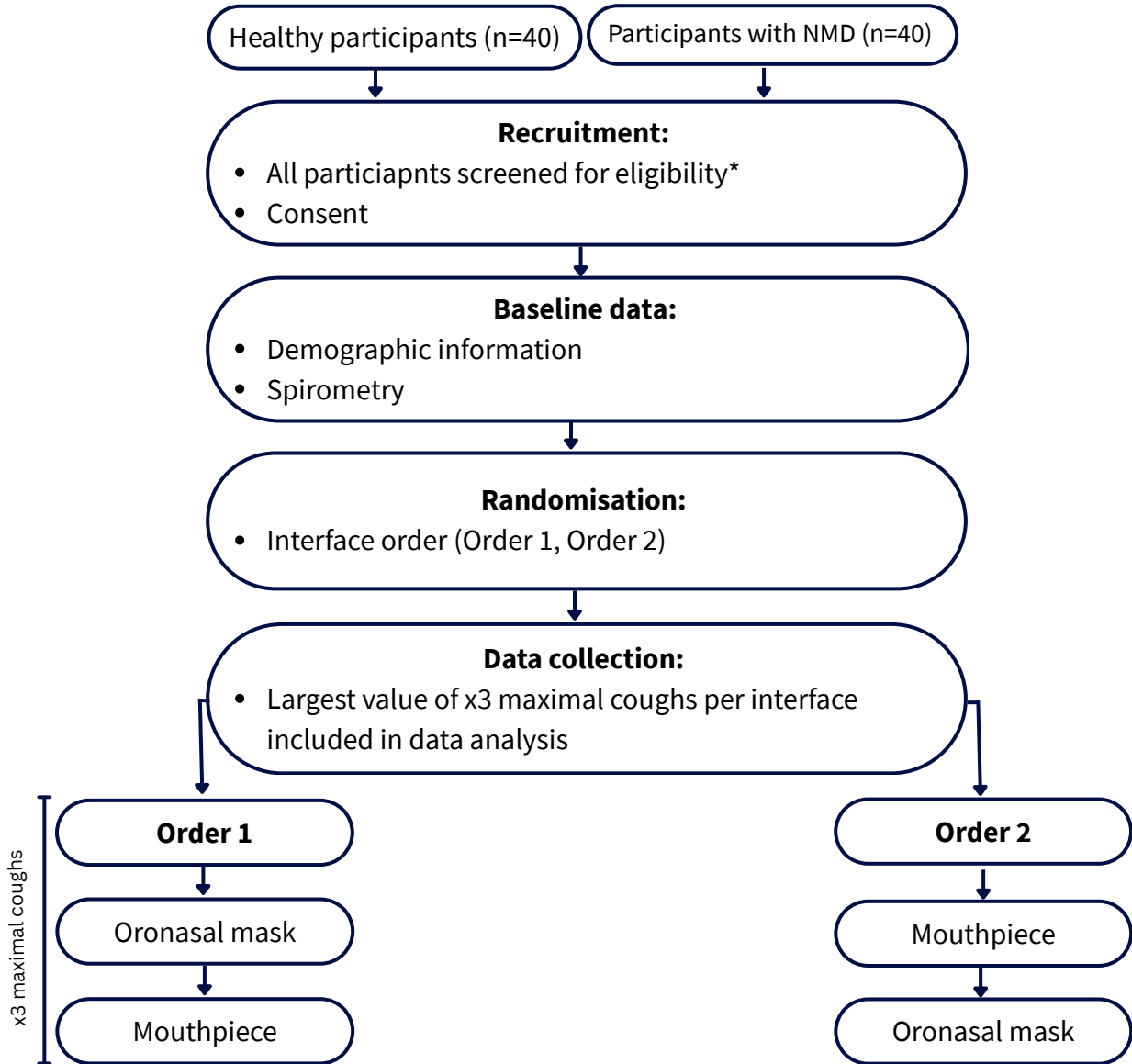


Fig 3: Study Procedure for Experiment 2 (Between-Interface Agreement)



*Eligibility included healthy adults, without disease and consecutive patients with a confirmed NMD diagnosis who attended inpatient or outpatient services of the state-wide, domiciliary ventilation service. All participants were >18 years of age, medically stable, not dependent on ventilation

RESULTS

Table 1: Participant Demographics

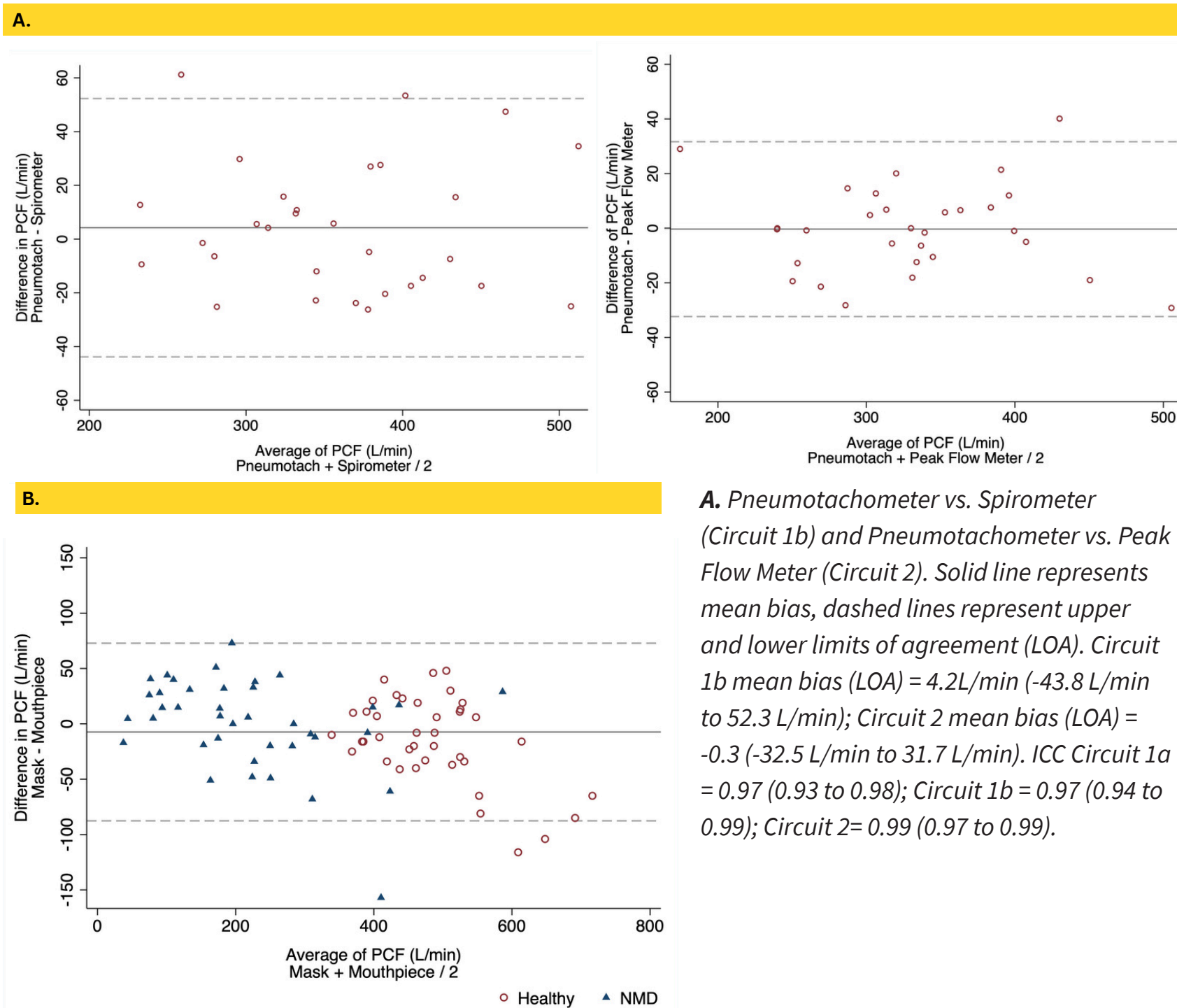
	Experiment 1	Experiment 2	
	Healthy participants n=30	Healthy participants n=40	Participants with NMD n=39
Age (years median IQR)	29 [26-43]	29 [25-32.5]	63 [51-73]
Sex (female) (%)	26 (87%)	34 (85%)	17 (43%)
Height	169.1 ± 8.4	169.0 ± 8.1	166.5 ± 8.9
BMI (kg/m ²)	25.5 ± 5.0	25.0 ± 4.6	26.3 ± 7.6
FEV1 (L)	3.13 ± 0.57	3.12 ± 0.63	1.06 ± 0.51
FVC (L)	3.98 ± 0.80	3.95 ± 0.75	1.46 ± 0.65
FVC (%pn)	96.2 ± 12.2	94.5 ± 11.9	41.5 ± 17.0
PCF Mean ± SD (Range)	362 ± 75 (229 - 530)	478 ± 79 (334 - 684)	220 ± 118 (29 - 601)
ALSFRS-R bulbar score ≤9 (%)	N/A	N/A	18 (45%)

BMI = body mass index; FEV1 = forced expiratory volume in one second, FVC = forced vital capacity; ALSFRS-R = Revised amyotrophic lateral sclerosis functional rating scale.

CONCLUSIONS

- There is limited interchangeability of devices and interfaces due to individual wide LOA
- Serial PCF measures should be standardised with the same device, interface and account for normal variability.

Fig 4: Bland and Altman Plots with Limits of Agreement



B. Group (all participants) mean bias (LOA) = -7.4 L/min (-87.6 L/min to 72.9 L/min). Mean bias (LOA) for PwNMD = 0.6 L/min (-81.4 L/min to 82.5 L/min); for healthy participants = -15.1 L/min (-91.6 L/min to 61.4 L/min). ICC for healthy participants = 0.95 (0.91 to 0.97); PwNMD = (0.95 to 0.98).



This research project gratefully acknowledges the support of all participants, and funding from MND Australia (Jim Zissimopoulos Postdoctoral Fellowship)