ONLINE SUPPLEMENTARY MATERIAL

Lung diffusing capacity for nitric oxide measured by two commercial devices: a randomised crossover comparison in healthy adults

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METHODS

Table S1. Device specifications for MasterScreen (Jaeger) and HypAir (Medisoft)

	MasterScreen	HypAir
Software Version	- Sentry Suite®, Version 3.0.4	- ExpAir, Version 1.34.01
Gas concentrations	- NO 400ppm, 0.04% - O_2 18.95% - CO 0.28 % - He 9.9%	- NO 400ppm, 0.04% - O_2 21% - CO 0.28 % - He 14%
Gas analysers	- Single sensors	- Single sensors
NO analyser	- Electrochemical cell (Type: 7NT Compact CiTiceL®, City Technology Ltd, City Technology Centre, Walton Rd, Portsmouth PO6 1SZ, UK). - Three electrode sensor - Measurement range: 0-100 ppm - Accuracy: 3ppm NO - Response time T_{90}: <15s - Resolution: 0.5 ppm - Repeatability: 2% of signal - Sensitivity: 0.55±0.11 μA/ppm - Output linearity: Linear	- Electrochemical cell (Type 3MNT, Part Number MFT60-014, CiTiceL®, City Technology Ltd, City Technology Centre, Walton Rd, Portsmouth PO6 1SZ, UK) - Three electrode sensor - Measurement range: 0-1000 ppm - Accuracy: <1% - Response time T_{90}: <10s at 20°C - Resolution: 0.5ppm - Repeatability: 2% of signal - Sensitivity: 1mV/ppm ± 5% - Output linearity: Linear
CO analyser	- Electrochemical cell - Range: 0-10 % CO - Accuracy: ± 0.003% CO (absolute) or ±1% CO <1% (relative) - Resolution: 0.0002% CO - Response time: T10-90 Sensor <40s	- Electrochemical cell - Range: 0-0.32 % CO - Accuracy: <1% (relative) - Resolution: N/A - Response time: 30-35s
O_2 analyser	- Electrochemical cell - Range: 0-100 % O_2 - Accuracy: ± 1% O_2 - Resolution: 0.05% O_2 - Response time $T1_{0-90}$: <12s	- Electrochemical cell - Range: 0-30 % O_2 - Accuracy: <1% O_2 - Resolution: N/A - Response time: <10s
He analyser	- Catharometer - Principle of thermal conductivity - Range: 0-10 % He - Accuracy: ± 0.05% He or ±2% He, whichever is greater - Resolution: 0.005% - Response time $_{T10-90}$: <200ms	- Catharometer - Principle of thermal conductivity - Range: 0-15.5 % He - Accuracy: < 1% He - Resolution: 0.005% - Response time: 5-10s

Flow transducer	- Pneumotach - Range: 0 to ± 20 L/s - Accuracy: 0.2 to 12 L/s: ± 2 % or 0.2 L/s, whichever is greater - Resolution: 10 mL/s - Resistance: < 0.05 kPa/(L/s) (0.5 $cmH_2O/(L/s)$) at 10 L/s	- Piezo-resistive differential pressure sensor - Linearity: <0.1 % - Relative accuracy: <0.5 % - Resolution: 0.007 L/s - Range: +-15 L/s adults; +-6 L/s Paediatric
Pressure transducer (Mouth pressure)	- Piezo-resistive - Range: ± 20 kPa (±150 mmHg) - Accuracy: ± 2 % - Resolution: 0.01 kPa (0.075 mmHg)	- Piezo-resistive - Linearity: < 0.1 % - Accuracy: < 0.5 % - Resolution: depends on the test
Gas reservoir	- Single bag for measurement of inspired gas concentrations. - Expired gas concentrations are measured within the device.	- Two separate bags to measure inspiratory and expiratory gas concentrations
Calculation of VA	VA = (VI – VD) x (He ins/He exp) VA, alveolar volume VI, inspired volume VD, deadspace volume He, helium	VA = (VI – VD) x (He ins/He exp) VA, alveolar volume VI, inspired volume VD, deadspace volume He, helium
Breath hold time	- 5 seconds (true apnoea) - Jones & Meade [1]	- 5 seconds (true apnoea) - Jones & Meade [1]
Calculations of total dead space	- Apparatus: 150 mL - Anatomic dead space: body weight x 2.2 - Filter: 55mL (see below)	- Apparatus: 100mL - Anatomic dead space: body weight x 2.2 - Filter: 55mL (see below)
Antibacterial filter	- Vitalograph ECO BVF™ - Dead space 55mL - Flow impedance <0.04 kPa/(L/s) at 1 L/s (< 0.4 $cmH_2O/(L/s)$ at 1 L/s)	- Vitalograph ECO BVF™ - Dead space 55mL - Flow impedance <0.04 kPa/(L/s) at 1 L/s (< 0.4 $cmH_2O/(L/s)$ at 1 L/s)
Sampling volume	- 750 mL	- 750 mL
Washout volume	- 750 mL	- 750 mL
Inspiratory volume	- ≥ 90% of vital capacity	- ≥ 90% of vital capacity

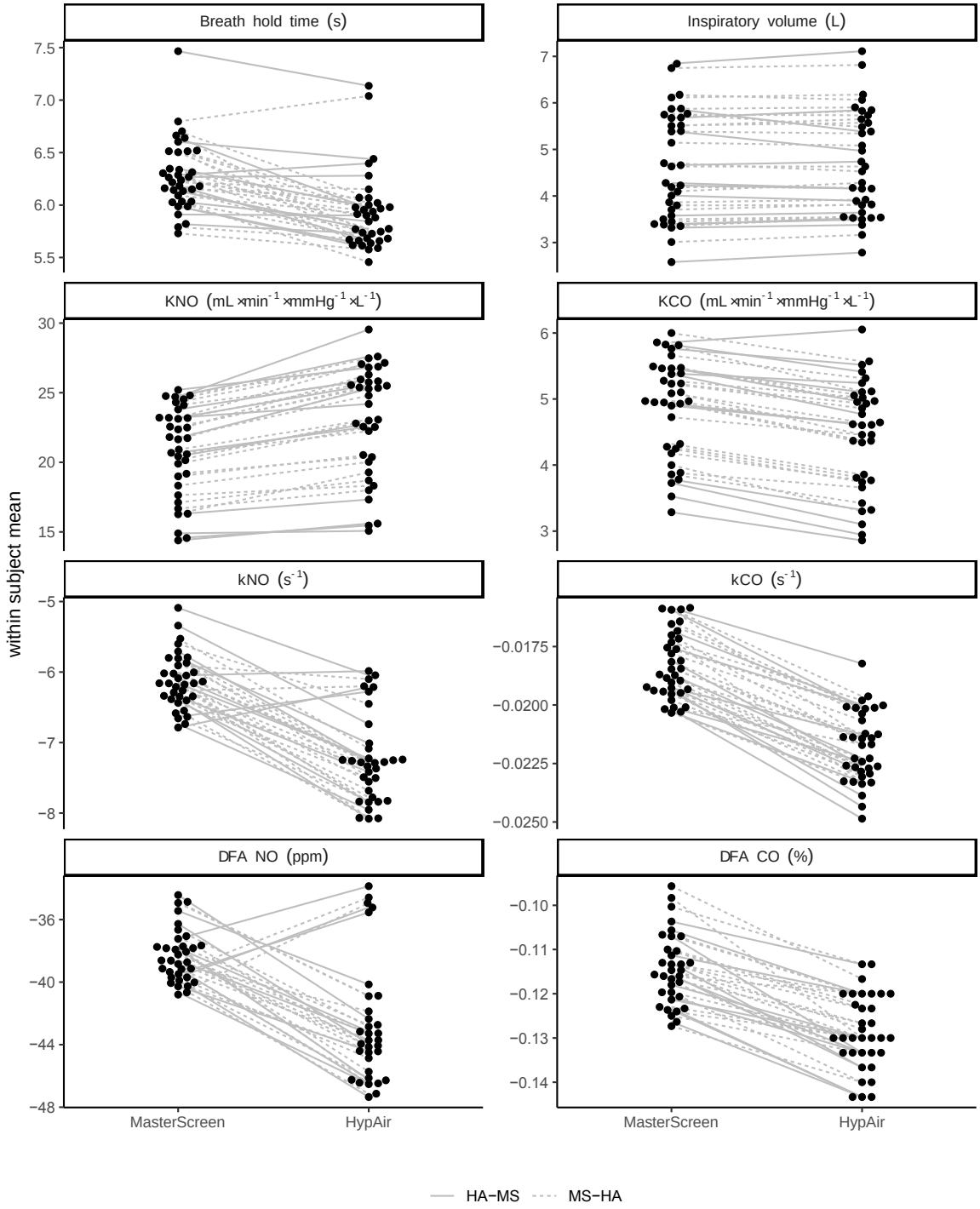
CO, carbon dioxide; He, helium; NO, nitric oxide; O_2, oxygen, VA, alveolar volume

Table S2. Inspired and expired gas concentrations for MasterScreen and HypAir

Variables	**MasterScreen**	**HypAir**
NO – inspired (ppm)	43.30 (43.19 to 43.60)	47.60 (46.27 to 48.93)
NO – expired (ppm)	5.07 (4.66 to 5.48)	4.78 (4.28 to 5.28)
NO - expired/inspired ratio	0.117 (0.107 to 0.127)	0.100 (0.090 to 0.110)
O_2 – inspired (%)	19.84 (19.64 to 20.04)	18.45 (18.13 to 18.77)
O_2 – expired (%)	17.40 (17.20 to 17.60)	16.34 (16.07 to 16.62)
O_2 - expired/inspired ratio	0.877 (0.870 to 0.884)	0.887 (0.873 to 0.900)
CO – inspired (%)	0.219 (0.217 to 0.220)	0.243 (0.241 to 0.246)
CO – expired (%)	0.104 (0.101 to 0.106)	0.114 (0.111 to 0.118)
CO - expired/inspired ratio	0.470 (0.458 to 0.481)	0.475 (0.464 to 0.468)
He – inspired (%)	7.61 (4.59 to 7.64)	12.17 (12.04 to 12.29)
He – expired (%)	5.61 (5.46 to 5.75)	8.32 (8.04 to 8.60)
He - expired/inspired ratio	0.737 (0.718 to 0.756)	0.683 (0.665 to 0.702)

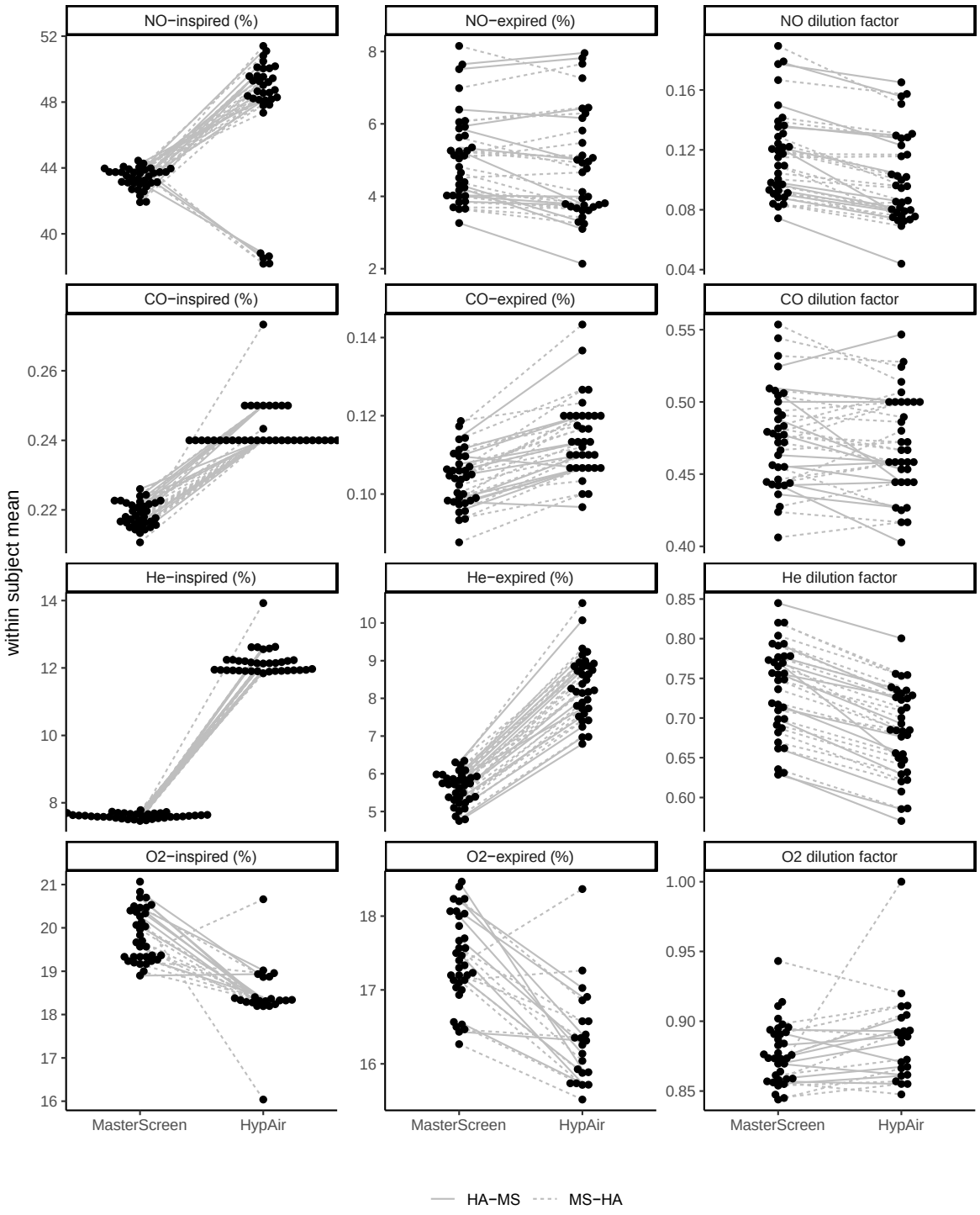
Data are means (95% confidence intervals). Inspired and expired gases concentrations for CO, carbon monoxide; He, helium; NO, nitric oxide, and O_2, oxygen.

Figure S1. Pulmonary diffusing capacity outcomes for MasterScreen and HypAir



Δ FA CO, expired – inspired gas concentration for carbon monoxide; Δ FA NO, expired – inspired gas concentration for nitric oxide; κCO, rate constant for CO removal from alveolar gas; KCO, physiological rate of CO uptake from alveolar gas; κNO, rate constant for NO removal from alveolar gas; KNO, physiological rate of NO uptake from alveolar gas; VA, alveolar volume.

Figure S2. Inspired and expired gas concentrations for MasterScreen and HypAir



CO, carbon monoxide; He, helium; NO, nitric oxide, and O_2, oxygen. Sequential measurements in random order: HypAir-MasterScreen (HA-MS) or MasterScreen-HypAir (MS-HA).

Table S3 Diffusing capacity outcomes from two biological controls during the study period.

Variables	**MasterScreen**			**HypAir**		
Person 1, male (26 years)	Mean (SD)	CV (%)	Mean variation	Mean (SD)	CV (%)	Mean variation
DLNO ($mL.min^{-1}.mmHg^{-1}$)	174.9 (5.4)	3.07	4.56	215.2 (6.8)	3.17	6.13
DLCO ($mL.min^{-1}.mmHg^{-1}$)	39.9 (0.8)	2.03	0.70	40.3 (0.9)	2.13	0.70
Alveolar volume (L)	7.6 (0.2)	2.72	0.13	8.4 (0.1)	1.62	0.10
KNO ($mL.min.^{-1}mmHg^{-1}.L^{-1}$)	22.2 (1.6)	3.15	1.03	25.8 (0.6)	2.19	0.47
KCO ($mL.min.^{-1}mmHg^{-1}.L^{-1}$)	5.19 (0.1)	2.68	0.12	4.83 (0.12)	2.38	0.09
κNO ($s.^{-1}$)	-6.30 (0.44)	-7.01	0.33	-7.86 (0.62)	-7.87	0.39
κCO ($s.^{-1}$)	-0.017 (0.00)	-11.99	0.002	-0.022 (0.01)	-4.55	0.001
Person 2, female (54 years)						
DLNO ($mL.min^{-1}.mmHg^{-1}$)	97.7 (3.0)	3.06	2.64	119.9 (3.3)	2.72	2.60
DLCO ($mL.min^{-1}.mmHg^{-1}$)	22.2 (0.6)	2.70	0.51	23.8 (0.4)	1.57	0.30
Alveolar volume (L)	4.40 (0.1)	1.05	0.04	4.91 (0.1)	0.92	0.03
KNO ($mL.min.^{-1}mmHg^{-1}.L^{-1}$)	22.2 (0.6)	2.70	0.51	24.39 (0.72)	2.97	0.54
KCO ($mL.min.^{-1}mmHg^{-1}.L^{-1}$)	5.3 (0.1)	1.76	0.07	4.85 (0.10)	1.99	0.09
κNO ($s.^{-1}$)	-6.08 (0.14)	-2.22	0.11	-7.44 (0.42)	-5.60	0.33
κCO ($s.^{-1}$)	-0.019 (0.00)	-2.27	0.000	-0.023 (0.001)	-3.94	0.0001

CV, coefficient of variation; DLCO, diffusing capacity for carbon monoxide; DLNO, diffusing capacity for nitric oxide; κCO, rate constant for CO removal from alveolar gas; KCO, physiological rate of CO uptake from alveolar gas; κNO, rate constant for NO removal from alveolar gas; KNO, physiological rate of NO uptake from alveolar gas; SD, standard deviation.

References

S1. Jones RS, Meade F. A theoretical and experimental analysis of anomalies in the estimation of pulmonary diffusing capacity by the single breath method. *Q J Exp Physiol Cogn Med Sci* 1961; 46: 131–143.