Appendix A

Table A.1. Comparison of actual and predicted values for all predictive equations of maximum respiratory mouth pressures (n=229).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Study, Country** | **Equation** | **Actual value, cmH2O** | **Predicted value, cmH2O** | **p-value** | **rs** | **Bias** | **95% CI** | **ICC** | **95% CI** |
| Black and Hyatt (1969)1, United States of America |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | 104 – (0.51 x age) | 79.4±21.7 | 70.7±5.3 | <0.001 | 0.33 | 8.7±20.7 | -31.8🡪49.2 | -0.15 | -0.06-0.35 |
| Pimax ♂ | 143 – (0.55 x age) | 94.7±27.2 | 105.8±5.0 | <0.001 | 0.42 | -11.1±25.5 | -61.1🡪39.0 | -0.15 | -0.02-0.31 |
| Pemax♀ | 170 – (0.53 x age) | 104.9±25.5 | 135.4±5.5 | <0.001 | 0.38 | -30.5±24.1 | -77.8🡪16.8 | 0.15 | -0.06-0.35 |
| Pemax♂ | 268 – (1.03 x age) | 141.3±35.7 | 198.4±9.4 | <0.001 | 0.38 | -57.1±33.6 | -122.8🡪8.7 | 0.17 | 0.01-0.33 |
| Wilson et al. (1984)2, United Kindom |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | -43 + (0.71 x Heightcm) | 79.4±21.7 | 67.6±4.6 | <0.001 | -0.06 | 11.8±22.3 | -31.9🡪55.5 | -0.006 | -0.22-0.20 |
| Pimax ♂ | 142 –(1.03 x age) | 94.7±27.2 | 72.4±9.4 | <0.001 | 0.42 | 22.4±24.8 | -26.3🡪71.1 | 0.26 | 0.10-0.40 |
| Pemax♀ | 3.5 + (0.55 x Heightcm) | 104.9±25.5 | 89.2±3.6 | <0.001 | 0.05 | 15.8±25.3 | -33.9🡪65.4 | 0.04 | -0.17-0.24 |
| Pemax♂ | 180 – (0.91 x age) | 141.3±35.7 | 118.5±8.3 | <0.001 | 0.38 | 22.8±33.7 | -43.2🡪88.8 | 0.16 | -0.01-0.31 |
| Enright et al. (1994)3, United States of America |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | (0.133 Wtlbs) - (0.805 Age) + 96 | 79.4±21.7 | 62.8±9.1 | <0.001 | 0.32 | 16.6±21.0 | -24.4🡪57.5 | 0.21 | 0.006-0.40 |
| Pimax ♂ | (0.131 Wtlbs) - (1.27 Age) + 153 | 94.7±27.2 | 90.0±12.4 | 0.040 | 0.44 | 4.8±24.6 | -43.4🡪53.0 | 0.32 | 0.17-0.46 |
| Pemax♀ | (0.344 Wtlbs) - (2.12 Age) + 219 | 104.9±25.5 | 121.8±19.9 | <0.001 | 0.39 | -16.9±25.7 | -67.3🡪33.5 | 0.37 | 0.18-0.54 |
| Pemax♂ | (0.250 Wtlbs) - (2.95 Age) + 347 | 141.3±35.7 | 173.3±22.7 | <0.001 | 0.44 | -32.0±33.6 | -97.9🡪33.9 | 0.37 | 0.22-0.50 |
| Enright et al. (1995)\*4, United States of America |  |  |  |  |  |  |  |  |  |
| Pimax♀ | 118 – (0.9 x age) + (0.10 x Wtlbs) | 79.4±21.7 | 73.8±9.8 | 0.032 | 0.33 | 5.6±20.9 | -35.4🡪46.5 | 0.23 | 0.03-0.42 |
| Pimax♂ | 149 – age + (0.10 x Wtlbs) | 94.7±27.2 | 98.8±9.8 | 0.058 | 0.44 | -4.1±24.7 | -52.4🡪44.3 | 0.27 | 0.11-0.42 |
| Johan et al. (1997)5 , Chia, Malaysia and India |  |  |  |  |  |  |  |  |  |
| Pimax♀ Chinese | 68.80 – (0.49 x age) – (0.05 x Heightcm) + (0.22 x Wtkg) | 79.4±21.7 | 43.6±5.7 | <0.001 | 0.31 | 35.8±20.8 | -4.9🡪76.5 | 0.15 | -0.07-0.34 |
| Pimax ♂ Chinese | 37.24 – (0.67 x age) + (0.15 x Heightcm) + (0.85 x Wtkg) | 94.7±27.2 | 84.5±12.7 | <0.001 | 0.36 | 10.3±26.0 | -40.6🡪61.2 | 0.25 | 0.09-0.40 |
| Pimax♀ Malay | 52.48 + (0.18 x age) – (0.09 x Heightcm) + (0.12 x Wtkg) | 79.4±21.7 | 58.2±2.3 | <0.001 | -0.25 | 21.3±22.4 | -22.7🡪65.2 | -0.05 | -0.26-0.16 |
| Pimax ♂ Malay | 151.32 – (0.33 x age) – (0.55 x Heightcm) + (0.38 x Wtkg) | 94.7±27.2 | 66.0±5.0 | <0.001 | 0.26 | 28.8±26.5 | -23.1🡪80.7 | 0.08 | -0.08-0.25 |
| Pimax♀ Indian | 54.65 – (0.48 x age) – (0.01 x Heightcm) + (0.24 x Wtkg) | 79.4±21.7 | 37.6±5.7 | <0.001 | 0.30 | 41.8±20.8 | 0.9🡪82.6 | 0.14 | -0.07-0.34 |
| Pimax ♂ Indian | 112.47 – (0.31 x age) – (0.31 x Heightcm)+ (0.51 x Wtkg) | 94.7±27.2 | 79.3±6.0 | <0.001 | 0.32 | 15.4±26.2 | -36.0🡪66.8 | 0.12 | -0.05-0.28 |
| Pemax ♀ Chinese | 112.14 – (0.59 x age) – (0.11 x Heightcm) – (0.07 x Wtkg) | 104.9±25.5 | 51.9±6.1 | <0.001 | 0.36 | 53.1±24.3 | 5.5🡪100.6 | 0.15 | -0.06-0.35 |
| Pemax ♂ Chinese | -106.17 – (0.52 x age) + (1.05 x Heightcm) + (1.03 x Wtkg) | 141.3±35.7 | 117.7±18.4 | <0.001 | 0.34 | 23.6±34.3 | -43.5🡪90.8 | 0.27 | 0.11-0.42 |
| Pemax ♀ Malay | 181.87 – (0.16 x age) – (0.90 x Heightcm) – (0.43 x Wtkg) | 104.9±25.5 | 2.78±8.6 | <0.001 | 0.42 | 102.1±27.8 | 47.7 🡪156.6 | -0.06 | -0.27-0.15 |
| Pemax ♂ Malay | 109.82 + (0.05 x age) – (0.22 x Heightcm) + (0.30 x Wtkg) | 141.3±35.7 | 99.7±3.0 | <0.001 | 0.18 | 41.6±35.3 | -27.5🡪110.8 | 0.03 | -0.14-0.19 |
| Pemax ♀ Indian | 130.36 – (0.49 x age) – (0.40 x Heightcm) + (0.17 x Wtkg) | 104.9±25.5 | 47.3±5.5 | <0.001 | 0.37 | 57.6±24.3 | 9.9 🡪105.3 | 0.13 | -0.08-0.33 |
| Pemax ♂ Indian | -13.66 – (0.62 x age) + (0.79 x Heightcm) + (0.06 x Wtkg) | 141.3±35.7 | 82.83±8.9 | <0.001 | 0.33 | 58.5±33.6 | -7.3 🡪124.3 | 0.17 | 0.00-0.32 |
| Morales et al. (1997)6, Spain |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | (-0.64 x age) + 125.18 | 79.4±21.7 | 83.4±6.7 | 0.022 | 0.33 | -4.0±20.6 | -44.4🡪36.4 | 0.18 | -0.03-0.37 |
| Pimax ♂ | (-1.03 x age) + (0.59 x Wtkg) + 133.07 | 94.7±27.2 | 110.0±12.2 | <0.001 | 0.41 | -15.2±24.9 | -64.1🡪33.6 | 0.30 | 0.14-0.44 |
| Pemax♀ | (-0.57 x age) +( 0.65 x Wtkg) + 116.23 | 104.9±25.5 | 122.0±9.5 | <0.001 | 0.33 | -17.1±24.1 | -64.3🡪30.1 | 0.22 | 0.01-0.41 |
| Pemax♂ | (-1.31 x age) + 263.12 | 141.3±35.7 | 174.6±12.0 | <0.001 | 0.38 | -33.3±33.4 | -98.8🡪32.3 | 0.21 | 0.05-0.37 |
| Neder et al. (1999)7, Brazil |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | (-0.49 x age) + 110.4 | 79.4±21.7 | 78.4±5.1 | 0.950 | 0.33 | 1.0±20.7 | -39.6🡪41.5 | 0.14 | -0.07-0.34 |
| Pimax ♂ | (-0.80 x age) + 155.3 | 94.7±27.2 | 101.2±7.3 | 0.003 | 0.42 | -6.5±25.1 | -55.6 🡪42.7 | 0.21 | 0.05-0.37 |
| Pemax♀ | (-0.61 x age) + 115.6 | 104.9±25.5 | 75.8±6.4 | <0.001 | 0.38 | 29.1±24.0 | -17.9 🡪76.2 | 0.17 | -0.04-0.36 |
| Pemax♂ | (-0.81 x age) + 165.3 | 141.3±35.7 | 110.5±7.4 | <0.001 | 0.38 | 30.8±33.8 | -35.5🡪97.0 | 0.14 | -0.03-0.30 |
| Hautmann et al. (2000)8, Germany |  |  |  |  |  |  |  |  |  |
| Pimax♀ | (-0.024 x age) + 8.55 | 79.4±21.7 | 71.2±2.5 | 0.002 | 0.33 | 8.2±21.1 | -33.1🡪49.5 | 0.07 | -0.14-0.28 |
| Pimax ♂ | (0.158 x BMI) -(0.051 x age) + 8.22 | 94.7±27.2 | 93.2±7.8 | 0.780 | 0.32 | 1.1±26.0 | -49.8🡪52.0 | 0.15 | -0.02-0.31 |
| Wohlgemuth et al. (2003)9, The Netherlands |  |  |  |  |  |  |  |  |  |
| Pimax | 7.224 – (0.0406 x age) + (0.032 x Wtkg) + 3.745 | 88.9±26.3 | 76.3±10.1 | <0.001 | 0.44 | 12.5±23.4 | -33.4🡪58.4 | 0.31 | 0.19-0.42 |
| Pemax | 7.224 – (0.0406 x age) + (0.032 x Wtkg) – (0.041 x age) | 123.2±37.0 | 101.6±14.75 | <0.001 | 0.49 | 25.1±33.3 | -40.2🡪90.3 | 0.41 | 0.30-0.51 |
| Sachs et al. (2009)10, United States of America |  |  |  |  |  |  |  |  |  |
| Pimax♀ | - 388 + (1.77 x age) + (-0.014 x age2) + (0.41 x Wtlbs) + (-0.0041 x age x Wtlbs) + (4.69 x Heightcm) + (-0.014 x Height2cm) | 79.4±21.7 | 116.4±11.4 | <0.001 | 0.06 | -37.0±24.0 | -84.09 🡪9.99 | 0.04 | -0.17-0.25 |
| Pimax ♂ | 9.8 + (-0.31 x age) + (1.47 x Wtlbs) + (-0.0026 x Wt2lbs) + (-0.0059 x age x Wtlbs) | 94.7±27.2 | 94.9±13.5 | 0.940 | 0.47 | -0.2±24.2 | -47.66🡪47.29 | 0.37 | 0.21-0.50 |
| Costa et al. (2010)11, Brazil |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | (−0.46 × age) + 74.25 | 79.4±21.7 | 44.2±4.8 | <0.001 | 0.33 | 35.2±20.7 | -5.4🡪75.8 | 0.14 | -0.08-0.33 |
| Pimax ♂ | (−1.24 × age) + 232.37 | 94.7±27.2 | 148.5±11.4 | <0.001 | 0.42 | -53.8±24.8 | -102.3🡪-5.3 | 0.30 | 0.14-0.44 |
| Pemax♀ | (−0.68 × age) + 119.35 | 104.9±25.5 | 75.0±7.1 | <0.001 | 0.38 | 30.0±23.9 | -17.0🡪76.9 | 0.18 | -0.03-0.38 |
| Pemax♂ | (−1.26 × age) + 183.31 | 141.3±35.7 | 98.1±11.6 | <0.001 | 0.38 | 43.2±33.4 | -22.4🡪108.7 | 0.20 | 0.04-0.36 |
| Simões et al. (2010)12, Brazil |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | (-0.85 x age) + 80.7 + (-0.3 x Wtkg) | 79.4±21.7 | 5.4±9.3 | <0.001 | 0.31 | 74.0±21.0 | 32.9 🡪115.1 | 0.21 | 0.006-0.41 |
| Pimax ♂ | (-0.76 x age) + 125 | 94.7±27.2 | 73.6±7.0 | <0.001 | 0.42 | 21.1±25.1 | -28.1🡪70.4 | 0.20 | 0.04-0.35 |
| Pemax♀ | (-0.89 x age) + 125.1 + (-0.18 x Wtkg) | 104.9±25.5 | 55.1±9.4 | <0.001 | 0.35 | 49.8±24.2 | 2.3🡪97.3 | 0.21 | -0.001-0.40 |
| Pemax♂ | (-0.83 x age) + 87.69 | 141.3±35.7 | 31.6±7.6 | <0.001 | 0.38 | 109.7±33.8 | 43.5🡪175.9 | 0.14 | -0.02-0.30 |
| Gopalakrishna et al. (2012)13 , India |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | 45.98 + (6.47 x age) | 79.4±21.7 | 468.4±67.4 | <0.001 | -0.33 | -389.0±77.1 | -540.1🡪-237.8 | -0.19 | -0.40-0.02 |
| Pimax ♂ | 83.36 – (0.25 x age) | 94.7±27.2 | 66.46±2.3 | <0.001 | 0.42 | 28.3±26.3 | -23.3🡪79.9 | 0.07 | -0.10-0.23 |
| Pemax♀ | 74.85 – (0.32 x age) | 104.9±25.5 | 54.0±3.3 | <0.001 | 0.38 | 51.0±24.6 | 2.9🡪99.1 | 0.09 | -0.12-0.29 |
| Pemax♂ | 133.36 – (0.907 x age) | 141.3±35.7 | 72.0±8.3 | <0.001 | 0.38 | 69.3±33.7 | 3.3🡪135.3 | 0.15 | -0.01-0.31 |
| Harik-Khan et al. (2012)14, United States of America |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | 171 – (0.694 x age) + (0.861 x Wtkg) – (0.743 x Heightcm) | 79.4±21.7 | 66.9±11.6 | <0.001 | 0.25 | 12.5±22.2 | -31.1🡪56.1 | 0.18 | -0.03-0.38 |
| Pimax ♂ | 126 – (1.028 x age) + (0.343 x Wtkg) | 94.7±27.2 | 83.6±10.6 | <0.001 | 0.43 | 11.2 ±24.7 | -37.2🡪59.5 | 0.29 | 0.13-0.43 |
| Pessoa et al. (2014)15, Brazil |  |  |  |  |  |  |  |  |  |
| Pimax | 63.27 – (0.55 x age) + (0.58 x Wtkg) | 88.9±26.3 | 80.6±14.7 | <0.001 | 0.40 | 8.3±24.4 | -39.6🡪56.1 | 0.34 | 0.22-0.45 |
| Sanchez et al. (2018)16, Brazil |  |  |  |  |  |  |  |  |  |
| Pimax model 2♀ | –94.75 + (0.816 x age) – (1.822 x BMI) | 79.4±21.7 | 92.6±12.4 | <0.001 | 0.17 | -13.3±23.2 | -58.7🡪32.2 | -0.14 | -0.34-0.07 |
| Pimax model 2♂ | –108.16 + (1.307 x age) – (2.904 x BMI) | 94.7±27.2 | 100.0±16.4 | <0.001 | 0.36 | -5.7±26.8 | -58.1🡪46.8 | -0.28 | -0.43- -0.12 |
| Pemax model 2♀ | 91.58 – (0.556 x age) + (0.798 x BMI) | 104.9±25.5 | 77.7±6.9 | <0.001 | 0.32 | 27.2±24.5 | -20.8🡪75.3 | 0.14 | -0.07-0.34 |
| Pemax model 2♂ | 98.36 – (0.672 x age) + (1.759 x BMI) | 141.3±35.7 | 101.5±9.1 | <0.001 | 0.43 | 39.4±33.5 | -26.3🡪105.0 | 0.18 | 0.01-0.33 |
| Pimax model 3♀ | –95.54 + (0.748 x age) – (0.688 x Wtkg) | 79.4±21.7 | 92.2±11.1 | <0.001 | 0.25 | -12.8±22.0 | -55.9🡪30.2 | -0.19 | -0.39-0.02 |
| Pimax model 3♂ | –110.07 + (1.208 x age) – (0.942 x Wtkg) | 94.7±27.2 | 102.6±16.3 | <0.001 | 0.40 | -8.1±25.9 | -58.8 🡪42.7 | -0.34 | -0.47- -0.18 |
| Pemax model 3♀ | 87.20 – (0.506 x age ) + (0.350 x Wtkg) | 104.9±25.5 | 77.3±6.7 | <0.001 | 0.39 | 27.6±23.9 | -19.2 🡪74.4 | 0.18 | -0.03-0.38 |
| Pemax model 3♂ | 98.84 – (0.610 x age) + (0.576 x Wtkg) | 141.3±35.7 | 103.0±9.1 | <0.001 | 0.46 | 38.2±33.0 | -26.5 🡪102.9 | 0.20 | 0.03-0.35 |
| Bruschi et al. (1992)17, Italy |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | 4.02 – 0.26 – (0.004 x age) + (0.47 x BSA) (from RV)  3.89 – 0.22 – (0.004 x age) + (0.52 x BSA) (from FRC) | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Pimax ♂ | 4.02 – (0.004 x age) + (0.47 x BSA) (from RV)  3.89 – (0.004 x age) + (0.52 x BSA) (from FRC) | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Pemax ♀ | 4.48 – 0.18 – (0.0004 x age) – (0.003 x age) + (0.25 x BSA) (from TLC)  4.54 – 0.35 – (0.003 x age) + (0.24 x BSA) (from FRC) | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Pemax ♂ | 4.48 – 0.18 – (0.0004 x age) – (0.003 x age) + (0.25 x BSA) (from TLC)  4.54 – 0.35 – (0.003 x age) + (0.24 x BSA) (from FRC) | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Windisch et al. (2004)18, Germany |  |  |  |  |  |  |  |  |  |
| Pimax ♀ | y + (-0.08 x age) + (0.04 x Wtkg) + (0.11x BMI)# | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Pimax ♂ | y + (-0.04 x age) + (0.06 x Wtkg) + (0.24 x BMI)# | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Lausted et al. (2006)19, United States of America |  | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Pimax ♀ | 0.234 x Ln (100% - %VC) - 0.0828 | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Pimax ♂ | 0.234 x Ln (100% - %VC) - 0.0828 | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Pemax♀ | 0.1426 x Ln (%VC) + 0.3402 | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |
| Pemax♂ | 0.1426 x Ln (%VC) + 0.3402 | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested | Not tested |

Results are expressed in mean±standard deviation, unless otherwise stated. CI: confidence intervals; Pemax: maximum expiratory pressure; Pimax: maximum inspiratory pressure; rs: spearman correlation coefficient; ICC: intraclass correlation coefficient; BSC: body surface area; %VC: percentage of vital capacity; Wtlb: weight in pounds; Wtkg weight in kilograms; BMI: body mass index; RV: residual volume; TLC: Total lung capacity; FRC: Functional residual capacity; Heightcm: Height in centimeters.

*\** Pemax is equal to study by the same author in 1999

#Authors were contacted for constant in the model. No response was obtained.

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