Supplemental Appendix 3

**Detailed comparison between results obtained in the derivation and validation group.**

In order to validate our score in an independent group of patients, 100 additional consecutive patients who had a polysomnography (PSG) were recruited. In that new sample, DES-OSA score was calculated before PSG. Newly obtained DES-OSA scores and PSG-recorded apnea hypopnea index (AHI) then served for further statistical analysis. These analyses were performed using XLSAT for Mac® (version 2015.2.02) and MEDCALC for Windows® (Version 15.6.1).

**Table 1:** Comparisons of sensitivities and specificities. Statistics observed in the derivation group and the validation group for multiple threshold values of the DES-OSA score in terms of Sensitivity (Se), Specificity (Sp), Positive Predictive value (PPV), Negative predictive value (NPV) and Cohen Kappa coefficient at detecting at least mild, moderate to severe and severe OSA (AHI >5, >15 and >30 events/hr, respectively).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Th | Se  (95% CI) | Sp  (95% CI) | Se + Sp | PPV  (TP/TP+FP) | NPV  (TN/TN+FN) | Kappa |
| AHI >5  events/hr | Derivation Group  (n = 139) | 1 | 1.000  (0.958 to 1.000) | 0.000  (0.000 to 0.142) | 1.000 | 0.791  (110/139) | /  (0/0) | 0.000  (0.000 to 0.000) |
| 2 | 1.000  (0.958 to 1.000) | 0.103  (0.029 to 0.274) | 1.103 | 0.809  (110/136) | 1.000  (3/3) | 0.154  (-0.002 to 0.311) |
| 3 | 0.982  (0.931 to 0.999) | 0.138  (0.050 to 0.313) | 1.120 | 0.812  (108/133) | 0.667  (4/6) | 0.169  (-0.003 to 0.341) |
| 4 | 0.927  (0.860 to 0.964) | 0.414  (0.256 to 0.593) | 1.341 | 0.857  (102/119) | 0.600  (12/20) | 0.385  (0.192 to 0.578) |
| 5 | 0.827  (0.745 to 0.887) | 0.724  (0.540 to 0.854) | 1.551 | 0.919  (91/99) | 0.525  (21/30) | 0.484  (0.319 to 0.648) |
| 6 | 0.673  (0.580 to 0.753) | 0.828  (0.648 to 0.927) | 1.500 | 0.937  (74/79) | 0.400  (24/60) | 0.359  (0.217 to 0.501) |
| 7 | 0.500  (0.408 to 0.592) | 0.931  (0.767 to 0.990) | 1.431 | 0.965  (55/57) | 0.329  (27/82) | 0.258  (0.149 to 0.366) |
| 8 | 0.291  (0.214 to 0.382) | 0.966  (0.811 to 1.000) | 1.256 | 0.970  (32/33) | 0.264  (28/106) | 0.130  (0.060 to 0.200) |
| 9 | 0.109  (0.063 to 0.183) | 1.000  (0.858 to 1.000) | 1.109 | 1.000  (12/12) | 0.228  (29/127) | 0.049  (0.017 to 0.080) |
| 10 | 0.018  (0.001 to 0.069) | 1.000  (0.858 to 1.000) | 1.018 | 1.000  (2/2) | 0.212  (29/137) | 0.008  (-0.003 to 0.019) |
| Validation Group  (n = 100) | 1 | 1.000  (0.950 to 1.000) | 0.000  (0.000 to 0.326) | 1.000 | 0.900  (90/100) | /  (0/0) | 0.000  (0.000 to 0.000) |
| 2 | 1.000  (0.950 to 1.000) | 0.200  (0.049 to 0.522) | 1.200 | 0.918  (90/98) | 1.000  (2/2) | 0.310  (-0.021 to 0.642) |
| 3 | 0.989  (0.933 to 1.000) | 0.200  (0.049 to 0.522) | 1.189 | 0.918  (89/97) | 0.667  (2/3) | 0.274  (-0.047 to 0.597) |
| 4 | 0.956  (0.887 to 0.986) | 0.400  (0.169 to 0.688) | 1.356 | 0.935  (86/92) | 0.500  (4/8) | 0.390  (0.086 to 0.694) |
| 5 | 0.911  (0.831 to 0.956) | 0.500  (0.238 to 0.762) | 1.411 | 0.943  (82/87) | 0.385  (5/13) | 0.363  (0.089 to 0.636) |
| 6 | 0.789  (0.692 to 0.861) | 0.800  (0.478 to 0.951) | 1.589 | 0.973  (71/73) | 0.296  (8/27) | 0.335  (0.133 to 0.537) |
| 7 | 0.667  (0.564 to 0.755) | 0.900  (0.571 to 1.000) | 1.567 | 0.984  (60/61) | 0.231  (9/39) | 0.248  (0.094 to 0.401) |
| 8 | 0.400  (0.305 to 0.503) | 1.000  (0.674 to 1.000) | 1.400 | 1.000  (36/36) | 0.156  (10/64) | 0.118  (0.042 to 0.193) |
| 9 | 0.156  (0.094 to 0.246) | 1.000  (0.674 to 1.000) | 1.156 | 1.000  (14/14) | 0.116  (10/86) | 0.035  (0.007 to 0.064) |
| 10 | 0.067  (0.029 to 0.142) | 1.000  (0.674 to 1.000) | 1.067 | 1.000  (6/6) | 0.106  (10/94) | 0.014  (-0.001 to 0.028) |
| 11 | 0.056  (0.021 to 0.128) | 1.000  (0.674 to 1.000) | 1.056 | 1.000  (5/5) | 0.105  (10/95) | 0.012  (-0.001 to 0.024) |
| 12 | 0.022  (0.002 to 0.083) | 1.000  (0.674 to 1.000) | 1.022 | 1.000  (2/2) | 0.102  (10/98) | 0.004  (-0.002 to 0.011) |
| AHI >15  events/hr | Derivation Group  (n = 139) | 1 | 1.000  (0.946 to 1.000) | 0.000  (0.000 to 0.079) | 1.000 | 0.597  (83/139) | /  (0/0) | 0.000  (0.000 to 0.000) |
| 2 | 1.000  (0.946 to 1.000) | 0.054  (0.013 to 0.153) | 1.054 | 0.610  (83/136) | 1.000  (3/3) | 0.063  (-0.006 to 0.133) |
| 3 | 1.000  (0.946 to 1.000) | 0.107  (0.047 to 0.219) | 1.107 | 0.624  (83/133) | 1.000  (6/6) | 0.125  (0.031 to 0.219) |
| 4 | 0.952  (0.878 to 0.984) | 0.286  (0.184 to 0.416) | 1.238 | 0.664  (79/119) | 0.800  (16/20) | 0.265  (0.126 to 0.405) |
| 5 | 0.880  (0.790 to 0.935) | 0.536  (0.407 to 0.660) | 1.415 | 0.737  (73/99) | 0.750  (30/40) | 0.435  (0.284 to 0.587) |
| 6 | 0.771  (0.669 to 0.849) | 0.732  (0.603 to 0.831) | 1.503 | 0.810  (64/79) | 0.683  (41/60) | 0.497  (0.352 to 0.643) |
| 7 | 0.590  (0.483 to 0.690) | 0.857  (0.839 to 0.928) | 1.448 | 0.860  (49/57) | 0.585  (48/82) | 0.416  (0.278 to 0.554) |
| 8 | 0.349  (0.256 to 0.457) | 0.929  (0.824 to 0.976) | 1.278 | 0.879  (29/33) | 0.491  (52/106) | 0.243  (0.128 to 0.358) |
| 9 | 0.133  (0.075 to 0.224) | 0.982  (0.895 to 1.000) | 1.115 | 0.917  (11/12) | 0.433  (55/127) | 0.095  (0.025 to 0.165) |
| 10 | 0.024  (0.002 to 0.090) | 1.000  (0.921 to 1.000) | 1.024 | 1.000  (2/2) | 0.409  (56/137) | 0.019  (-0.008 to 0.047) |
| Validation Group  (n = 100) | 1 | 1.000  (0.933 to 1.000) | 0.000  (0.000 to 0.127) | 1.000 | 0.670  (67/100) | /  (0/0) | 0.000  (0.000 to 0.000) |
| 2 | 1.000  (0.933 to 1.000) | 0.061  (0.008 to 0.208) | 1.061 | 0.684  (67/98) | 1.000  (2/2) | 0.080  (-0.026 to 0.185) |
| 3 | 1.000  (0.933 to 1.000) | 0.091  (0.025 to 0.245) | 1.091 | 0.691  (67/97) | 1.000  (3/3) | 0.118  (-0.006 to 0.243) |
| 4 | 1.000  (0.933 to 1.000) | 0.242  (0.127 to 0.413) | 1.242 | 0.728  (67/92) | 1.000  (8/8) | 0.300  (0.130 to 0.470) |
| 5 | 0.970  (0.890 to 0.997) | 0.333  (0.198 to 0.505) | 1.303 | 0.747  (65/87) | 0.846  (11/13) | 0.359  (0.175 to 0.542) |
| 6 | 0.896  (0.796 to 0.951) | 0.606  (0.436 to 0.753) | 1.502 | 0.822  (60/73) | 0.741  (20/27) | 0.526  (0.346 to 0.706) |
| 7 | 0.806  (0.694 to 0.884) | 0.788  (0.619 to 0.895) | 1.594 | 0.885  (54/61) | 0.667  (26/39) | 0.568  (0.401 to 0.734) |
| 8 | 0.522  (0.405 to 0.637) | 0.970  (0.831 to 1.000) | 1.492 | 0.972  (35/36) | 0.500  (32/64) | 0.397  (0.258 to 0.537) |
| 9 | 0.209  (0.128 to 0.323) | 1.000  (0.873 to 1.000) | 1.209 | 1.000  (14/14) | 0.384  (33/86) | 0.148  (0.066 to 0.231) |
| 10 | 0.090  (0.039 to 0.186) | 1.000  (0.873 to 1.000) | 1.090 | 1.000  (6/6) | 0.351  (33/94) | 0.061  (0.010 to 0.112) |
| 11 | 0.075  (0.029 to 0.168) | 1.000  (0.873 to 1.000) | 1.075 | 1.000  (5/5) | 0.347  (33/95) | 0.050  (0.005 to 0.096) |
| 12 | 0.030  (0.003 to 0.110) | 1.000  (0.873 to 1.000) | 1.030 | 1.000  (2/2) | 0.347  (33/98) | 0.020  (-0.008 to 0.048) |
| AHI >30  events/hr | Derivation Group  (n = 139) | 1 | 1.000  (0.909 to 1.000) | 0.000  (0.000 to 0.050) | 1.000 | 0.345  (48/139) | /  (0/0) | 0.000  (0.000 to 0.000) |
| 2 | 1.000  (0.909 to 1.000) | 0.033  (0.008 to 0.098) | 1.033 | 0.353  (48/136) | 1.000  (3/3) | 0.023  (-0.003 to 0.049) |
| 3 | 1.000  (0.909 to 1.000) | 0.066  (0.028 to 0.140) | 1.066 | 0.361  (48/133) | 1.000  (6/6) | 0.046  (0.008 to 0.085) |
| 4 | 1.000  (0.909 to 1.000) | 0.220  (0.147 to 0.316) | 1.220 | 0.403  (48/119) | 1.000  (20/20) | 0.163  (0.088 to 0.237) |
| 5 | 0.917  (0.798 to 0.971) | 0.396  (0.301 to 0.499) | 1.312 | 0.444  (44/99) | 0.900  (36/40) | 0.250  (0.136 to 0.363) |
| 6 | 0.896  (0.773 to 0.958) | 0.604  (0.501 to 0.699) | 1.500 | 0.544  (43/79) | 0.917  (55/60) | 0.434  (0.302 to 0.566) |
| 7 | 0.750  (0.610 to 0.851) | 0.769  (0.672 to 0.844) | 1.519 | 0.632  (36/57) | 0.854  (70/82) | 0.497  (0.050 to 0.644) |
| 8 | 0.521  (0.383 to 0.665) | 0.912  (0.833 to 0.956) | 1.433 | 0.758  (25/33) | 0.783  (83/106) | 0.467  (0.312 to 0.623) |
| 9 | 0.229  (0.132 to 0.368) | 0.989  (0.933 to 1.000) | 1.218 | 0.917  (11/12) | 0.709  (90/127) | 0.265  (0.125 to 0.405) |
| 10 | 0.042  (0.004 to 0.149) | 1.000  (0.950 to 1.000) | 1.042 | 1.000  (2/2) | 0.664  (91/137) | 0.054  (-0.018 to 0.126) |
| Validation Group  (n = 100) | 1 | 1.000  (0.917 to 1.000) | 0.000  (0.000 to 0.092) | 1.000 | 0.530  (53/100) | /  (0/0) | 0.000  (0.000 to 0.000) |
| 2 | 1.000  (0.917 to 1.000) | 0.043  (0.005 to 0.152) | 1.043 | 0.541  (53/98) | 1.000  (2/2) | 0.045  (-0.016 to 0.106) |
| 3 | 1.000  (0.917 to 1.000) | 0.064  (0.016 to 0.180) | 1.064 | 0.546  (53/97) | 1.000  (3/3) | 0.067  (-0.007 to 0.142) |
| 4 | 1.000  (0.917 to 1.000) | 0.170  (0.087 to 0.305) | 1.170 | 0.576  (53/92) | 1.000  (8/8) | 0.179  (0.064 to 0.293) |
| 5 | 1.000  (0.917 to 1.000) | 0.277  (0.169 to 0.419) | 1.277 | 0.609  (53/87) | 1.000  (13/13) | 0.288  (0.152 to 0.425) |
| 6 | 0.981  (0.889 to 1.000) | 0.553  (0.412 to 0.686) | 1.534 | 0.712  (52/73) | 0.963  (26/27) | 0.548  (0.395 to 0.700) |
| 7 | 0.906  (0.792 to 0.962) | 0.723  (0.581 to 0.831) | 1.629 | 0.787  (48/61) | 0.872  (34/39) | 0.635  (0.485 to 0.786) |
| 8 | 0.623  (0.488 to 0.740) | 0.936  (0.820 to 0.984) | 1.559 | 0.917  (33/36) | 0.688  (44/64) | 0.548  (0.395 to 0.701) |
| 9 | 0.245  (0.149 to 0.377) | 0.979  (0.877 to 1.000) | 1.224 | 0.929  (13/14) | 0.535  (46/86) | 0.214  (0.091 to 0.337) |
| 10 | 0.113  (0.050 to 0.231) | 1.000  (0.908 to 1.000) | 1.113 | 1.000  (6/6) | 0.500  (47/94) | 0.107  (0.023 to 0.191) |
| 11 | 0.094  (0.038 to 0.208) | 1.000  (0.908 to 1.000) | 1.094 | 1.000  (5/5) | 0.495  (47/95) | 0.089  (0.012 to 0.166) |
| 12 | 0.038  (0.004 to 0.136) | 1.000  (0.908 to 1.000) | 1.038 | 1.000  (2/2) | 0.480  (47/98) | 0.036  (-0.013 to 0.084) |

**Table 2:** Comparisons of the areas under ROC curves.Statistics observed in the derivation group and the validation group in terms of area under ROC curves (AUROC), Standard Error (SE) and 95% Confidence Interval (95% CI). A comparison between the area under ROC curves between derivation group and control group was performed using a z test. A two-tailed P-Value < 0.05 was considered significant.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | **AUROC** | **SE** | **95% CI** | **Statistics** | **P values** |
| **AHI > 5 events/hr** | Derivation group | 0.832 | 0.036 | (0.762-0.902) | Difference = -0.037  SE = 0.057  z = -0.651 | 0.515 |
| Validation group | 0.869 | 0.044 | (0.782-0.956) |
| **AHI > 15 events/hr** | Derivation group | 0.805 | 0.036 | (0.734-0.876) | Difference = -0.068  SE = 0.049  z = -1.373 | 0.170 |
| Validation group | 0.873 | 0.034 | (0.806-0.940) |
| **AHI > 30 events/hr** | Derivation group | 0.834 | 0.039 | (0.757-0.911) | Difference = -0.062  SE = 0.050  z = -1.229 | 0.219 |
| Validation group | 0.896 | 0.032 | (0.833-0.959) |

**Figure 1:** ROC curve of DES-OSA at detecting at least mild OSA (AHI > 5 events/hr) for the derivation group (green line) and the validation group (red line).



**Figure 2:** ROC curve of DES-OSA at detecting at moderate to severe OSA (AHI > 15 events/hr) for the derivation group (green line) and the validation group (red line).



**Figure 3:** ROC curve of DES-OSA at detecting severe OSA (AHI > 30 events/hr) for the derivation group (green line) and the validation group (red line).



**Table 3:** Probit model parameters estimation in both groups. Pairs of data for each patient were used for these analyses. Those pairs consisted in their DES-OSA score and AHI. Model parameters estimations are given with their respective statistical significance and 95 % confidence interval (95 % CI).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  | **Estimation** | **Standard error** | **Z** | **P** | **95% CI** | |
|  | | **Inferior limit** | **Superior limit** |
| **AHI > 5 events/hr** | **Derivation** | DES-OSA score | 0.422 | 0.081 | 5.190 | < 0.001 | 0.262 | 0.581 |
| Constant | -1.374 | 0.416 | 3.305 | 0.001 | -2.189 | -0.559 |
| **Validation** | DES-OSA score | 0.430 | 0.116 | 3.697 | 0.001 | 0.202 | 0.657 |
| Constant | -1.152 | 0.630 | 1.828 | 0.067 | -2.387 | 0.083 |
| **AHI >15**  **events/hr** | **Derivation** | DES-OSA score | 0.401 | 0.068 | 5.899 | < 0.001 | 0.268 | 0.534 |
| Constant | -2.024 | 0.399 | 5.075 | < 0.001 | -2.805 | -1.242 |
| **Validation** | DES-OSA score | 0.605 | 0.116 | 5.197 | < 0.001 | 0.377 | 0.833 |
| Constant | -3.402 | 0.745 | 4.569 | < 0.001 | -4.862 | -1.943 |
| **AHI >30**  **events/hr** | **Derivtion** | DES-OSA score | 0.477 | 0.080 | 5.994 | < 0.001 | 0.321 | 0.633 |
| Constant | -3.353 | 0.526 | 6.373 | < 0.001 | -4.384 | -2.322 |
| **Validation** | DES-OSA score | 0.795 | 0.147 | 5.405 | < 0.001 | 0.507 | 1.084 |
| Constant | -5.298 | 1.023 | 5.178 | < 0.001 | -7.303 | -3.292 |

**Table 4:** Theoretical DES-OSA scores that are associated with a given probability of an AHI >5, >15 or >30 events/hr, as well as their 95 % confidence interval (95% CI), and according to our Probit models. Highlighted cells correspond to the threshold values selected by the analyses of sensitivities, specificities and Kappa coefficient of Cohen in the derivation group. These thresholds were a DES-OSA score of 5 at detecting at least mild OSA, 6 at detecting moderate to severe OSA and 7 at detecting severe OSA.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DERIVATION GROUP** | | | **VALIDATION GROUP** | | |
|  | **Probability** | **DES-OSA** | **95% CI** | | **DES-OSA** | **95% CI** | |
| **Inferior limit** | **Superior limit** | **Inferior limit** | **Superior limit** |
| AHI >5  events/hr | 0.01 | -2.260 | -6.636 | -0.241 | -2.734 | -11.709 | 0.094 |
| 0.05 | -0.643 | -4.060 | 0.954 | -1.147 | -8.358 | 1.157 |
| 0.10 | 0.219 | -2.692 | 1.597 | -0.301 | -6.577 | 1.730 |
| 0.20 | 1.263 | -1.046 | 2.386 | 0.723 | -4.430 | 2.432 |
| 0.30 | 2.015 | 0.128 | 2.967 | 1.461 | -2.892 | 2.949 |
| 0.40 | 2.658 | 1.117 | 3.478 | 2.092 | -1.590 | 3.403 |
| 0.50 | 3.259 | 2.020 | 3.977 | 2.682 | -0.388 | 3.842 |
| 0.60 | 3.860 | 2.886 | 4.514 | 3.272 | 0.788 | 4.307 |
| 0.70 | 4.503 | 3.741 | 5.158 | 3.903 | 1.997 | 4.854 |
| 0.80 | 5.256 | 4.608 | 6.047 | 4.642 | 3.288 | 5.617 |
| 0.90 | 6.300 | 5.595 | 7.495 | 5.666 | 4.699 | 7.056 |
| 0.95 | 7.162 | 6.309 | 8.791 | 6.512 | 5.546 | 8.563 |
| 0.99 | 8.778 | 7.562 | 11.310 | 8.098 | 6.804 | 11.719 |
| AHI >15  events/hr | 0.01 | -0.755 | -3.997 | 0.910 | 1.779 | -1.005 | 3.081 |
| 0.05 | 0.946 | -1.478 | 2.215 | 2.906 | 0.779 | 3.923 |
| 0.10 | 1.853 | -0.144 | 2.920 | 3.506 | 1.723 | 4.380 |
| 0.20 | 2.951 | 1.453 | 3.791 | 4.233 | 2.852 | 4.946 |
| 0.30 | 3.743 | 2.580 | 4.444 | 4.758 | 3.650 | 5.371 |
| 0.40 | 4.419 | 3.510 | 5.036 | 5.206 | 4.311 | 5.754 |
| 0.50 | 5.052 | 4.328 | 5.639 | 5.625 | 4.900 | 6.142 |
| 0.60 | 5.684 | 5.071 | 6.318 | 6.044 | 5.445 | 6.574 |
| 0.70 | 6.361 | 5.771 | 7.139 | 6.492 | 5.965 | 7.099 |
| 0.80 | 7.152 | 6.494 | 8.195 | 7.016 | 6.493 | 7.794 |
| 0.90 | 8.250 | 7.410 | 9.748 | 7.744 | 7.130 | 8.852 |
| 0.95 | 9.157 | 8.132 | 11.065 | 8.344 | 7.615 | 9.767 |
| 0.99 | 10.858 | 9.451 | 13.571 | 9.471 | 8.483 | 11.526 |
| AHI >30  events/hr | 0.01 | 2.152 | -0.014 | 3.296 | 3.736 | 1.887 | 4.638 |
| 0.05 | 3.580 | 2.066 | 4.415 | 4.593 | 3.208 | 5.291 |
| 0.10 | 4.342 | 3.156 | 5.031 | 5.050 | 3.904 | 5.646 |
| 0.20 | 5.264 | 4.433 | 5.819 | 5.603 | 4.733 | 6.092 |
| 0.30 | 5.929 | 5.293 | 6.448 | 6.002 | 5.311 | 6.432 |
| 0.40 | 6.497 | 5.956 | 7.057 | 6.343 | 5.783 | 6.745 |
| 0.50 | 7.028 | 6.508 | 7.694 | 6.662 | 6.194 | 7.068 |
| 0.60 | 7.559 | 7.005 | 8.386 | 6.980 | 6.566 | 7.429 |
| 0.70 | 8.127 | 7.499 | 9.165 | 7.321 | 6.921 | 7.859 |
| 0.80 | 8.792 | 8.048 | 10.105 | 7.720 | 7.292 | 8.407 |
| 0.90 | 9.714 | 8.783 | 11.436 | 8.273 | 7.759 | 9.214 |
| 0.95 | 10.476 | 9.377 | 12.546 | 8.730 | 8.124 | 9.901 |
| 0.99 | 11.904 | 10.478 | 14.644 | 9.587 | 8.785 | 11.213 |

**Figure 4:** Probit models (solid lines) and 95% CI (dotted lines) found in the derivation group (green lines) and the validation group (red lines) and depicting the probability of detecting at least mild OSA (AHI >5 events/hr) as a function of DES-OSA.



**Figure 5:** Probit models (solid lines) and 95% CI (dotted lines) found in the derivation group (green lines) and the validation group (red lines) and depicting the probability of detecting moderate to severe OSA (AHI > 15 events/hr) as a function of DES-OSA.



**Figure 6:** Probit models (solid lines) and 95% CI (dotted lines) found in the derivation group (green lines) and the validation group (red lines) and depicting the probability of detecting severe OSA (AHI > 30 events/hr) as a function of DES-OSA.

