Supplementary Material File 4

[Table 96: Association between factors and nurse perceptions of staffing adequacy: univariable models with ward and hospital level random effects, matching staffing adequacy to the same day ii](#_Toc17363579)

[Table 97: Association between staffing shortfall and nurse perceptions of staffing adequacy: day level analysis matching staffing adequacy to the same day iii](#_Toc17363580)

[Table 98:Association between staffing shortfall and nurse perceptions of staffing adequacy: shift level analysis matching staffing adequacy to the same shift iv](#_Toc17363581)

[Table 99:Association between staffing shortfall and nurse perceptions of staffing adequacy: day level analysis using first parts of wards v](#_Toc17363582)

[Table 100: Association between staffing shortfall and nurse perceptions of “enough staff for quality”- day level analysis without hospital Trust D vi](#_Toc17363583)

Table 96: Association between factors and nurse perceptions of staffing adequacy: univariable models with ward and hospital level random effects, matching staffing adequacy to the same day

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Enough staff for quality** | | | **Nursing care left undone** | | | **Staff breaks missed** | | |
| **Variable** | **Odds ratio** | **95% confidence interval** | **p-value** | **Odds ratio** | **95% confidence interval** | **p-value** | **Odds ratio** | **95% confidence interval** | **p-value** |
| **Overall shortfall (HPPD)** | 0.88 | [0.86, 0.90] | **<0.001** | 1.17 | [1.12, 1.22] | **<0.001** | 1.22 | [1.17, 1.27] | **<0.001** |
| **Registered nurse shortfall (HPPD)** | 0.95 | [0.93, 0.97] | **<0.001** | 1.09 | [1.04, 1.15] | **<0.001** | 1.15 | [1.09, 1.20] | **<0.001** |
| **Nursing support worker shortfall (HPPD)** | 0.88 | [0.86, 0.91] | **<0.001** | 1.13 | [1.07, 1.19] | **<0.001** | 1.12 | [1.07, 1.18] | **<0.001** |
| **Skill mix (registered nurse HPPD/ total HPPD)** | 0.66 | [0.51, 0.87] | **0.003** | 1.10 | [0.70, 1.73] | 0.681 | 1.01 | [0.65, 1.56] | 0.971 |
| **Patient turnover (per care hour)** | 0.74 | [0.26, 2.11] | 0.569 | 7.26 | [1.37, 38.34] | **0.020** | 19.63 | [4.17, 92.40] | **<0.001** |
| **Ward type- other (reference)** |  |  |  |  |  |  |  |  |  |
| **Surgical** | 0.55 | [0.33, 0.94] | **0.028** | 1.96 | [1.09, 3.52] | **0.024** | 2.13 | [1.23, 3.67] | **0.007** |
| **Proportion single rooms** | 0.88 | [0.28, 2.77] | 0.827 | 1.51 | [0.46, 5.03] | 0.499 | 1.06 | [0.34, 3.27] | 0.925 |
| **Day of week- Monday (reference)** |  |  |  |  |  |  |  |  |  |
| **Tuesday** | 0.98 | [0.87, 1.11] | 0.735 | 0.94 | [0.76, 1.15] | 0.544 | 1.25 | [1.02, 1.54] | **0.032** |
| **Wednesday** | 1.10 | [0.97, 1.25] | 0.123 | 0.81 | [0.66, 1.00] | 0.053 | 0.92 | [0.74, 1.15] | 0.473 |
| **Thursday** | 1.24 | [1.09, 1.40] | **0.001** | 0.87 | [0.70, 1.07] | 0.181 | 0.77 | [0.61, 0.96] | **0.019** |
| **Friday** | 1.04 | [0.92, 1.18] | 0.510 | 0.85 | [0.69, 1.05] | 0.131 | 1.03 | [0.83, 1.27] | 0.809 |
| **Saturday** | 1.00 | [0.88, 1.14] | 0.959 | 0.87 | [0.70, 1.08] | 0.201 | 1.00 | [0.81, 1.25] | 0.966 |
| **Sunday** | 1.29 | [1.14, 1.47] | **<0.001** | 0.69 | [0.55, 0.86] | **0.001** | 0.64 | [0.51, 0.81] | **<0.001** |

Table 97: Association between staffing shortfall and nurse perceptions of staffing adequacy: day level analysis matching staffing adequacy to the same day

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Enough staff for quality** | | | **Nursing care left undone** | | | **Staff breaks missed** | | |
| **Variable** | **Odds ratio** | **95% confidence interval** | **p-value** | **Odds ratio** | **95% confidence interval** | **p-value** | **Odds ratio** | **95% confidence interval** | **p-value** |
| **Registered nurse shortfall (HPPD)** | 0.90 | [0.88, 0.93] | **<0.001** | 1.15 | [1.10, 1.22] | **<0.001** | 1.22 | [1.16, 1.28] | **<0.001** |
| **Nursing support worker shortfall (HPPD)** | 0.85 | [0.82, 0.87] | **<0.001** | 1.18 | [1.12, 1.25] | **<0.001** | 1.21 | [1.14, 1.27] | **<0.001** |
| **Turnover (per care hour)** | 2.25 | [0.73, 6.88] | 0.156 | 2.12 | [0.36, 12.31] | 0.404 | 3.20 | [0.60, 17.13] | 0.175 |
| **Ward type – other (reference)** |  |  |  |  |  |  |  |  |  |
| **Surgical** | 0.51 | [0.30, 0.88] | **0.015** | 2.12 | [1.18, 3.80] | **0.012** | 2.24 | [1.27, 3.93] | **0.005** |
| **Proportion single rooms** | 0.55 | [0.18, 1.70] | 0.300 | 2.95 | [0.91, 9.55] | **0.071** | 2.57 | [0.80, 8.31] | 0.114 |
| **Day of week- Monday (reference)** |  |  |  |  |  |  |  |  |  |
| **Tuesday** | 0.98 | [0.86, 1.10] | 0.691 | 0.94 | [0.76, 1.15] | 0.533 | 1.26 | [1.02, 1.54] | **0.029** |
| **Wednesday** | 1.10 | [0.97, 1.24] | 0.135 | 0.82 | [0.66, 1.01] | 0.062 | 0.94 | [0.76, 1.17] | 0.567 |
| **Thursday** | 1.23 | [1.08, 1.39] | **0.001** | 0.88 | [0.71, 1.08] | 0.219 | 0.78 | [0.62, 0.97] | **0.026** |
| **Friday** | 1.03 | [0.91, 1.17] | 0.642 | 0.85 | [0.69, 1.05] | 0.135 | 1.03 | [0.83, 1.27] | 0.809 |
| **Saturday** | 1.02 | [0.90, 1.16] | 0.735 | 0.88 | [0.71, 1.09] | 0.237 | 1.02 | [0.82, 1.27] | 0.858 |
| **Sunday** | 1.30 | [1.14, 1.48] | **<0.001** | 0.71 | [0.57, 0.89] | **0.003** | 0.67 | [0.53, 0.85] | **0.001** |
| **Standard deviation between wards** | 1.07 |  |  | 1.08 |  |  | 1.06 |  |  |
| **Standard deviation between hospitals** | 0.81 |  |  | 0.97 |  |  | 0.72 |  |  |
| **Akaike information criterion** | 21157 |  |  | 8529 |  |  | 8274 |  |  |
| **Bayesian information criterion** | 21270 |  |  | 8642 |  |  | 8386 |  |  |

Table 98:Association between staffing shortfall and nurse perceptions of staffing adequacy: shift level analysis matching staffing adequacy to the same shift

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Enough staff for quality** | | | **Nursing care left undone** | | | **Staff breaks missed** | | |
| **Variable** | **Odds ratio** | **95% confidence interval** | **p-value** | **Odds ratio** | **95% confidence interval** | **p-value** | **Odds ratio** | **95% confidence interval** | **p-value** |
| **Registered nurse shortfall (HPPD)** | 0.93 | [0.91, 0.94] | **<0.001** | 1.13 | [1.10, 1.16] | **<0.001** | 1.14 | [1.11, 1.16] | **<0.001** |
| **Nursing support worker shortfall (HPPD)** | 0.91 | [0.90, 0.93] | **<0.001** | 1.14 | [1.11, 1.17] | **<0.001** | 1.14 | [1.11, 1.17] | **<0.001** |
| **Time of day – Evening** |  |  |  |  |  |  |  |  |  |
| **Morning** | 1.24 | [1.18, 1.31] | **<0.001** | 0.70 | [0.64, 0.77] | **<0.001** | 0.45 | [0.41, 0.48] | **<0.001** |
| **Afternoon** | 1.11 | [1.03, 1.20] | **0.007** | 1.07 | [0.91, 1.25] | 0.423 | 0.99 | [0.85, 1.15] | 0.881 |
| **Day of week- Monday (reference)** |  |  |  |  |  |  |  |  |  |
| **Tuesday** | 0.97 | [0.90, 1.05] | 0.500 | 0.99 | [0.86, 1.14] | 0.928 | 1.08 | [0.95, 1.23] | 0.237 |
| **Wednesday** | 1.08 | [0.99, 1.17] | **0.077** | 0.96 | [0.84, 1.11] | 0.592 | 1.10 | [0.97, 1.25] | 0.139 |
| **Thursday** | 1.07 | [0.99, 1.16] | 0.103 | 0.97 | [0.84, 1.11] | 0.630 | 1.08 | [0.95, 1.23] | 0.248 |
| **Friday** | 1.00 | [0.92, 1.08] | 0.933 | 1.00 | [0.87, 1.15] | 0.996 | 1.20 | [1.05, 1.36] | **0.006** |
| **Saturday** | 1.02 | [0.94, 1.11] | 0.666 | 0.90 | [0.78, 1.05] | 0.174 | 1.02 | [0.89, 1.16] | 0.821 |
| **Sunday** | 1.29 | [1.19, 1.40] | **<0.001** | 0.69 | [0.59, 0.80] | **<0.001** | 0.62 | [0.54, 0.72] | **<0.001** |
| **Ward type- Other (reference)** |  |  |  |  |  |  |  |  |  |
| **Surgical** | 0.61 | [0.35, 1.05] | 0.072 | 1.97 | [1.14, 3.42] | **0.015** | 2.14 | [1.32, 3.48] | **0.002** |
| **Proportion single rooms** | 0.45 | [0.15, 1.39] | 0.167 | 2.85 | [0.94, 8.65] | 0.064 | 2.80 | [1.05, 7.45] | 0.039 |
| **Turnover (per care hour)** | 1.25 | [0.88, 1.78] | 0.221 | 0.53 | [0.29, 0.99] | **0.045** | 1.33 | [0.80, 2.23] | 0.272 |
| **Standard deviation between wards** | 1.09 |  |  | 1.06 |  |  | 0.94 |  |  |
| **Standard deviation between hospitals** | 0.67 |  |  | 0.90 |  |  | 0.72 |  |  |
| **Akaike information criterion** | 47966 |  |  | 19237 |  |  | 22315 |  |  |
| **Bayesian information criterion** | 48107 |  |  | 19378 |  |  | 22456 |  |  |

Table 99:Association between staffing shortfall and nurse perceptions of staffing adequacy: day level analysis using first parts of wards

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Enough staff for quality** | | | **Nursing care left undone** | | | **Staff breaks misseda** | | |
| **Variable** | **Odds ratio** | **95% confidence interval** | **p-value** | **Odds ratio** | **95% confidence interval** | **p-value** | **Odds ratio** | **95% confidence interval** | **p-value** |
| **Registered nurse shortfall (HPPD)** | 0.90 | [0.87, 0.92] | **<0.001** | 1.13 | [1.07, 1.19] | **<0.001** | 1.11 | [1.05, 1.17] | **<0.001** |
| **Nursing support worker shortfall (HPPD)** | 0.86 | [0.84, 0.89] | **<0.001** | 1.13 | [1.06, 1.19] | **<0.001** | 1.10 | [1.04, 1.16] | **0.001** |
| **Turnover (per nursing hour)** | 0.83 | [0.27, 2.55] | 0.746 | 4.31 | [0.75, 24.90] | 0.102 | 4.54 | [0.84, 24.50] | 0.078 |
| **Ward type – other (reference)** |  |  |  |  |  |  |  |  |  |
| **Surgical** | 0.54 | [0.30, 0.96] | **0.034** | 2.10 | [1.12, 3.95] | **0.021** | 2.10 | [1.14, 3.85] | **0.017** |
| **Proportion single rooms** | 0.52 | [0.16, 1.69] | 0.275 | 3.04 | [0.88, 10.42] | 0.078 | 2.10 | [0.62, 7.09] | 0.234 |
| **Day of week- Monday (reference)** |  |  |  |  |  |  |  |  |  |
| **Tuesday** | 1.12 | [0.99, 1.27] | 0.081 | 0.89 | [0.71, 1.10] | 0.286 | 0.72 | [0.58, 0.89] | **0.002** |
| **Wednesday** | 1.27 | [1.12, 1.44] | **<0.001** | 0.97 | [0.79, 1.21] | 0.809 | 0.60 | [0.48, 0.75] | **<0.001** |
| **Thursday** | 1.07 | [0.95, 1.22] | 0.276 | 0.92 | [0.74, 1.15] | 0.451 | 0.82 | [0.66, 1.01] | 0.057 |
| **Friday** | 1.03 | [0.91, 1.17] | 0.626 | 0.92 | [0.73, 1.15] | 0.445 | 0.81 | [0.65, 1.00] | **0.049** |
| **Saturday** | 1.28 | [1.12, 1.46] | **<0.001** | 0.77 | [0.61, 0.98] | **0.031** | 0.50 | [0.39, 0.64] | **<0.001** |
| **Sunday** | 1.02 | [0.89, 1.15] | 0.816 | 1.13 | [0.91, 1.40] | 0.261 | 0.81 | [0.65, 1.00] | 0.053 |
| **Standard deviation between wards** | 1.09 |  |  | 1.12 |  |  | 1.09 |  |  |
| **Standard deviation between hospitals** | 0.75 |  |  | 0.92 |  |  | 0.68 |  |  |
| **Akaike information criterion** | 20132 |  |  | 8089 |  |  | 7789 |  |  |
| **Bayesian information criterion** | 20244 |  |  | 8201 |  |  | 7901 |  |  |
| *aDid not converge* | | | | | | | | | |

Table 100: Association between staffing shortfall and nurse perceptions of “enough staff for quality”- day level analysis without hospital Trust D

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Enough staff for quality?** | | |
| **Variable** | **Odds ratio** | **95% confidence interval** | **p-value** |
| **Registered nurse shortfall (HPPD)** | 0.89 | [0.86, 0.91] | **<0.001** |
| **Nursing support worker shortfall (HPPD)** | 0.84 | [0.81, 0.87] | **<0.001** |
| **Turnover (per care hour)** | 0.83 | [0.26, 2.63] | 0.747 |
| **Ward type – other (reference)** |  |  |  |
| **Surgical** | 0.45 | [0.27, 0.76] | **0.003** |
| **Proportion single rooms** | 0.61 | [0.24, 1.57] | 0.304 |
| **Day of week- Monday (reference)** |  |  |  |
| **Tuesday** | 1.20 | [1.05, 1.37] | **0.008** |
| **Wednesday** | 1.31 | [1.15, 1.50] | **<0.001** |
| **Thursday** | 1.13 | [0.99, 1.29] | 0.071 |
| **Friday** | 1.08 | [0.94, 1.24] | 0.278 |
| **Saturday** | 1.40 | [1.21, 1.61] | **<0.001** |
| **Sunday** | 1.03 | [0.90, 1.17] | 0.697 |
| **Standard deviation between wards** | 0.88 |  |  |
| **Standard deviation between hospitals** | 0.49 |  |  |
| **Akaike information criterion** | 17680 |  |  |
| **Bayesian information criterion** | 17789 |  |  |