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**SI Table 1: Association between nurse staffing level and risk of patient mortality**

| **First Author (Year)** | **Nurse Staffing Measure** | **Internal Validity** | **Nature of association**  | **Mortality**  | **Survival** **In-hospital** |
| --- | --- | --- | --- | --- | --- |
| **In-hospital** | **In- ICU** | **30-day or 28-day** |
| Amaravadi(2000) | NNPR | ++ |  | H-L 0.70(0.30-2.0)OR |  |  |  |
| Baykara(2018) | N:P | + |  |  |  | L-H 2.00 (1.26 -3.04)ORL2-H 1.43(0.98-2.01)OR  |  |
| Blegen(2011) | NHPPD | ++ |  | L-H 0.02(0.01-0.03)Reg |  |  |  |
| Checkley(2014) | Bed: nurse | + |  |  | L-H 3.70(0.50- 6.80)% |  |  |
| Cho(2008) | N:PT N:PS | ++ |  | L-H 0.54(0.22-1.33)ORL-H 1.43(1.16-1.77)OR |  |  |  |
| Dimick (2001) | NNPR | ++ |  | L-H 0.49(0.18-1.29)OR |  |  |  |
| Dodek(2015) | N:P | ++ |  | H-L 2.08(1.45–0.97)ORH-L 1.37(0.81–2.33)OR |  |  |  |
| Graf(2010) | N:P | + |  | NR |  |  |  |
| Jansson(2020) | N:P | ++ |  | L-H 0.91(0.72-1.16)OR |  |  |  |
| Kelly(2014) | N:P | + |  |  |  | L-H 1.03(0.93–1.15)OR30 |  |
| Kim(2020) | N:bed | ++ |  | H–L 0.44(0.27 - 0.70)ORL3-L 0.50(0.33-0.76)ORL2-L 0.83(0.57-1.19)OR |  |  |  |
| Kim(2019) | N: bed Tertiary hopsitals General hospitals | - | *NR* |  |  |  | H-L2 2.35(1.27-4.36)ORL-L2 *NR*H-L2 1.38(0.96–1.99)ORL-L2 0.81(0.54-1.22)OR |
| Kim(2012) | N:P | + |  | H- L 0.65(0.33-1.30)HR |  | H-L 0.46(0.21-0.99)HR28 |  |
| Lee (2017) | Workload: N  | ++ |  |  |  |  | L-H 0.35(0.16-0.79)OR |
| Margadant(2020) | Mean NNRMean N:P | ++ |  | L-H 1.24(1.05-1.46)ORL2-H 1.29(1.10-1.51)ORL3-H 1.07(0.92-1.25)ORL-H 1.03(0.82-1.30)ORL2-H 1.02(1.00-1.47)ORL3-H 1.08(0.92-1.27)OR |  |  |  |
| Neuraz(2015) | N:P | ++ |  |  | L-H 3.50(1.30-9.10)RRL2-H 2.30(0.90-5.80)RRL3-H 2.00(0.80-5.00)RRL4-H 1.90(0.70-4.60)RR |  |  |
| Sakr(2015) | N:P | ++ |  | H-L 0.69(0.53-0.90)ORL3-L 0.71(0.57-0.87)ORL2-L 0.84(0.70-1.01)OR |  |  |  |
| Stone(2007) | NHPPD | ++ |  |  |  | H-L 0.89(0.76-1.05)OR30L3-L 0.81(0.69-0.95)OR30L2-L 0.8(0.77-1.02)OR30 |  |
| Tarnow-Mordi(2000) | Workload per occupied bed | ++ |  | L-H 3.10(1.90-5.00)ORL2-H 1.90(1.20-3.10)ORL3-H 2.00(1.20-3.30)OR |  |  |  |
| Van den Heede(2008) | NHPPD | ++ |  | *NR* |  |  |  |
| West(2014) | N:bed | ++ |  |  | H-L 0.90(0.83-0.97) OR |  |  |

**Nurse staffing measure [***Ratio antecedents and consequents may have been calculated either way round, for e.g. as N:P or P:N]****: N:P*** *Nurse to Patient ratio; N:PT in tertiary hospitals, N:PS in secondary hospitals (Cho, 2008);* ***NNPR*** *Night-time Nurse to Patient Ratio;* ***N: VentP*** *nurse to ventilated patient ratio;* ***N: Bed*** *Nurse to bed ratio;* ***N*** *number of nurses on shift;* ***NHPPD*** *nursing hours per patient day;* ***NNR*** *NAS score per nurse ratio;* ***Workload*** *composite measure based on average nursing requirement per occupied bed and peak occupancy in any shift during patient’s stay (Tarnow-Mordi, 2000); total TISS-76 divided by the average number of direct patient care nurses per 24hour day (Lee, 2017).* **Internal Validity***: ++ Strong; + Moderate, - Weak.*

 *Higher staffing is significantly (p<0.05) beneficial, higher staffing is numerically beneficial. Higher staffing is significantly (p<0.05) detrimental, higher staffing is numerically detrimental. No evidence of a significant association (p≥0.05) and no figures given.*

***OR*** *Odds Ratio (95% Confidence Intervals, CIs)* ***OR30****Odds Ratio (95% CIs) for 30-day mortality*

***Reg*** *Non-standardised regression coefficient (95% CIs)*

***%*** *% increase in annual ICU mortality per unit increase of staffing (95% CIs)*

***HR***  *Hazard Ratio HR (95% CIs) for 30 day mortality* ***HR28****HR (95% CIs) for 28-day mortality*

***RR***  *Relative Risk (95% CIs)*

***NR*** *Not Reported*

***L-H*** *Lowest compared to highest amount of nurse staffing,* ***H-L*** *Highest compared to Lowest.*

***L2-H*** *= second lowest level of staffing compared to highest* ***L3- L*** *=third lowest level of staffing compared to lowest*

**SI Table 2: Association between nurse staffing levels and risk of patient nosocomial infection**

| **First Author (Year)** | **Nurse Staffing Measure** | **Internal Validity** | **Nature of association** | **Type of nosocomial infection** |
| --- | --- | --- | --- | --- |
| **CLABSI** | **CVC-BSI** | **MRSA** | **Pneumonia** | **Septicaemia/****sepsis** | **VAP** | **Other** |
| Amaravadi (2000) | NNPR | ++ |  |  |  |  | L-H 2.40(1.20-4.7)OR | L-H 3.60(1.10-12.5)OR |  |  |
| Blegen(2011) | NHPPD | ++ |  |  |   |  |  | L-H -0.04(-0.07, -0.01)Cor |  | L-H 0.02(-0.03,-0.06)Cor |
| Blot(2011) | N:P | - |  |  |  |  |  |  | L-H 1.74(0.76-4.99)ORL2-H 1.32(0.55-3.13)ORL3-H 1.78(0.80-4.97)OR |  |
| Boev(2015) | NHPPD | + |  | L-H -0.42(0.84-0.00)Cor |  |  |  |  | L-H -0.02(-0.18,-0.13)Cor |  |
| Dancer(2006) | N | + |  |  |  | L-H 6.90(0.49-310.0)OR |  |  |  |  |
| Dorsey (2000) | Staffing quotient | + |  |  |  |  |  |  |  | L-H -0.88DSQ |
| Fridkin(1996) | N:PNHPPD | + |  |  | L-H -0.22DNPL-H -3.3DNH |  |  |  |  |  |
| Halwani 2006 | N:P | ++ |  |  |  |  |  |  |  | L-H 3.28(1.43-7.53)OR |
| Hugonnet(2007) | N:P | ++ |  |  |  |  |  |  | Late onsetH-L 0.42(0.18-0.99)HREarly onsetH-L 0.78(0.42-1.45)HR |  |
| Jansson(2019) |  N:P | + |  |  |  |  |  |  | L-H 0.30(0.20-0.40)ROC |  |
| Schwab(2012) | N:VentP | + |  |  | GraphID |  |  |  | GraphID | H-L 0.42(0.32-0.55)IRL3-L 0.64(0.54-0.75)IRL2-L 0.77(0.67-0.88)IR |
| N:P | + |  |  | GraphID |  |  |  | GraphID | GraphID |
| Stone (2007) | NHPPD | ++ |  | H-L 0.57(0.20 -1.67)ORL3-L 0.32 (0.15-0.70)ORL2-L 0.97 (0.55-1.17)OR |  |  |  |  | H-L 0.21(0.08-0.53)ORL3-L 0.68 (0.39-1.21)ORL2-L 0.71 (0.43-1.19)OR | H-L 0.86(0.37 – 1.98)ORL3-L 0.96(0.44-2.07)ORL2-L 0.79(0.50-1.25)OR |
| Vicca (1993) | N:P  | + |  |  |  | H-L -0.15(-0.07, -0.23)Cor |  |  |  |  |

**Nurse staffing measure [***Ratio antecedents and consequents may have been calculated either way round, for e.g. as N:P or P:N]****: N:P*** *Nurse to Patient ratio, further broken down in Table 1 included in the article;* ***NNPR*** *Night-time Nurse to Patient Ratio;* ***N: VentP*** *nurse to ventilated patient ratio;* ***NHPPD*** *nursing hours per patient day;* ***N*** *number of nurses on shift****.* Internal Validity***: ++ Strong; + Moderate, - Weak.*

 *Higher staffing is significantly (p<0.05) beneficial, higher staffing is numerically beneficial. Higher staffing is significantly (p<0.05) detrimental, higher staffing is numerically detrimental. No evidence of a significant association (p≥0.05) and no figures given.* ***CLABSI****,Central Line Associated Blood Stream Infection.* ***CVC BSI****, Central Venous Catheter-Associated Blood Stream Infection.* ***Other****: ‘infection due to medical care’ (Blegen, 2011); enterobacter and serratia (Dorsey, 2000);pathogens including MRSA (Halwani, 2006); bloodstream and pneumonia infections (Schwab, 2012); Catheter Associated Urinary Tract Infection (Stone, 2007).*

***OR*** *Odds Ratio (95% Confidence Intervals, CIs)*

***Cor*** *Regression/correlation coefficient (95% CIs)*

***DSQ*** *Difference in staffing quotient between outbreak and non-outbreak months, p=.02*

***DNP*** *Difference in N:P between outbreak and non-outbreak, p<.01*

***DNH*** *Difference in NHPPD between outbreak and non-outbreak, -3.3, p<.01*

***%*** *% increase per unit increase of staffing (95% CIs)*

***HR*** *Hazard Ratio HR (95% CI)*

***IR*** *Incident Rate Ratio (95% CIs)*

***ROC*** *Receiver operating characteristic curve: area under the curve (95% CI)*

***GraphID*** *Graph presentation of incidence density*

***L-H*** *Lowest compared to highest amount of nurse staffing,* ***H-L*** *Highest compared to Lowest.*

***L2-H*** *= second lowest level of staffing compared to highest* ***L3- L*** *=third lowest level of staffing compared to lowest*