**Note to readers:** These tables provide a quick overview of the major finding of studies included in Lynn Unruh's literature review. Some findings may have been reported only for select subgroups. For more comprehensive information, readers should consult the studies.

**Results:** (–), statistically negative relationship between nurse staffing and the patient outcome (higher staffing is related to lower incidences or rates of that patient outcome); (+), statistically positive relationship between nurse staffing and the patient outcome (higher staffing is related to higher incidences or rates of that patient outcome); NS, results were not significant.

**Notes:** APD, adjusted patient-days; FTE, full-time employees; GI, gastrointestinal; HPPD, hours per patient-day; LN, licensed nurses; RPN, registered practical nurses (Canadian study); UTI, urinary tract infection.

* Acuity adjusted.

† Medical patients only.

‡ Surgical patients only.

§ Original staffing measure studied was the patient-to-nurse ratio. Measure has been inverted in this table for consistency of explanation of results.

|| Number of licensed nurse full-time employees (FTEs). Patient volume and acuity are controlled in the regression equation.

## Table 1. Nurse Staffing and Patient Outcomes: Studies and Results, 2002–2006 (21 studies)

| STUDY | STAFFING MEASURE | OUTCOME | |
|---|---|---|---|
| **Blood Stream Infections** | | | |
| Cho S, et al. *Nurs Res* 2003;52(2):71-9. | RN HPPD | NS | |
| | RN hrs | NS | |
| | All hrs | NS | |
| Whitman GR, et al. *J Nurs Adm* 2002;32(12):633-9. | RN HPPD | NS (central line infection) | |
| **Cardiac Arrest or Shock** | | | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | NS† | NS‡ |
| | RN hrs:all | (–)† | NS‡ |
| **Complications** | | | |
| Dang D, et al. *Heart Lung* 2002;31(3):219-28. | RN:patient ratio in ICU | (–) | |
| Elting LS, et al. *Cancer* 2005;104(5):975-84. | RN:patient ratio | NS | |
| Newhouse RP, et al. *AORN J* 2005;81(3):508-28. | RN staffing | NS | |
| **Falls** | | | |
| Cho S, et al. *Nurs Res* 2003;52(2):71-9. | RN HPPD | NS | |
| | RN hrs | NS | |
| | All hrs | NS | |
| Dunton N, et al. *Nurs Outlook* 2004;52:53-9. | RN HPPD | (–) | |
| | RN hrs:all hrs | (–) | |
| | Contract nurse hrs | (+) | |
| Krauss MJ, et al. *J Gen Intern* Med 2005;20:116-22. | Nurse:patient ratio§ | (–) | |
| McGillis Hall L, et al. *J Nurs Adm* 2004;34(1):41-5. | RNs:RPNs | NS | |
| Unruh L. *Med Care* 2003;41(1):142-52. | LNs:FTEs‖ | (–) | |
| | LNs:all nurses | (+) | |
| Whitman GR, et al. *J Nurs Adm* 2002;32(12):633-9. | RN HPPD | (–) | |
| **Failure to Rescue** | | | |
| Aiken LH, et al. *JAMA* 2002; 288(16):1987-93. | RN:patient ratio§ | (–) | |
| Aiken LH, et al. *JAMA* 2003;290(12):1617-23. | RN:patient ratio§ | (–) | |
| | RN education level | (–) | |
| Halm M, et al. *Clin Nurs Spec* 2005;19(5):241-51. | RN:patient ratio | NS | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | NS† | (–)‡ |
| | RN hrs:all hrs | (–)† | NS‡ |
| Seago JA, et al. *J Nurs Adm* 2006;36(1):13-21. | RN HPPD | NS | |
| | Non-RN HPPD | (+) | |
| | RN skill mix | NS | |
| | Total HPPD | (+) | |

| STUDY | STAFFING MEASURE | OUTCOME | |
|---|---|---|---|
| **Medication errors** | | | |
| McGillis Hall L, et al. *J Nurs Adm* 2004;34(1):41-5. | RNs:RPNs | (–) | |
| Whitman GR, et al. *J Nurs Adm* 2002;32(12):633-9. | RN HPPD | (–) | |
| **Mortality** | | | |
| Aiken LH, et al. *JAMA* 2002;288(16):1987-93. | RN:patient ratio§ | (–) | |
| Aiken LH, et al. *JAMA* 2002;290(12):1617-23. | RN:patient ratio§ | (–) | |
| | RN education level | (–) | |
| Elting LS, et al. *Cancer* 2005;104(5):975-84. | RN:patient ratio | (–) | |
| Estabrooks CA, et al. *Nurs Research* 2005;54(2):74-84. | RNs:all nurses | (–) | |
| | RN education level | (–) | |
| | Perceptions of RN adequacy | NS | |
| | Temporary nursing staff | (+) | |
| Halm M, et al. *Clin Nurs Spec* 2005;19(5):241-51. | RN:patient ratio | NS | |
| Mark BA, et al. *Health Serv Res* 2004;39(2):279-99. | RN:inpatient day | (–) | |
| Morales IJ, et al. *Crit Care Med* 2003;31(3):858-63. | ≥ 3 admissions per shift | NS | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | NS† | NS‡ |
| | RN hrs:all hrs | NS† | NS‡ |
| Newhouse RP, et al. *AORN J* 2005;81(3):508-28. | RN staffing | NS | |
| | Agency RN use | (–) | |
| Person SD, et al. *Med Care* 2004;42(1):4-12. | RN:average daily census | (–) | |
| Rothberg MB, et al. *Med Care* 2005;43(8):785-91. | Nurse:patient ratio | (–) | |
| Tourangeau AE, et al. *Nurs Research* 2002;55(4):71-88. | RN hrs:all hrs | (–) | |
| | RN HPPD | NS | |
| **Pneumonia** | | | |
| Cho S, et al. *Nurs Res* 2003;52(2):71-9. | RN HPPD | (–) | |
| | RN hrs | (–) | |
| | All hrs | NS | |
| Kovner C, et al. *Health Serv Res* 2002;37(3):611-29. | RN:APD | (–) | |
| Mark BA, et al. *Health Serv Res* 2004;39(2):279-99. | RN:inpatient day | NS | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | NS† | NS‡ |
| | RN hrs:all hrs | (–)† | NS‡ |
| Unruh L. *Med Care* 2003;41(1):142-52. | LNs:FTEs‖ | (+) | |
| | LNs:all nurses | (–) | |
| **Postoperative infections** | | | |
| Cho S, et al. *Nurs Res* 2003;52(2):71-9. | RN HPPD | NS | |
| | RN hrs | NS | |
| | All hrs | NS | |
| McGillis Hall L, et al. *J Nurs Adm* 2004;34(1):41-5. | RNs:RPNs | (–) | |
| | Years of nursing experience | (–) | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | NS† | NS‡ |
| | RN hrs:all hrs | NS† | NS‡ |
| Unruh L. *Med Care* 2003;41(1):142-52. | LNs:FTEs‖ | NS | |
| | LNs:all nurses | NS | |
| **Patient Satisfaction** | | | |
| Seago JA, et al. *J Nurs Adm* 2006;36(1):13-21. | RN HPPD | NS | |
| | Non-RN HPPD | NS | |
| | RN skill mix | (+) | |
| | Total HPPD | (+) | |

| STUDY | STAFFING MEASURE | OUTCOME | |
|---|---|---|---|
| **Pulmonary Compromise** | | | |
| Kovner C, et al. *Health Serv Res* 2002;37(3):611-29. | RN:APD | NS | |
| Unruh L. *Med Care* 2003;41(1):142-52. | LNs:FTEs‖ | (–) | |
| | LNs:all nurses | NS | |
| **Restraint Use** | | | |
| Whitman GR, et al. *J Nurs Adm* 2002;32(12):633-9. | RN HPPD | (–) | |
| **Skin Breakdown** | | | |
| Cho S, et al. *Nurs Res* 2003;52(2):71-9. | RN HPPD | NS | |
| | RN hrs | NS | |
| | All hrs | (+) | |
| Mark BA, et al. *Health Serv Res* 2004;39(2):279-99. | RN:inpatient day | NS | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | NS† | NS‡ |
| | RN hrs:all hrs | NS† | NS‡ |
| Unruh L. *Med Care* 2003;41(1):142-52. | LNs:FTEs‖ | (–) | |
| | LNs:all nurses | (–) | |
| Whitman GR, et al. *J Nurs Adm* 2002;32(12):633-9. | RN HPPD | NS | |
| **Thrombosis** | | | |
| Kovner C, et al. *Health Serv Res* 2002;37(3):611-29. | RN:APD | NS | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | NS† | NS‡ |
| | RN hrs:all hrs | NS† | NS‡ |
| **UTIs** | | | |
| Cho S, et al. *Nurs Res* 2003;52(2):71-9. | RN HPPD | NS | |
| | RN hrs | NS | |
| | All hrs | NS | |
| Kovner C, et al. *Health Serv Res* 2002;37(3):611-29. | RN:APD | NS | |
| Mark BA, et al. *Health Serv Res* 2004;39(2):279-99. | RN:inpatient day | NS | |
| McGillis Hall L, et al. *J Nurs Adm* 2004;34(1):41-5. | RNs:RPNs | NS | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | (–)† | NS‡ |
| | RN hrs:all hrs | (–)† | (–)‡ |
| Unruh L. *Med Care* 2003;41(1):142-52. | LNs:FTEs‖ | (–) | |
| | LNs:all nurses | NS | |
| **Upper GI Bleeding** | | | |
| Needleman J, et al. *New Engl J Med* 2002;346(22):1715-22. | RN hrs:inpatient-day* | (–)† | NS‡ |
| | RN hrs:all hrs | (–)† | NS‡ |

**Results:** *For quantitative study results:* (–), statistically negative relationship between nurse staffing or workload and the nursing outcome; (+), statistically positive relationship between nurse staffing or workload and the nursing outcome; NS, results were not significant. *For qualitative or descriptive study results:* (↑) positive relationship between nurse staffing or workload and the nursing outcome; (↓), negative relationship between nurse staffing or workload and the nursing outcome; blank cell, the specific outcome was not studied.
The indicated staffing or workload measure may have been one of many factors influencing the given nurse outcome.

**Notes:** * This is an actual patient-to-nurse ratio, obtained from administrative data and linked to nurse survey data.

## Table 2. Nurse Staffing and Nurse Outcomes: Studies and Results, 1994–2006 (23 studies)

| STUDY | PERCEIVED STAFFING OR WORKLOAD MEASURE | OUTCOME |
|---|---|---|
| **Burnout** | | |
| Aiken LH, et al. *JAMA* 2002;288(16):1987-93. | High patient:nurse ratio* | (+) |
| Demerouti E, et al. *J Adv Nurs* 2000;32(2):454-64. | High job demands | (+) |
| **Disengagement and intent to quit** | | |
| Demerouti E, et al. *J Adv Nurs* 2000;32(2):454-64. | High job demands | (+) |
| Gardulf A, et al. *J Nurs Manag* 2005;13(4):329-37. | Stressful work | (+) |
| | High work tempo | (+) |
| Geiger-Brown J, et al. *AAOHN J* 2004;52(1):16-22. | High work demands | (↑) |
| Hayhurst A, et al. *J Nurs Care Qual* 2005;20(3):283-8. | High work pressure | NS |
| **Exhaustion** | | |
| Demerouti E, et al. *J Adv Nurs* 2000;32(2):454-64. | High job demands | (+) |
| Halm M, et al. *Clin Nurs Spec* 2005;19(5):241-51. | Clinical specialty | NS |
| Janssen PPM, et al. *J Adv Nurs* 1999;29(6):1360-9. | High workload | (+) |
| McNeese-Smith D. *J Adv Nurs* 1999;29(6):1332-41. | Work overload | (↑) |
| Sheward L, et al. *J Nurs Manag* 2005;13:51-60. | Low RN:patient ratio | (+) |
| **Health Status** | | |
| Landeweerd J, Boumans N. *Journal of Occupational and Organizational Psychology* 1994;67(3):207-18. | Work pressure | (–) |
| Weyers S, et al. Scand *J Caring Sci* 2006;20:26-34. | Effort–reward imbalance | (–) |
| **Job Dissatisfaction** | | |
| Aiken LH, et al. *JAMA* 2002;288(16):1987-93. | High patient:nurse ratio* | (+) |
| Dunn S, et al. *J Nurs Manag* 2005;13:22-31. | Inadequate staffing | (↑) |
| | Lack of time to do work | (↑) |
| Halm M, et al. *Clin Nurs Spec* 2005;19(5):241-51. | Clinical specialty | NS |
| Khowaja K, et al. *J Nurs Manag* 2005;13:32-9. | High workload | (↑) |
| McNeese-Smith D. *J Adv Nurs* 1999;29(6):1332-41. | Work overload | (↑) |
| Sheward L, et al. *J Nurs Manag* 2005;13:51-60. | Low RN:patient ratio | (+) |
| **Job Satisfaction** | | |
| Davidson H, et al. *Med Care* 1997;35(6):634-45. | Work overload | (–) |
| Dunn S, et al. *J Nurs Manag* 2005;13:22-31. | Inadequate staffing | (↓) |
| | Lack of time to do work | (↓) |
| Gaertner S. *Human Resource Management Review* 1999;9(4):479-93. | High workload | (–) |
| Kovner C, et al. *J Nurs Scholarsh* 2006;38(1):71-9. | High workload | NS |
| Shaver KH, Lacey LM. *J Nurs Adm* 2003;33(3):166-72. | Understaffing | (–) |

| STUDY | PERCEIVED STAFFING OR WORKLOAD MEASURE | OUTCOME |
|---|---|---|
| **Life Satisfaction and Quality** | | |
| Demerouti E, et al. *J Adv Nurs* 2000;32(2):454-64. | High job demands | (–) |
| Geiger-Brown J, et al. *AAOHN J* 2004;52(1):16-22. | High work demands | (↓) |
| **Injury: Assault** | | |
| Lanza ML, et al. *Journal of the American Psychiatric Nurses Association* 1997;3(2):42-8. | Low number of RNs | NS |
| **Injury: Musculoskeletal** | | |
| Bruce S, et al. *Can Nurse* 2002;98(9):12-7. | High workload | (+) |
| Trinkoff AM, et al. *Am J Prev Med* 2003;24(3):270-5. | Physical demands | (+) |
| **Injury: Needlestick** | | |
| Clarke SP, et al. *Am J Public Health* 2002;92(7):1115-9. | High patient:nurse ratio | (+) |
| Clarke SP, et al. *Am J Infect Control* 2002;30(4):207-16. | High workload | (+) |
| **Stress** | | |
| Bruce S, et al. *Can Nurse* 2002;98(9):12-7. | High workload | (+) |
| **Turnover** | | |
| Strachota E, et al. *J Nurs Adm* 2003;33(2):111-7. | Poor staffing | (↑) |
| | Poor work environment | (↑) |
| | Work stress | (↑) |

**Results:** (–), statistically negative relationship between nurse staffing and the financial outcome; (+), statistically positive relationship between nurse staffing and the financial outcome; NS, results were not significant.

**Notes:** HPPD, hours per patient-day; LOS, length of stay.

* Nonlinear relationship: although higher staffing levels were associated with higher costs, so were below-average staffing levels.

† Recommended nurse hrs:actual nurse hours.

‡ Nurse staffing is related to increased patient complications, which is related to increased lengths of stay.

## Table 3. Nurse Staffing and Financial Outcomes: Studies and Results, 1983–2007 (18 studies)

| STUDY | STAFFING OR WORKLOAD | OUTCOME |
|---|---|---|
| **Costs: General** | | |
| Glandon G, et al. *Nurs Manag* 1989;20(5):30-3. | RN skill mix | (+) |
| Halloran EJ. *Nurs Manag* 1983;14(8):18-22. | RN skill mix | (–) |
| Jones CJ. *J Nurs Adm* 2005;35(1):41-49. | RN turnover | (+) |
| Shukla RK. *Inquiry* 1983;20:173-84. | RN skill mix | (+) |
| Strachota E, et al. *J Nurs Adm* 2003;33(2):111-7. | RN turnover | (+) |
| Titler M, et al. *Nurs Econ* 2005;23(6):290-306. | RN HPPD | (+,–)* |
| Titler M, et al. *Nurs Outlook* 2007;55(1):5-14. | RN HPPD | (–) |
| | RN HPPD below median | (+) |
| **Costs: Patient Complications** | | |
| Cho S, et al. *Nurs Res* 2003;52(2):71-9. | RN hrs | (–) |
| | RN skill mix | (–) |
| Dimick JB, et al. *Am J Crit Care* 2001;10(6):376-82. | RN:patient ratio | (–) |
| **Costs: Operating** | | |
| Bloom JR, et al. *Soc Sci Med* 1997;44(2):147-55. | RN skill mix | NS |
| | RN tenure > 5 yrs | (–) |
| | Part-time RN staff | (–) |
| | Temporary RNs | (+) |
| McCue M, et al. *Journal of Health Care Finance* 2003;29(4):54-76. | RN hrs | (+) |
| | RN skill mix | (+) |
| **Costs: Personnel** | | |
| Bloom JR, et al. *Soc Sci Med* 1997;44(2):147-55. | RN skill mix | NS |
| | RN tenure > 5 yrs | (–) |
| | Part-time RN staff | (–) |
| | Temporary RNs | NS |
| **Costs: Net** | | |
| Needleman J, et al. *Health Affairs* 2006;25(1):204-11. | RN HPPD | (+) |
| | RN skill mix without more hrs | (–) |
| Rothberg MB, et al. *Med Care* 2005;43(8):785-91. | Patient:nurse ratio | (–) |
| **LOS** | | |
| Behner KG, et al. *Health Care Manage Rev* 1990;15(4):63-71. | Nurse workload† | (+)‡ |
| Brown MP, et al. *Advances in Health Care Management* 2002;3:45-57. | RN hrs | (–) |
| Cho S, et al. *Nurs Res* 2003;52(2):71-9. | RN hrs | (–) |
| | RN skill mix | (–) |
| Morales IJ, et al. *Crit Care Med* 2003;31(3):858-63. | ≥ 3 admissions per shift | NS |
| Needleman J, et al. *Health Affairs* 2006;25(1):204-11. | RN HPPD | (–) |
| Pronovost PJ, et al. *JAMA* 1999;281(14):1310-7. | RN:patient ratio | (–) |
| Shamian J, et al. *J Nurs Adm* 1994;24(7/8):52-7. | RN HPPD | (–) |
| **Profits** | | |
| McCue M, et al. *Journal of Health Care Finance* 2003;29(4):54-76. | RN hrs | NS |
| | RN skill mix | (–) |