Chapter 23. Patient Acuity

Bonnie M. Jennings

Background

For more than 50 years, researchers have worked to develop staffing methodologies to accurately indicate the number of nurses needed to give good care to patients.[1] By the 1980s, patient classification systems (PCSs) were in common use to predict patient requirements for nursing care. These requirements, or patient acuity, could then be used to manage nursing personnel resources, costs, and quality.[2, 3]

PCSs have numerous limitations, however. Paramount among these are (a) validity and reliability are infrequently monitored;[4, 5] (b) the tools are often complex and require considerable time to complete;[4] (c) they lack credibility among staff nurses and administrators;[5, 6] (d) they are not designed to detect census variability throughout the day from patient movement due to admissions, discharges, transfers, and short-stays;[7, 8] and (e) their focus on tasks shortchanges the cognitive work and knowledge inherent to expert nursing care and sophisticated surveillance.[9, 10]

As restructuring and mergers escalated in the 1990s, issues of patient acuity once again moved to the foreground. Patients were said to be sicker and leaving health care facilities more quickly. Concerns about rising patient acuity continue into the new millennium because of the relentless change that is now common in health care. Moreover, acuity is one of many elements that comprise the often used but not yet well specified concept of workload.[11, 12]

Research Evidence

In assessing the research conducted between 1995 and 2005 about patient acuity, three things stand out. First, most of the research reports are about developing or comparing instruments to measure patient acuity. Unlike early PCSs that were designed for medical-surgical patients in acute care facilities, these instruments are tapping into other care settings such as long-term care,[13–17] home care,[18, 19] emergency departments (EDs),[20–28] and neurological rehabilitation centers,[29–33] to name but a few. There is little evidence, however, regarding the extent to which these tools are being used.

Second, most reports simply mention that patient acuity is increasing without supporting data. Only four studies actually examined trends in patient acuity to empirically substantiate perceptions that acuity is rising. Interestingly, these investigations were all conducted outside the United States. PCS scores were compared over 3 months in 1996 and the same period in 1999 for critical care patients in one Australian hospital.[34] Acuity varied by shift (day, evening, night), with the evening shift demonstrating the highest patient acuity. Although the PCS scores followed similar patterns in 1996 and 1999, the PCS scores were higher for all shifts in 1999.

Monthly PCS data from 17 units in a Swedish hospital indicated that average scores in each of four acuity categories increased from 1995 to 1996.[35] The investigators concluded that patients were sicker and their treatments more time consuming. However, they also demonstrated discrepancies between actual and required staff, with the actual staff consistently lower than required. This gap has also been observed in U.S. hospitals.[6] In a Canadian study from Ontario, case-mix data were examined for all acute care hospitals from 1997 to 2002.[36] After controlling

for age, it was evident that the average inpatient case-mix index (CMI) increased by 17 percent over the 5 years of data that were examined. The least complex patients declined by 24 percent, and the most complex patients increased by 144 percent, representing an overall increase of 211 percent for the most complex patients. The fourth study examined care needs for long-term-care (LTC) residents in Alberta, Canada, between 1988 and 1999.[37] The data demonstrated an increase in residents needing greater help with activities of daily living and more intervention for difficult behaviors such as dementia.

Finally, studies were rarely designed to assess patient acuity in relation to patient outcomes. Of those shown in Table 1, three evaluated heterogeneous groupings of patients in acute care settings.[38–40] An additional three studies examined acuity in more homogeneous patient populations. One study focused exclusively on critical care patients,[41] and another considered only obstetrical care for teenagers.[42] Acuity was also examined in relation to patient outcomes in the ED.[43]

Evidence-Based Practice Implications

There is little empirical evidence about the relationship between acuity and patient safety, making the practice implications from these studies modest. Although three studies showed a positive association between acuity and adult mortality,[38, 40, 41] findings were more equivocal for the relationship between acuity and neonatal mortality rates.[42] This latter study illustrated that factors other than acuity were more predictive of outcomes, particularly weekend births and ethnicity or race. The investigators who studied critical care patients concluded that variations in mortality might be partially explained by excess workload.[40]

Findings from the studies involving a variety of inpatients were not consistent. As expected, the two studies using the same dataset[38, 40] both showed similar results—a positive relationship between acuity and adverse outcomes such as infections and decubiti, but not medication errors and falls. The third study was conducted on 32 units in a different hospital.[39] Data were collected for a full year. Although the association between hours of nursing per patient day was statistically significant ($r = .60$; $P < .05$), the relationship between acuity and adverse outcomes was not examined. Rather, acuity was a significant predictor of various self-care measures such as symptom management.

The ED study assessed patient satisfaction as the outcome measure.[43] Although this work did not provide evidence about outcomes related to patient safety, it did illustrate how patient perceptions come into play regarding features of care delivery. Patients whose acuity placed them in the ‘emergent’ category were more satisfied with their care than patients in either the ‘urgent’ or ‘routine’ acuity groups. However, when perceived throughput time was controlled, acuity did not predict satisfaction with ED care. The importance of patient perceptions was clearly in effect in determining satisfaction.

Research Implications

At present, very little is known about the relationship between acuity and outcomes. The lack of a standardized approach to measuring acuity has broad research implications. For investigations using PCSs, reports need to include information about the psychometric properties of the tools. It would also be helpful to examine the relationship of PCS acuity to clinical outcomes using more homogeneous patient groupings.

Perhaps the most important research issues concern greater clarity about the larger concept—workload. There is an urgent need to develop a conceptual model illustrating the relationships of the various elements comprising workload as well as a standardized definition of workload. Empirical testing of the model might then better elucidate how acuity, as one aspect of workload, relates to patient safety.

It would also be very helpful if U.S. studies were conducted to ascertain whether the perceptions of increased acuity are verifiable. It would be most beneficial if these studies looked not just at acuity in the aggregate, but also at acuity for homogeneous patient populations. This could help clarify whether acuity for medical-surgical patients has escalated. Finally, it would be useful to have a sense of acuity in the outpatient setting, given how patient care has shifted. Although outpatient acuity is particularly difficult to capture, it remains a research challenge for the future.

Conclusion

Patient acuity is a concept that is very important to patient safety. Presumably, as acuity rises, more nursing resources are needed to provide safe care. Very little research has actually been conducted, however, to verify this premise. Moreover, findings from the research that has been conducted are largely inconsistent. Design issues account for these differences. In addition, it is possible that factors other than patient acuity may contribute more to patient outcomes. It remains important to derive a much better grasp of the relationship between patient acuity, outcomes, and patient safety. At present, little can be said with confidence about this association.

Search Strategy

The literature for this review was identified by searching the MEDLINE® and CINAHL® databases from 1995 to 2005 for research-based articles published in the English language. A reference librarian assisted in choosing the search terms. In the CINAHL® search, the terms were "patient acuity" or "patient classification." This yielded 345 citations. The MEDLINE® search was tried four times using various combinations of terms such as "patient acuity," "patient classification," "severity of illness index," "acute disease classification" and "diagnosis related groups." The combined efforts of the four searches resulted in identifying 98 references.

The abstracts for all 443 citations were reviewed. Of these, 104 were considered to be potential candidates for use in this review. The references that were excluded from this assessment included a wide array of topics that were irrelevant to patient acuity. The diversity of these articles is too great to provide a complete view of them, but a few examples include quality of life, menstrual cycle abnormalities, blood pressure variability, and fever management for children.

After reading the 104 candidate articles in their entirety, an additional 72 papers were omitted from the remainder of the analysis. Papers were excluded because they were more tangentially related to patient acuity (e.g., indicators of patient dependency), they were reviews of literature, or they did not focus on patients per se (e.g., a way to classify school-age children with disabilities). As a result, this review was based on findings from 32 research reports.

Author Affiliation

Bonnie M. Jennings, D.N.Sc., R.N., F.A.A.N., colonel, U.S. Army (Retired), and health care consultant; e-mail: bmjennings@cox.net.

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References

1. Abdellah FG, Levine E. Work-sampling applied to the study of nursing personnel. Nurs Res 1954;3(1):11-6.
2. Malloch K, Conovaloff A. Patient classification systems, part 1: the third generation. J Nurs Adm 1999;29(7/8): 49-56.
3. Van Slyck A, Johnson KR. Using patient acuity data to manage patient care outcomes and patient care costs. Outcomes Manage 2001;5(1):36-40.
4. DeGroot H. Patient classification system evaluation, part I: essential system elements. J Nurs Adm 1989;19(6):30-5.
5. Hlusko DL, Nichols BS. Can you depend on your patient classification system? J Nurs Adm 1996;26(4):39-44.
6. Minnick AF, Pabst MK. Improving the ability to detect the impact of labor on patient outcomes. J Nurs Adm 1998;28(12):17-21.
7. Budreau G, Balakrishnan R, Titler M, et al. Caregiver-patient ratio: capturing census and staffing variability. Nurs Econ 1999;17(6):317-24.
8. Wagner C, Budreau G, Everett LQ. Analyzing fluctuating unit census for timely staffing intervention. Nurs Econ 2005;23(2):85-90.
9. Ball C, Walker G, Harper P, et al. Moving on from 'patient dependency' and 'nursing workload' to managing risk in critical care. Intensive Crit Care Nurs 2004;20:62-8.
10. Fulton TR, Wilden BM. Patient requirements for nursing care: The development of an instrument. Can J Nurs Adm 1998;11(1):31-51.
11. Mark BA, Salyer J, Harless DW. What explains nurses' perceptions of staffing adequacy? J Nurs Adm 2002;32(5):234-42.
12. Seago JA. The California experiment. Alternatives for minimum nurse-to-patient ratios. J Nurs Adm 2002;32(1):48-58.
13. Adams-Wendling L. Clocking care hours with workload measurement tools. Nurs Manage 2003;34(8):34-9.
14. Grando VT, Rantz MJ, Petroski GF, et al. Prevalence and characteristics of nursing homes residents requiring light-care. Res Nurse Health 2005;28:210-9.
15. Hendricks A, Whitford J, Nugent G. What would VA nursing home care cost? Methods for estimating private sector payments. Med Care 2003;41(6, Suppl):II52-II60.
16. Mueller C. The RUG-III case mix classification system for long-term care nursing facilities. Is it adequate for nurse staffing? J Nurs Adm 2000;30(11):535-43.
17. Swanson EA, Glick OJ. Reliability and validity of a new preadmission acuity tool for long-term care. J Nurs Measure 1995;3(1):77-88.
18. Calver J, D'Arcy C, Homan J, et al. A preliminary casemix classification system for home and community care clients in Western Australia. Aust Health Rev 2004;27(2):27-39.
19. Santamaria N, Daly S, Addicott R, et al. The development, validity and reliability of the hospital in the home dependency scale (HDS). Aust J Adv Nurs 2001;19(4):8-14.
20. Eitel DR, Travers DA, Rosenau AM, et al. The Emergency Severity Index triage algorithm. Version 2 is reliable and valid. Acad Emerg Med 2003;10(10):1070-80.

21. Gorelick MH, Lee C, Cronan K, et al. Pediatric Emergency Assessment Tool (PEAT): a risk-adjustment measure for pediatric emergency patients. Acad Emerg Med 2001;8(2):156-62.

22. Gorelick MH, Alpern ER, Alessandrini EA. A system for grouping presenting complaints: The pediatric emergency reason for visit clusters. Acad Emerg Med 2005;12(8):723-31.

23. Maldonado T, Avner JR. Triage of the pediatric patient in the emergency department: Are we all in agreement? Pediatrics 2004;114(2):356-60.

24. Tanabe P, Gimbel R, Yarnold PR, et al. Reliability and validity of scores on the Emergency Severity Index Version 3. Acad Emerg Med 2004;11(1):59-65.

25. Tanabe P, Gimbel R, Yarnold PR, et al. The Emergency Severity Index (version 3) 5-level triage system scores predict ED resource consumption. J Emerg Nurs 2004;30(1):22-9.

26. Tanabe P, Travers D, Gilboy N, et al. Refining Emergency Severity Index triage criteria. Acad Emerg Med 2005;12(6):497-501.

27. Wollaston A, Fahey P, McKay M, et al. Reliability and validity of the Toowoomba adult trauma triage tool: a Queensland, Australia study. Accident Emerg Nurs 2004;12:230-7.

28. Wuerz RC, Travers D, Gilboy N, et al. Implementation and refinement of the Emergency Severity Index. Acad Emerg Med 2001;8(2):170-6.

29. Gross JC, Faulkner EA, Goodrich SW, et al. A patient acuity and staffing tool for stroke rehabilitation inpatients based on the FIM™ instrument. Rehab Nurs 2001;26(3):108-13.

30. Gross JC, Goodrich SW, Kain ME, et al. Determining stroke rehabilitation inpatients' level of nursing care. Clin Nurs Res 2001;10(1):40-51.

31. Lowthian P, Disler P, Ma S, et al. The Australian national sub-acute and non-acute patient casemix classification (AN-SNAP): its application and value in a stroke rehabilitation programme. Clin Rehab 2000;14:532-7.

32. Post MW, Visser-Meily MJ, Gispen LS. Measuring nursing needs of stroke patients in clinical rehabilitations: a comparison of validity and sensitivity to change between the Northwick Park Dependency Score and the Barthel Index. Clin Rehab 2002;16:182-9.

33. Turner-Stokes L, Tonge P, Hyein K, et al. The Northwick Park Dependency Score (NPDS): a measure of nursing dependency in rehabilitation. Clin Rehab 1998;12:304-18.

34. Donoghue J, Decker V, Mitten-Lewis S, et al. Critical care dependency tool: monitoring the changes. Austral Crit Care 2001;14(2):56-63.

35. Levenstam AK, Bergsbom I. Changes in patients' need of nursing care reflected in the Zebra system. J Nurs Manage 2002;10:191-9.

36. Preyra C. Coding response to a case-mix measurement system based on multiple diagnoses. Health Serv Res 2004;39(4,Pt1):1027-45.

37. Wilson DM, Truman CD. Long-term-care residents. Concerns identified by population and care trends. Can J Pub Health 2004;95:382-6.

38. Blegen MA, Goode CJ, Reed L. Nurse staffing and patient outcomes. Nurs Res 1998;47(1):43-50.

39. Potter P, Barr N, McSweeney M, et al. Identifying nurse staffing and patient outcome relationships: a guide for change in care delivery. Nurs Econ 2003;21(4):158-66.

40. Reed L, Blegen MA, Goode CS. Adverse patient occurrences as a measure of nursing care quality. J Nurs Adm 1998;28(5):62-9.

41. Tarnow-Mordi WO, Hau C, Warden A, et al. Hospital mortality in relation to staff workload: a 4-year study in an adult intensive-care unit. Lancet 2000;356(Jul 15):185-9.

42. Hamilton P, Restrepo E. Weekend birth and higher neonatal mortality: a problem of patient acuity or quality of care? J Obstet Gyn Neonatal Nurs 2003;32(6):724-33.

43. Boudreaux ED, Friedman J, Chansky ME, et al. Emergency department patient satisfaction: Examining the role of acuity. Acad Emerg Med 2004;11(2):162-8.

Table 1. Evidence on Patient Acuity

Source	Safety Issue Related to Clinical Practice	Design Type	Study Design, Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Finding(s)
Blegen 1998[38]	Inpatient outcomes (acuity was measured by the monthly reports derived from the hospital's acuity system)	Cross-sectional	Design: Level 3 Patient outcomes: deaths, rates of falls, medication errors, decubiti, urinary tract and respiratory infections (Level 1), complaints	42 inpatient units in an 880-bed hospital during FY 1993 (prior to restructuring); 21,783 discharged patients; 1,074 full-time equivalent nursing staff members, 832 of whom were RNs		In bivariate correlations, acuity was negatively associated with medication errors and falls, and positively correlated with infections, decubiti, complaints, and death.
Boudreaux 2004[43]	ED patients (acuity was measured by triage categories assigned by trained nurses—emergent, urgent, routine)	Cross-sectional	Design: Level 3 Patient outcomes: satisfaction (Level 4)	1,865 patients over 1 month at a large inner-city hospital ED Patients: average age 30 years; 53% female		Patients with higher acuity were more satisfied with care and perceived their throughput time more favorably; satisfaction was more closely linked to perceived throughput times than to actual throughput times or acuity.

Source	Safety Issue Related to Clinical Practice	Design Type	Study Design, Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Finding(s)
Hamilton and Restrepo 2003[42]	Neonatal deaths preventable in the perinatal period (acuity was measured using maternal medical risk factors such as hypertension, anemia, previous birth of an infant who was preterm or small for gestational age)	Cross-sectional	Design: Level 3 Patient outcomes: mortality (Level 1)	All births to teenage mothers (< 20 years of age) in Texas in 1999 and 2000 (N = 11,749) with a focus on neonatal deaths (prior to the 28th day of life) (n = 397); mean neonatal mortality/1,000 live births = 3.6; Hispanic (56%), White (27%), African American (15%), other (2%)		Neonatal mortality rates differed significantly between weekdays and weekends (odds ratio [OR] = 1.42, 95% CI = 1.14–1.76, *P* = 0.001). When ethnicity and or race were examined with day of the week, a statistically significant difference was found for births to Hispanic teens (OR = 1.728, 95% CI = 1.275–2.342, *P* < 0.001). Differences in acuity did not fully explain higher weekend neonatal mortality rates.
Potter 2003[39]	Patient outcomes (after adjusting for acuity)	Cross-sectional	Design: Level 3 Patient outcomes: fall and medication error index (Level 1); self-reports of symptom management, self-care, health status; patient satisfaction	32 inpatient units in one hospital from 2000 to 2001; 3,418 patients		Unit data were aggregated to create yearly data due to small numbers for some variables. Acuity was a significant predictor of the self-care measures of importance and understanding, and indexes of self-care symptom management.

Source	Safety Issue Related to Clinical Practice	Design Type	Study Design, Study Outcome Measure(s)	Study Setting & Study Population	Study Intervention	Key Finding(s)
Reed 1998[40]	Adverse occurrences among inpatients (acuity was measured by an institutionally standardized measure; average daily acuity/month was used)	Cross-sectional	Design: Level 3 Patient outcomes: deaths, pressure ulcers, nosocomial infections, medication administration errors (Level 1), complaints	42 inpatient units in an 880-bed hospital during FY 1993 (prior to restructuring). This was a secondary data analysis of a mix of units: 5 surgical; 10 medical; 3 obstetrical; 8 pediatric; 4 critical care; 4 psychiatric; 2 eye, ear, nose; 6 orthopedic and neuroscience.		Deaths, pressure ulcers, infections, patient complaints were positively intercorrelated and positively correlated to patient acuity. When patient acuity was controlled, these adverse outcomes seemed to share a common underlying characteristic indicating something other than acuity, such as the quality of care.
Tarnow-Mordi 2000[41]	Staff workload (after adjusting for risk using the APACHE II; workload was defined by average nursing requirement per occupied bed and peak occupancy)	Prospective cohort	Design: Level 3 Patient outcome: hospital mortality (Level 1)	1,050 patients admitted to an adult ICU in Scotland between January 1, 1992, and December 31, 1995. Patients: Age, 16 to $\geq$70, with 43% of the patients in the $\geq$ 70 age group58% male		Predicted mortality was calculated using the APACHE II. The 337 hospital deaths were 49 more than predicted by APACHE II (95% CI = 34–65). Adjusted mortality was more than two times higher (OR = 3.1, 95%CI = 1.9–5.0) for patients exposed to high ICU workload.