

Journal of Nursing Studies and Patient Care

Review Article

Predictors of nurse job satisfaction in intensive care nursing staff with medication administration errors

Walsh L^{1*}, Kelly A² and O'Brien S³

¹Department of Patient Care Research, Uruguay Institute for Advanced Nursing Science, Wales

²Department of Clinical Patient Care Research, Arno Institute for Advanced Nursing Science, United Kingdom

³Department of Clinical Patient Care Research, Oder Research Center for Nursing Science, Scotland

*Address for Correspondence: Liam Walsh, Department of Patient Care Research, Uruguay Institute for Advanced Nursing Science, Wales; E-mail: liam.walsh@uruguay.edu

Received: 14 July 2019; Accepted: 5 October 2019; Published: 2 January 2020.

Citation of this article: Walsh L, Kelly A, O'Brien S (2020) Predictors of nurse job satisfaction in intensive care nursing staff with medication administration errors. J Nurs Stud Patient Care, 2(1): 01-07. DOI: [10.5281/zenodo.22814838](https://doi.org/10.5281/zenodo.22814838)

Copyright: © 2020 Liam Walsh, et al. This is an open access article distributed under the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: Intensive care nurses work at the intersection of two demanding processes, sustained high-acuity monitoring and a dense, high-alert medication regimen, and multinational audits find that a substantial share of ICU drug administrations involve an error or near-miss.

Objective: This review synthesizes the published evidence on the predictors of job satisfaction among intensive care nursing staff and examines how those same predictors relate to the occurrence of medication administration errors on the same units.

Methods: We synthesized cross-sectional and longitudinal nurse-survey studies, multi-hospital and multinational staffing analyses, and direct observational studies of medication administration in intensive care and comparable acute-care settings.

Findings: Staffing adequacy and patient-to-nurse ratio, workload and interruption frequency, burnout, and practice-environment quality, including leadership, empowerment, and a non-punitive learning climate, emerge repeatedly as predictors in both the job-satisfaction literature and the medication administration error literature, with burnout and missed care acting as plausible mediating pathways between the two.

Conclusions: Nurse job satisfaction and medication administration safety in intensive care appear to be governed by a shared, largely modifiable set of workforce predictors rather than separate causal chains, arguing for interventions that address staffing, interruptions, and psychological safety together.

Keywords: job satisfaction; intensive care nursing; medication administration errors; nurse burnout; staffing

1. Introduction

Intensive care units concentrate two pressures that rarely coexist elsewhere in a hospital at the same intensity: a nursing workforce that must sustain vigilance across physiologically unstable patients on multiple concurrent high-alert infusions, and a medication-use process dense enough that a single omitted step can reach the patient within minutes. Multinational audits of parenteral drug administration in intensive care have found that at least one error or near-miss accompanies roughly one in three drug administrations observed at the bedside, far higher than on general wards [1]. Earlier work established that adverse drug events and potential adverse drug events cluster disproportionately in critical care areas relative to bed count [2], and a prospective critical-care safety study confirmed that both errors and serious adverse events remain common even in units with mature safety infrastructure [3]. Systematic reviews of the causes of medication administration error consistently point to work-system factors, chiefly interruptions, workload, and staffing adequacy, as the dominant contributors [4].

Running alongside this safety literature is a separate but empirically entangled body of work on nurse job satisfaction. Job satisfaction has been defined and measured inconsistently across decades of nursing research, but reviews converge on a core set of domains, autonomy, workload, relationships with colleagues and management, and perceived recognition, that predict both retention and reported quality of care [5,6]. A more recent systematic review confirmed that these same domains remain the strongest predictors of hospital nurse satisfaction across health systems with very different staffing models [7]. What has received comparatively less synthesis is the specific intersection of these two literatures in the intensive care setting: the predictors that make ICU nurses satisfied or dissatisfied, and how those same predictors, largely through staffing, workload, and burnout, appear to shape the likelihood of medication administration error on the same units. This review

synthesizes the published evidence on that intersection, organized around workforce and staffing predictors, burnout and practice-environment predictors, the medication administration error literature specific to intensive care, and the mechanisms that plausibly link the two.

2. Job satisfaction in intensive care nursing: conceptual background

Job satisfaction in nursing is now understood less as a single global attitude than as a composite of satisfaction with discrete facets of the work, a distinction that matters because different facets predict different downstream outcomes. Lu and colleagues' foundational review identified pay, workload, professional relationships, and opportunities for autonomy and growth as the facets most consistently associated with overall satisfaction [5], and their subsequent update confirmed that workload and staffing adequacy had, if anything, become more dominant predictors as acute-care patient acuity rose [7]. Zangaro and Soeken's meta-analysis of job satisfaction instruments found that satisfaction correlated most strongly with organizational commitment and least with demographic variables such as age or years of experience, reinforcing that satisfaction is shaped primarily by modifiable features of the work environment [6]. Flinkman and colleagues' integrative review of nurses' intention to leave the profession identified job dissatisfaction, alongside burnout and poor work-life balance, as the strongest predictor of turnover intention, a finding with particular relevance to intensive care, where sustained unit expertise is itself a patient-safety asset that attrition erodes [8].

Intensive care nursing carries structural features that intensify these generic predictors: patients are more acutely unstable, the nurse-to-patient ratio is deliberately compressed, technology and monitoring burden is higher, and end-of-life and family-communication demands are more frequent. Ulrich and colleagues' baseline survey of

critical care nurses' work environments found that perceived staffing adequacy and collaborative physician relationships were the factors most strongly associated with nurses' intent to remain in critical care [9], and a decade-later survey using the same framework found that despite substantial investment in healthy-work-environment initiatives, staffing adequacy and workload remained the top-ranked unmet need reported nationally [10]. Together these surveys frame staffing and workload as the central, persistently unresolved driver of ICU nurse satisfaction across more than a decade of measurement.

3. Workforce and staffing predictors of satisfaction

The empirical case that nurse staffing levels causally shape both job satisfaction and patient outcomes rests substantially on the multi-hospital, multi-country studies led by Aiken and colleagues. Their landmark analysis of over 10,000 nurses across Pennsylvania hospitals found that each additional patient per nurse was associated with a 23% increase in the odds of burnout and a 15% increase in the odds of job dissatisfaction, alongside a measurable increase in patient mortality [11]. A companion cross-national analysis found a consistent association between higher patient-to-nurse ratios and worse nurse-reported quality of care regardless of national context [12], and the subsequent twelve-country RN4CAST survey confirmed the relationship had persisted a decade later, with inadequate staffing linked to higher job dissatisfaction and intention to leave, and lower nurse- and patient-rated care quality [13].

Staffing's downstream effects extend into the adverse-event outcomes most relevant to medication safety. Cho and colleagues found that lower nurse staffing was independently associated with a higher incidence of adverse events, including pneumonia and unplanned extubation, and with higher costs of care [14]. Stone and colleagues, studying intensive care units specifically, found that better staffing and a stronger unit-level safety

climate were each independently associated with fewer bloodstream infections and lower 30-day mortality, positioning staffing as an ICU-specific safety lever [15]. Kalisch and Lee's cross-sectional analysis found that adequate staffing predicted both lower missed-care rates and stronger nurse-reported teamwork, suggesting staffing shapes satisfaction partly through the unit's collaborative climate [16]. Blegen and colleagues' work linking nurse experience and education to quality of care further established that the skill-mix component of staffing, not just headcount, independently predicts both error rates and care quality [17].

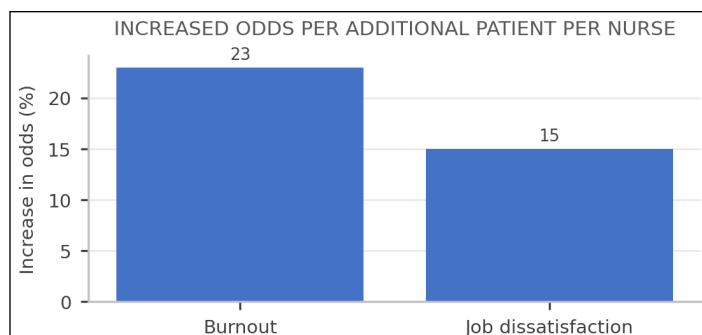


Figure 1: Odds of nurse burnout and job dissatisfaction per additional patient added to a nurse's workload, from a multi-hospital staffing survey [11].

4. Burnout, practice environment, and empowerment

Staffing's influence on satisfaction is substantially mediated through burnout, a pathway characterized in enough independent cohorts to be considered well established. Vahey and colleagues, analyzing the same Pennsylvania nurse cohort used in the original staffing-mortality work, found that nurse burnout was independently associated with lower patient satisfaction scores, demonstrating that the staffing-to-outcome pathway runs partly through the nurse's own emotional exhaustion [18]. Poghosyan and colleagues' six-country investigation confirmed that burnout, and specifically emotional exhaustion, predicted lower nurse-reported quality of care consistently across health systems with different staffing regulations [19]. McHugh and

colleagues' national survey of United States hospital nurses found widespread dissatisfaction and burnout concentrated among nurses caring for the most medically complex patients, with dissatisfaction rates in some hospitals exceeding 40%, a pattern with direct relevance to intensive care [20]. Cimiotti and colleagues extended the burnout pathway into a specific safety outcome, finding that hospitals with higher nurse burnout also had significantly higher rates of catheter-associated urinary tract and surgical-site infection [21].

Table 1: Predictors of ICU nurse job satisfaction identified across the reviewed studies, grouped by domain [10,24,23,26].

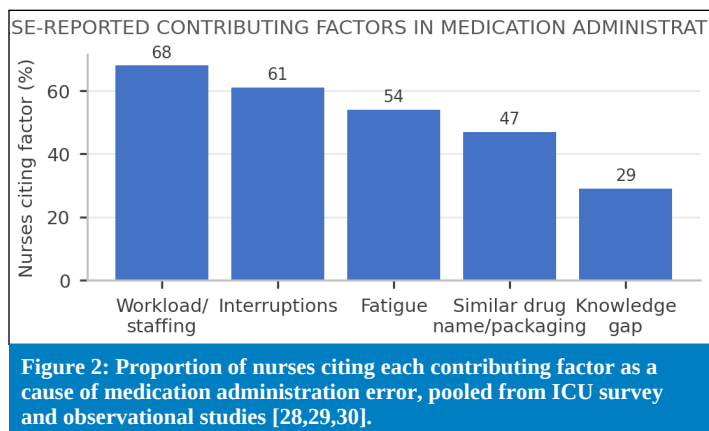
Domain	Representative predictor	Direction of association	Key source(s)
Staffing / workload	Patient-to-nurse ratio	Higher ratio lowers satisfaction	[11,10]
Burnout	Emotional exhaustion score	Higher burnout lowers satisfaction	[19,21]
Practice environment	Nurse-physician relations, leadership	Better environment raises satisfaction	[24,25]
Empowerment	Access to information, resources, support	Higher empowerment lowers job strain	[22,23]
Patient-facing outcome	Patient-rated satisfaction with care	Tracks nurse work-environment quality	[26,18]

The practice-environment and empowerment literature offers a complementary explanation for why units with comparable staffing numbers nonetheless report very different satisfaction levels. Laschinger and colleagues' structural empowerment framework found that nurses perceiving greater access to information, support, resources, and opportunity reported significantly lower job strain independent of workload itself [22], and their later analysis found that strong empowerment was also associated with lower burnout and, through that pathway, better patient-safety outcomes [23]. Van Bogaert and colleagues' multilevel modelling found that better nurse-physician relations and unit leadership quality predicted lower burnout and higher job satisfaction independent of patient-to-nurse ratio [24], a finding their

later survey replicated while additionally linking practice-environment quality to lower rates of nurse-reported adverse patient events [25]. Kutney-Lee and colleagues, analyzing linked nurse- and patient-survey data, found that hospitals with better nurse work environments had significantly higher patient satisfaction with care, evidence that the predictors driving nurse satisfaction are also valued by patients [26]. Estryn-Behar and colleagues' longitudinal analysis of European nurses found that perceived work-life imbalance and poor supervisor support were the strongest independent predictors of subsequent turnover [27].

5. Medication administration errors in intensive care

The medication administration error literature in intensive care describes a process with unusually little margin for the interruptions and workload spikes that ICU nursing routinely produces. Tang and colleagues' study of contributing factors found that nurses most frequently attributed administration errors to heavy workload, inadequate staffing, and frequent interruptions, with individual knowledge deficits cited far less often than system-level pressures [28]. Cheragi and colleagues' survey similarly found that fatigue, high patient-to-nurse ratios, and similar drug packaging or naming were the most commonly cited causes, with near-misses substantially outnumbering formally documented errors [29]. Keers and colleagues' systematic review concluded that the causes of medication administration error cluster reliably into workload and staffing, interruptions and distractions, and communication failures, a taxonomy that maps closely onto the predictors identified in the job-satisfaction literature [4].



Elganzouri and colleagues' direct observational time study found that interrupted administrations took measurably longer and were more likely to deviate from the five-rights standard than uninterrupted ones, providing observational evidence for the mechanism nurses describe qualitatively [30]. Roughead and Semple's review of Australian acute care similarly identified workload, staffing, and interruption as the dominant modifiable causes of administration error, concluding that system redesign targeting these factors had a stronger evidence base than error-specific training alone [31]. Valentin and colleagues' multinational ICU study additionally found that error rates varied systematically by unit-level organizational factors including staffing ratio, tying the error rate back to the same variable dominating the satisfaction literature [1]. Rothschild and colleagues found that serious medical errors clustered during high-workload shifts and were more frequent among fatigued nurses, adding a within-shift dimension to the workload-error relationship [3].

6. Linking satisfaction, burnout, and medication error

A smaller but directly relevant body of work has tested the staffing-satisfaction-error pathway explicitly rather than treating the two literatures as parallel. Mark and Belyea's analysis of longitudinal unit-level data found that staffing levels predicted subsequent medication error rates, strongest in units where staffing had been persistently

inadequate rather than transiently reduced, suggesting a cumulative, fatigue-mediated mechanism [32]. Chang and Mark's related analysis found that unit-level learning climate, nurses' shared sense that errors could be reported without punitive consequence, moderated the staffing-error relationship, with better learning climates associated with fewer errors at comparable staffing levels [33]. Kalisch and Lee's analysis of missed nursing care found that inadequate staffing predicted higher rates of omitted care, including delayed or omitted medication administration, establishing missed care as a plausible intermediate step between low staffing, low satisfaction, and downstream error [34].

Table 2: Studies linking staffing, satisfaction, or burnout directly to medication administration error or its intermediate outcomes.			
Study	Population / design	Linking mechanism	Reported association
[32]	Longitudinal unit-level data	Staffing adequacy over time	Persistent understaffing predicts higher medication error rate
[33]	Cross-sectional unit survey	Learning climate	Non-punitive climate lowers error rate at comparable staffing
[34]	Cross-sectional, missed care	Missed nursing care	Inadequate staffing predicts omitted/delayed medication administration
[36]	Qualitative, second-victim	Post-error psychological recovery	Error involvement can impair confidence and job satisfaction

The psychological aftermath of involvement in a medication error further closes the loop back to satisfaction. Wolf and colleagues found that most nurses involved in a medication error reported significant emotional distress, including anxiety and diminished confidence, regardless of whether the error reached the patient [35]. Scott and colleagues' foundational work on the "second victim" phenomenon described a predictable recovery trajectory after involvement in an adverse event, characterized by chaos, intrusive reflection, and, without adequate support, lasting impairment of professional confidence and job satisfaction [36]. Schwappach and

Boluarte's survey of clinicians involved in medical error found comparable sequelae and identified perceived organizational support, rather than error severity, as the strongest predictor of recovered confidence and job engagement [37]. Bates and colleagues' adverse-drug-event epidemiology underscores why this feedback loop matters at scale: because errors and near-misses are frequent in high-acuity care rather than rare, the cumulative psychological burden on ICU nurses is a routine occupational exposure rather than an occasional one [2].

7. Conclusion

The evidence reviewed here converges on a small set of predictors that appear repeatedly across both the nurse job satisfaction literature and the intensive care medication administration error literature: staffing adequacy and nurse-to-patient ratio, workload and interruption frequency, burnout, and the quality of the practice environment, including leadership, empowerment, and a non-punitive learning climate. These predictors do not operate as two separate causal chains; the staffing literature shows that inadequate staffing lowers satisfaction largely through burnout, the medication error literature shows that the same inadequate staffing and resulting interruptions raise administration error risk through a related fatigue pathway, and involvement in a resulting error then feeds back to further erode the satisfaction of the nurse involved. For intensive care units, where baseline error opportunity is already elevated by patient acuity and drug complexity, this reciprocal relationship argues for interventions that address staffing, interruption reduction, and psychological safety together rather than as separate improvement programs. Research that measures satisfaction, burnout, and error rate concurrently within the same ICU cohorts would substantially strengthen the causal case assembled here from largely parallel literatures.

8. References

1. Valentin, A., Capuzzo, M., Guidet, B., Moreno, R., Metnitz, B., Bauer, P., et al. (2009) Errors in administration of parenteral drugs in intensive care units: multinational prospective study. *BMJ*, 338: b814. DOI: [10.1136/bmj.b814](https://doi.org/10.1136/bmj.b814)
2. Bates, D.W., Cullen, D.J., Laird, N., Petersen, L.A., Small, S.D., Servi, D., et al. (1995) Incidence of adverse drug events and potential adverse drug events: implications for prevention. *JAMA*, 274(1): 29-34. DOI: [10.1001/jama.1995.03530010043033](https://doi.org/10.1001/jama.1995.03530010043033)
3. Rothschild, J.M., Landrigan, C.P., Cronin, J.W., Kaushal, R., Lockley, S.W., Burdick, E., et al. (2005) The Critical Care Safety Study: the incidence and nature of adverse events and serious medical errors in intensive care. *Critical Care Medicine*, 33(8): 1694-1700. DOI: [10.1097/01.CCM.0000171609.91035.BD](https://doi.org/10.1097/01.CCM.0000171609.91035.BD)
4. Keers, R.N., Williams, S.D., Cooke, J., Ashcroft, D.M. (2013) Causes of medication administration errors in hospitals: a systematic review of quantitative and qualitative evidence. *Drug Safety*, 36(11): 1045-1067. DOI: [10.1007/s40264-013-0090-2](https://doi.org/10.1007/s40264-013-0090-2)
5. Lu, H., While, A.E., Barriball, K.L. (2005) Job satisfaction among nurses: a literature review. *International Journal of Nursing Studies*, 42(2): 211-227. DOI: [10.1016/j.ijnurstu.2004.09.003](https://doi.org/10.1016/j.ijnurstu.2004.09.003)
6. Zangaro, G.A., Soeken, K.L. (2007) A meta-analysis of studies of nurses' job satisfaction. *Research in Nursing & Health*, 30(4): 445-458. DOI: [10.1002/nur.20202](https://doi.org/10.1002/nur.20202)
7. Lu, H., Barriball, K.L., Zhang, X., While, A.E. (2012) Job satisfaction among hospital nurses revisited: a systematic review. *International Journal of Nursing Studies*, 49(8): 1017-1038. DOI: [10.1016/j.ijnurstu.2011.11.009](https://doi.org/10.1016/j.ijnurstu.2011.11.009)
8. Flinkman, M., Leino-Kilpi, H., Salanterä, S. (2010) Nurses' intention to leave the profession: integrative review. *Journal of Advanced Nursing*, 66(7): 1422-1434. DOI: [10.1111/j.1365-2648.2010.05322.x](https://doi.org/10.1111/j.1365-2648.2010.05322.x)

Citation: Walsh L, Kelly A, O'Brien S (2020) Predictors of nurse job satisfaction in intensive care nursing staff with medication administration errors. *J Nurs Stud Patient Care*, 2(1): 01-07.

9. Ulrich, B.T., Lavandero, R., Hart, K.A., Woods, D., Leggett, J., Taylor, D. (2006) Critical care nurses' work environments: a baseline status report. *Critical Care Nurse*, 26(5): 46-57.
10. Ulrich, B., Barden, C., Cassidy, L., Varn-Davis, N. (2019) Critical care nurse work environments 2018: findings and implications. *Critical Care Nurse*, 39(2): 67-84. DOI: [10.4037/ccn2019605](https://doi.org/10.4037/ccn2019605)
11. Aiken, L.H., Clarke, S.P., Sloane, D.M., Sochalski, J., Silber, J.H. (2002) Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *JAMA*, 288(16): 1987-1993. DOI: [10.1001/jama.288.16.1987](https://doi.org/10.1001/jama.288.16.1987)
12. Aiken, L.H., Clarke, S.P., Sloane, D.M. (2002) Hospital staffing, organization, and quality of care: cross-national findings. *International Journal for Quality in Health Care*, 14(1): 5-13. DOI: [10.1093/intqhc/14.1.5](https://doi.org/10.1093/intqhc/14.1.5)
13. Aiken, L.H., Sermeus, W., Van den Heede, K., Sloane, D.M., Busse, R., McKee, M., et al. (2012) Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. *BMJ*, 344: e1717. DOI: [10.1136/bmj.e1717](https://doi.org/10.1136/bmj.e1717)
14. Cho, S.H., Ketefian, S., Barkauskas, V.H., Smith, D.G. (2003) The effects of nurse staffing on adverse events, morbidity, mortality, and medical costs. *Nursing Research*, 52(2): 71-79. DOI: [10.1097/00006199-200303000-00003](https://doi.org/10.1097/00006199-200303000-00003)
15. Stone, P.W., Mooney-Kane, C., Larson, E.L., Horan, T., Glance, L.G., Zwanziger, J., et al. (2007) Nurse working conditions and patient safety outcomes. *Medical Care*, 45(6): 571-578. DOI: [10.1097/MLR.0b013e3180383667](https://doi.org/10.1097/MLR.0b013e3180383667)
16. Kalisch, B.J., Lee, K.H. (2011) Nurse staffing levels and teamwork: a cross-sectional study of patient care units in acute care hospitals. *Journal of Nursing Scholarship*, 43(1): 82-88. DOI: [10.1111/j.1547-5069.2010.01375.x](https://doi.org/10.1111/j.1547-5069.2010.01375.x)
17. Blegen, M.A., Vaughn, T.E., Goode, C.J. (2001) Nurse experience and education: effect on quality of care. *Journal of Nursing Administration*, 31(1): 33-39. DOI: [10.1097/00005110-200101000-00006](https://doi.org/10.1097/00005110-200101000-00006)
18. Vahey, D.C., Aiken, L.H., Sloane, D.M., Clarke, S.P., Vargas, D. (2004) Nurse burnout and patient satisfaction. *Medical Care*, 42(2 Suppl): II57-66. DOI: [10.1097/01.mlr.0000109126.50398.5a](https://doi.org/10.1097/01.mlr.0000109126.50398.5a)
19. Poghosyan, L., Clarke, S.P., Finlayson, M., Aiken, L.H. (2010) Nurse burnout and quality of care: cross-national investigation in six countries. *Research in Nursing & Health*, 33(4): 288-298. DOI: [10.1002/nur.20383](https://doi.org/10.1002/nur.20383)
20. McHugh, M.D., Kutney-Lee, A., Cimiotti, J.P., Sloane, D.M., Aiken, L.H. (2011) Nurses' widespread job dissatisfaction, burnout, and frustration with health benefits signal problems for patient care. *Health Affairs*, 30(2): 202-210. DOI: [10.1377/hlthaff.2010.0100](https://doi.org/10.1377/hlthaff.2010.0100)
21. Cimiotti, J.P., Aiken, L.H., Sloane, D.M., Wu, E.S. (2012) Nurse staffing, burnout, and health care-associated infection. *American Journal of Infection Control*, 40(6): 486-490. DOI: [10.1016/j.ajic.2012.02.029](https://doi.org/10.1016/j.ajic.2012.02.029)
22. Laschinger, H.K., Finegan, J., Shamian, J., Wilk, P. (2001) Impact of structural and psychological empowerment on job strain in nursing work settings: expanding Kanter's model. *Journal of Nursing Administration*, 31(5): 260-272. DOI: [10.1097/00005110-200105000-00006](https://doi.org/10.1097/00005110-200105000-00006)
23. Spence Laschinger, H.K., Leiter, M.P. (2006) The impact of nursing work environments on patient safety outcomes: the mediating role of burnout/engagement. *Journal of Nursing Administration*, 36(5): 259-267. DOI: [10.1097/00005110-200605000-00019](https://doi.org/10.1097/00005110-200605000-00019)
24. Van Bogaert, P., Clarke, S., Roelant, E., Meulemans, H., Van de Heyning, P. (2010) Impacts of unit-level nurse practice environment and burnout on nurse-reported outcomes: a multilevel modelling approach. *Journal of Clinical Nursing*, 19(11-12): 1664-1674. DOI: [10.1111/j.1365-2702.2009.03128.x](https://doi.org/10.1111/j.1365-2702.2009.03128.x)
25. Van Bogaert, P., Timmermans, O., Weeks, S.M., van Heusden, D., Wouters, K., Franck, E. (2014) Nursing unit teams

- matter: impact of unit-level nurse practice environment, nurse work characteristics, and burnout on nurse reported job outcomes, quality of care, and patient adverse events. *International Journal of Nursing Studies*, 51(8): 1123-1134. DOI: [10.1016/j.ijnurstu.2013.12.009](https://doi.org/10.1016/j.ijnurstu.2013.12.009)
26. Kutney-Lee, A., McHugh, M.D., Sloane, D.M., Cimiotti, J.P., Flynn, L., Neff, D.F., et al. (2009) Nursing: a key to patient satisfaction. *Health Affairs*, 28(4): w669-w677. DOI: [10.1377/hlthaff.28.4.w669](https://doi.org/10.1377/hlthaff.28.4.w669)
 27. Estryn-Behar, M., Van der Heijden, B.I., Fry, C., Hasselhorn, H.M. (2010) Longitudinal analysis of personal and work-related factors associated with turnover among nurses. *Nursing Research*, 59(3): 166-177. DOI: [10.1097/NNR.0b013e3181dbb29f](https://doi.org/10.1097/NNR.0b013e3181dbb29f)
 28. Tang, F.I., Sheu, S.J., Yu, S., Wei, I.L., Chen, C.H. (2007) Nurses relate the contributing factors involved in medication errors. *Journal of Clinical Nursing*, 16(3): 447-457. DOI: [10.1111/j.1365-2702.2005.01540.x](https://doi.org/10.1111/j.1365-2702.2005.01540.x)
 29. Cheragi, M.A., Manoocheri, H., Mohammadnejad, E., Ehsani, S.R. (2013) Types and causes of medication errors from nurse's viewpoint. *Iranian Journal of Nursing and Midwifery Research*, 18(3): 228-231.
 30. Elganzouri, E.S., Standish, C.A., Androwich, I. (2009) Medication administration time study (MATS): nursing staff performance of medication administration. *Journal of Nursing Administration*, 39(5): 204-210. DOI: [10.1097/NNR.0b013e3181a23d6d](https://doi.org/10.1097/NNR.0b013e3181a23d6d)
 31. Roughead, E.E., Semple, S.J. (2009) Medication safety in acute care in Australia: where are we now? Part 1: a review of the extent and causes of medication problems 2002-2008. *Australia and New Zealand Health Policy*, 6: 18. DOI: [10.1186/1743-8462-6-18](https://doi.org/10.1186/1743-8462-6-18)
 32. Mark, B.A., Belyea, M. (2009) Nurse staffing and medication errors: cross-sectional or longitudinal relationships? *Research in Nursing & Health*, 32(1): 18-30. DOI: [10.1002/nur.20305](https://doi.org/10.1002/nur.20305)
 33. Chang, Y.K., Mark, B. (2011) Effects of learning climate and registered nurse staffing on medication errors. *Nursing Research*, 60(1): 32-39. DOI: [10.1097/NNR.0b013e3182028008](https://doi.org/10.1097/NNR.0b013e3182028008)
 34. Kalisch, B.J., Lee, K.H. (2010) The impact of teamwork on missed nursing care. *Nursing Outlook*, 58(5): 233-241. DOI: [10.1016/j.outlook.2010.06.004](https://doi.org/10.1016/j.outlook.2010.06.004)
 35. Wolf, Z.R., Serembus, J.F., Smetzer, J., Cohen, H., Cohen, M. (2000) Responses and concerns of healthcare providers to medication errors. *Clinical Nurse Specialist*, 14(6): 278-287. DOI: [10.1097/00002800-200011000-00011](https://doi.org/10.1097/00002800-200011000-00011)
 36. Scott, S.D., Hirschinger, L.E., Cox, K.R., McCoig, M., Brandt, J., Hall, L.W. (2009) The natural history of recovery for the healthcare provider "second victim" after adverse patient events. *Quality & Safety in Health Care*, 18(5): 325-330. DOI: [10.1136/qshc.2009.032870](https://doi.org/10.1136/qshc.2009.032870)
 37. Schwappach, D.L., Boluarte, T.A. (2009) The emotional impact of medical error involvement on physicians: a call for leadership and organisational accountability. *Swiss Medical Weekly*, 139(1-2): 9-15. DOI: [10.4414/smw.2009.12417](https://doi.org/10.4414/smw.2009.12417)