

Improving Patient Outcomes through Medical-Surgical Nursing Certification: A Longitudinal Descriptive Pilot Study

Norma D. McNair
Rebecca S. Lash
Raquel Branom
Mary-Lynn Brecht

Certification among nurses is promoted widely by health-care leaders and nursing specialty professional organizations. Specialty certification is seen as a way for nurses to demonstrate nursing knowledge and professional development. By improving nurse knowledge and the nurse practice environment, certification may create a better nursing workforce and improve patient outcomes (Coelho, 2020; Conley, 2019; Whitehead et al., 2019). Certification also is considered in the American Nurses Credentialing Center's Magnet Recognition Program®, which recognizes nursing excellence (Commission on Magnet Recognition, 2021). National specialty certifications are highly valued by healthcare leaders, and increasing nurse certification rates is often a critical goal (Marfell et al., 2021). Despite efforts to increase certification, variability in certification rates exists across nursing specialties, hospitals, and hospital units.

An estimated 4.2 million registered nurses (RNs) exist in the United States (Smiley et al., 2021). A survey by the American Board of Nursing Specialties (2020) identified over 1 million certified nurses in the United States, including advanced practice RNs; this represents approximately 24% of all RNs. As of January 2022, more than 39,000 RNs were certified medical-surgical nurses holding the Certified Medical-Surgical Registered Nurse (CMSRN®) credential

Nursing certification demonstrates knowledge in a specialty practice area. This pilot study evaluated improvement in certification rates and patient outcomes on six units. Certification rates increased. Patient length of stay, hospital readmission rates, and teaching satisfaction scores also improved.

(Medical-Surgical Nursing Certification Board, 2022). As of December 2022, more than 32,500 RNs also were certified in medical-surgical nursing by the American Nurses Credentialing Center (n.d.a).

In a two-hospital Magnet®-designated system in an urban setting in the southwest, national specialty certifications have been valued highly, and increasing nurse certification rates consistently remains a key strategic initiative (L. Galuska, personal communication, April 2023). Certification rates were low in the organization, especially in medical-surgical nursing areas, and promotion of certification in this

specialty had not been a priority. Organizational leaders determined improving certification rates would be beneficial for patients and the Magnet® designation. In 2015, a workgroup within the hospital system's shared governance council dedicated to nursing professional development sought to identify perceived barriers to certification and develop strategies to promote an organizational culture that supports certification. The goal of the certification initiative, supported by hospital leaders and implemented by the unit-based clinical nurse specialist (CNS), was to increase certification overall in the medical-surgi-

Norma D. McNair, PhD, RN, ACNS-BC, FAHA, was Clinical Nurse Specialist, Ronald Reagan UCLA Medical Center, Los Angeles, CA, at the time of this study.

Rebecca S. Lash, PhD, RN, is Assistant Professor, Indiana University School of Nursing, Fort Wayne, IN. She was Nursing Professional Development Specialist, UCLA Health, Los Angeles, CA, at the time of this study.

Raquel Branom, DNP, RN, ACNS-BC, is Nurse Professional Development, Baylor Scott & White Health, Waco, TX. She was Clinical Nurse Specialist, Ronald Reagan UCLA Medical Center, Los Angeles, CA, at the time of this study.

Mary-Lynn Brecht, PhD, is Adjunct Professor, UCLA School of Nursing, Los Angeles, CA.

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Background

Specialty certification has been identified as a way to demonstrate nursing professional knowledge. The impact of care by certified nurses on overall patient outcomes and nurse satisfaction remains unclear, particularly in medical-surgical nursing areas. No study has examined the optimal proportion of certified nurses on a unit or the impact of dramatically increasing certification in one specialty area.

Aims

Determine feasibility of a focused intervention to increase certification rates among medical-surgical nurses and determine if an increase in certification rates improves unit-level, nurse-sensitive patient outcomes. Evaluate existence of a threshold of certification to achieve improvements in unit-level patient and nurse outcomes.

Methods

This prospective, longitudinal, descriptive pilot study was conducted in two urban university-affiliated, Magnet[®]-designated medical centers. The intervention included quarterly offerings of review classes for the medical-surgical nursing certification examination. Data were evaluated and compared to certification rates on six units. Mixed-effects regression models for repeated measures were fit for each outcome of interest.

Results

Certification rates improved from 23% to 35%. Average patient length of stay decreased, and readmission rate and teaching satisfaction scores improved.

Limitations and Implications

The relatively small sample limited the number of observations per quarter. Numerous quality improvement interventions were ongoing and may have had an impact on outcomes of interest. Nurse leaders would benefit from information regarding target certification rates and outcomes that are impacted most by certification.

Conclusion

Data from this pilot may be used to inform larger-scale, multi-system research.

Review of the Literature

Articles published 2017-2022 were searched on PubMed[®], CINAHL Complete, and the Cochrane Collaboration databases. Search terms included *nursing certification*, *nursing certification and patient outcomes*, *nursing certification and nurse-sensitive indicators*, and *Magnet[®] designation and nursing certification*. The search focused on original research, evidence-based practice projects, and systematic reviews/meta-analyses.

Recent studies examining the relationship between nurse certification and patient or nurse outcomes were lacking, and no studies were found on specific nurse specialties or outcomes related to certification. The two available systematic reviews evaluated the following patient outcomes: falls, pressure injuries, restraint use, central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), mortality, failure-to-rescue rates, medication errors, ventilator-associated pneumonia, and patient satisfaction (Coelho, 2020; Whitehead et al., 2019). Evaluated nurse-related outcomes in these reviews included job satisfaction, nurse empowerment, the provision of appropriate symptom management, and nurse knowledge (Coelho, 2020; Whitehead et al., 2019).

Among nine studies reviewed by Coelho (2020), certification was associated with a decrease in the incidence of hospital-acquired infection and falls but had no association to pressure injury or mortality. Another review examined patient, nursing, and organizational outcomes in 41 studies (Whitehead et al., 2019). Most reported research on certification had *low* or *very low* levels of evidence. Improvement in falls and infections rates was noted, but was not found in pressure injury or mortality.

In the literature, strategies to improve certification rates for medical-surgical nurses are lacking, however. One study documented steps taken to develop a certification program on a medical-surgical

cal units. A group of nurse leaders and clinical nurse representatives from the two hospitals in the academic healthcare system identified key barriers to certification, including the financial burden of certification and lack of mentorship throughout the certification process.

Purpose/Research Question

The purpose of this study was to evaluate if specialty nursing certification, as a structural component of health care, influences nurse-sensi-

tive patient outcomes and other important nursing indicators. The specific aims of this research were to evaluate feasibility of a focused intervention to increase certification among medical-surgical nurses; examine the relationship between increases in certification rates and improvement in unit-level nurse-sensitive patient outcomes, nurse satisfaction, and nurse practice environment; and determine if a threshold of certification rates can be identified for achieving improvements in unit level patient and nurse outcomes.

unit. This program had administrative support, mentoring of clinical nurses, on-site review course, on-site examination administration, support with examination application and fees, and peer support through weekly study sessions (Perlstein et al., 2014). This program had a pass rate of 82.3%, higher than the national average for the medical-surgical certification exam. Other specialties also offer similar strategies that could be helpful in developing an organizational program. These strategies include financial support for the examination, on-site review courses, practice exams, and support from leaders (Cierzynski & Serwetnyk, 2015; Edwin, 2022; Getselman & Ma, 2022; Smith et al., 2021; Stucky & Wymer, 2020). Strategies used in this health system were review courses offered quarterly with paid time for attendance and financial support for certification through the Success Pays[®] program (American Nurses Credentialing Center, n.d.b). Leadership support was essential in assuring success. In addition to the above-mentioned strategies, leaders encouraged eligible nurses to take the review course and sit for the examination, and announced each certification on their units. Nurses participated in Certified Nurses Day and were provided jackets to indicate they were certified nurses.

Structured certification review study groups for nurses were part of the support and coaching strategy. Due to competing priorities and difficulty with establishing an acceptable time for nursing staff, it was not possible to implement this component. Staff feedback indicated the individualized attention provided by the CNS at the unit level was valuable and introduced accountability for nurses to take the certification course and the exam. Unit-based CNSs were available on all units, but interaction with staff may have been different depending on the unit and the style of the CNS.

Given the wide variation in certification rates, study designs, and specialty areas studied, the impact of certification on patient and nurse

outcomes remains unclear. Any benefit of certification on patient outcomes at the unit level may be realized only after a certain proportion of nurses are certified, with consistent influence on overall quality of patient care. For instance, one study showed a positive relationship between certification and outcomes in operative areas where certification rates tend to be higher (Dierkes et al., 2021). To the knowledge of these authors, no study has examined the optimal proportion of certified nurses on a unit or the impact of dramatically increasing certification in one specialty area. This study aimed to address these gaps in the literature.

Ethics

This study was considered exempt from institutional review board evaluation per policy 45 CFR part 46 of the U.S. Office for Human Research Protections (2016) as no identifiers were obtained.

Sample Selection

The sample consisted of RNs on six medical-surgical units across two hospitals in an urban academic medical health system. Each unit was a specialty unit for particular medical-surgical patients (e.g., vascular, orthopedic, head and neck surgery). Of 305 nurses employed across the units, 267 were eligible for certification. While each unit employed a different number of RNs, the range was 42-58. Pre-intervention, an average of 22% of eligible nurses were certified (range 13%-26%) on these units.

Beginning in September 2016, the organization implemented an initiative to increase certification among medical-surgical nurses. At the time of the study, the greatest number of eligible non-certified nurses worked on the medical-surgical units; this prompted selection of this specialty area for a targeted educational intervention. The hospital provided review courses and financial support for the cost of the certification examination. The primary goal of the intervention was to reach

a certification rate of at least 40% (approximately 122 RNs) across the medical-surgical units by March 2018. Quarterly certification review courses over the study period allowed up to 300 nurses to attend.

Design and Method

The primary variable of interest for this prospective, longitudinal, descriptive pilot study was the proportion of certified nurses on each unit. Data on the variables of interest were collected quarterly at the organizational level as part of ongoing quality and performance improvement initiatives. Four calendar-year quarters of baseline data (Q4 2015-Q3 2016) and eight quarters of post-intervention data (Q4 2016-CY Q3 2018) were compiled in an Excel[®] spreadsheet. Data sources included the health system's Nursing Demographic Database and several national benchmarking entities, such as the National Database of Nursing Quality Indicators, University HealthSystem Consortium, and Press Ganey[®].

All analyses were performed at the unit level. Descriptive statistics and bivariate comparisons among unit certification rates were analyzed. Outcomes were evaluated before and after the intervention period, as well as over the 12-quarter time period, to compare patterns of certification and outcomes over time. Given the small sample, the analysis was designed to detect large effects in the outcomes. The following patient outcomes were evaluated at the unit level: average length of stay (ALOS), length of stay observed compared to expected (LOS-OE), 30-day readmission rates, number of falls with and without injury, fall rates with and without injury, number of CAUTIs, CAUTI rates (standardized infection ratio [SIR]), number of CLABSI, CLABSI rates, and medication errors (wrong patient, wrong dose). The SIR is calculated by dividing the number of observed infections by the number of predicted infections (Centers for Disease Control and Prevention, 2022).

Press Ganey patient satisfaction results were used to measure unit ranking in overall care and patient education. Specifically, responses were analyzed to *Overall Rating of Care* (0-10) and “The nurse explained things in a way that I can understand.” Results were collected as percentage and rank.

Pre- and post-intervention means and standard deviations were calculated for each outcome by unit. The change between periods also was calculated as the mean across post-intervention observations minus the mean across pre-intervention observations. If values were missing for any quarter, that quarter was excluded from calculations. Paired t-tests were used to calculate differences in means and effect sizes. Mixed effects regression models for repeated measures were used to evaluate pre-to-post-intervention change, with a separate model run for each outcome. These models adjusted for within-unit correlation across time and nursing hours per patient day (NHPPD). The effect of interest is pre-post intervention; results may indicate a statistically significant change in the outcome between periods.

This study was designed as a pilot to explore effect sizes and feasibility. It thus was not powered for statistical hypothesis testing. Post-hoc power analysis indicated the sample size was sufficient to detect large effects as statistically significant. In consultation with the statistician, given the relatively small sample size, it was important to include variables that may warrant further study based on large effect sizes even though statistical significance was not achieved. An effect size was considered medium if it was approximately 0.5, and large if it was approximately 0.8 or larger (Cohen, 1998).

Mixed effects regression models for repeated measures were used to assess the association of level of certification (percentage certified, percentage BSN-prepared, and percentage credentialed as both certified and BSN-prepared) to levels of outcomes across all time points, controlling for NHPPD. Finally, re-

TABLE 1.
Percentage of Certified Nurses by Unit (Rounded)

	Pre	Post	Difference
Unit 1	25	47	22
Unit 2	24	40	18
Unit 3	28	33	5
Unit 4	16	38	22
Unit 5	28	27	-1
Unit 6	19	29	10
Across all units	23	35	12*

*Statistically significant ($p \leq 0.05$)

searchers explored if a threshold for certification rates could be identified to see observable improvements in outcomes. A 30% certification rate was evaluated as a possible threshold; in addition, thresholds of 25%, 35%, and 40% were evaluated using locally estimated scatterplot smoothing (LOESS). Mixed effects regression models for repeated measures were used to examine difference in outcomes for subgroups of observations created by each threshold. Models included all post-intervention observations, adjusting for within-unit correlation and controlling for NHPPD.

Findings

For all units, the percentage of certified nurses increased from 23% to 35%. Five of the six units saw an overall increase in the percentage of nurses certified (range 5%-22%; see Table 1). Across all units, the ALOS, CAUTI rates, percentage of nurses certified, and percentage of BSN-prepared certified nurses increased, while the LOS-OE and readmission rates decreased ($p < 0.05$). In comparisons using paired t-tests, differences across all units for ALOS, CAUTI rates, percentage of nurses certified, and percentage of BSN-prepared certified nurses increased, while the LOS-OE and readmission rates decreased ($p < 0.05$) (see Table 2).

Results showed statistically significant decreases before and after the intervention for LOS-OE, but unexpectedly an increase in average

length of stay (ALOS). Several other variables showed effects of potential interest with large effect sizes and/or significance ($p \leq 0.20$): decreased falls, and increases in CAUTI-SIR, readmission rate, and satisfaction rating for teaching. Results of the mixed-effects regression models for each outcome variable controlling for NHPPD were generally consistent with the simple paired t-test results. Results from these more complex models noted significant differences before and after the intervention for ALOS, LOS-OE, and readmission rates ($p < 0.05$) (see Table 3).

A higher percentage of certified nurses was associated significantly with lower readmission rates and higher rank for teaching satisfaction score ($p < 0.05$). Also of interest was the moderate association of a higher percentage of certified nurses with lower LOS-OE readmission rate, number of CLABSIs, higher overall care satisfaction, teaching rating, and teaching rank score.

Results showed using 25% as threshold did not produce subgroups with differences in outcomes. Some differences were detectable at 30% for ALOS ($p = 0.171$) and LOS-OE ($p = 0.099$), but were not statistically significant. ALOS was 6.14 for nursing units with less than 30% certified and 5.47 for those units with 30% or more certified nurses. LOS-OE was 1.09 and 1.02, respectively, for these subgroups. Differences (statistically nonsignificant) also were

TABLE 2.
Pre- and Post-Intervention Outcomes

	Pre-Mean	Post-Mean	Difference	p-value, Paired t-test	Effect Size
ALOS	5.03	5.79	0.76	0.032	1.21
LOS-OE	1.11	1.04	-0.07	0.027	1.26
Readmission rate	20.45	14.01	-6.45	0.135	0.73
Falls (#)	4.31	3.48	-0.83	0.070	0.94
Falls with injury (#)	0.83	0.88	0.04	0.589	0.06
Falls rate	1.55	1.80	0.25	0.881	0.24
Falls with injury rate	0.43	0.51	0.08	0.641	0.20
CAUTI (#)	0.88	0.96	0.08	0.455	0.11
CLABSI (#)	0.38	0.42	0.04	0.111	0.14
CAUTI rate	0.98	1.71	0.73	0.614	0.79
CLABSI rate	0.73	1.12	0.39	0.563	0.25
Medication error (wrong patient)	0.04	0.00	-0.04	0.363	0.41
Medication error (wrong dose)	1.38	1.79	0.42	0.496	0.30
Overall rating (%)	86.94	88.49	1.50	0.101	0.81
Teaching (%)	72.07	74.51	2.46	0.799	0.76
Overall rating rank	76.64	77.62	0.98	0.660	0.19
Teaching rank	38.94	52.04	13.10	0.120	0.76
Certified (%)	22.96	35.63	12.67	0.020	1.34
BSN (%)	72.87	77.91	5.04	0.120	0.75
Certified+BSN (%)	18.74	26.17	8.92	0.050	2.52
NHPPD	10.59	10.51	0.08	0.810	0.10

ALOS = average length of stay, BSN = Bachelor of Science in Nursing, CAUTI = catheter-associated urinary tract infection, CLABSI = central line-associated bloodstream infection, LOS-OE = length of stay observed over expected, NHPPD = nursing hours per patient day

detectable for fall rate and falls with injury rate. However, the rates were greater for units with a higher percentage of certified nurses. Higher threshold values did not produce differences in other outcomes.

Discussion

Although the study was not designed to assess directly the causality of certification leading to changes in outcomes, the presumption was the intervention would change certification levels and this would be reflected in improvements in outcomes. For organizational leaders interested in increasing certification rates, the described efforts to do so were effective. Nurses were engaged to take the

review courses and the exam. Nurses who might have been reluctant to take the examination were motivated by their colleagues' success. With relief of the financial burden of the review course and the examination, many nurses reconsidered their position regarding certification and chose to test. Each newly certified nurse was recognized on Certified Nurses Day and received a jacket identifying the nurse as certified. In keeping with past literature, organizational support resulted in increased certification rates (Smith et al., 2021).

While results indicate certification can have a positive impact on patient outcomes, the exact impact on certain interventions remains unclear. As expected, for example,

LOS-OE and readmission rates decreased. However, ALOS increased. These inconsistencies may be due to the small sample as well as differences in patient acuity and other factors not considered in the study (e.g., nurse turnover). Results support previous literature suggesting certification can improve outcomes (Halm, 2021; Marfell et al., 2021). While increases were not statistically significant, large effect sizes were found for the number of falls, CAUTI rates, and patient satisfaction with patient education.

Because the healthcare environment experiences consistent change, and unit characteristics and organizational initiatives likely impact patient care outcomes, detecting the impact of certification can be chal-

TABLE 3.
Association of Percentage Certified with Outcomes, Controlling for NHPPD

Outcome	Model: % Certified		Model: % BSN		Model: % Certified and BSN	
	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err
ALOS	0.2 [^]	0.012	-0.011	0.028	0.037 [^]	0.022
LOS-OE	-0.003 [@]	0.002	-0.007 [@]	0.003	-0.005 [*]	0.002
Readmission rate	-.0274 [*]	0.105	0.318 [@]	0.167	-0.468 [*]	0.170
Falls (#)	-0.03	0.037	-0.065	0.061	-0.051	0.057
Falls rate	0.033	0.021	-0.010	0.025	-0.001	0.027
Falls with injury (#)	0.007	0.019	-0.010	0.023	0.005	0.024
CAUTI (#)	-0.005	0.024	0.017	0.040	0.002	0.018
CAUTI rate	0.023	0.023	0.016	0.040	NA	NA
CLABSI (#)	-0.020 [@]	0.012	0.040 ^{**}	0.001	-0.021 [@]	0.012
CLABSI rate	-0.022	0.028	0.029	0.040	-0.089 [*]	0.033
Medication error (wrong dose)	-0.004	0.023	0.035	0.038	0.024	0.037
Patient satisfaction – Overall rating of care (%)	0.088 [@]	0.049	0.043	0.115	0.065	0.088
Patient satisfaction – Overall rating of care (rank)	-0.098	0.204	0.194	0.458	-0.771 [@]	0.419
Patient satisfaction – Patient education (%)	0.142 [^]	0.092	-0.072	0.197	-0.066	0.173
Patient satisfaction – Patient education (rank)	0.914 [*]	0.365	-0.884	0.838	0.402	0.671

***p*<0.01; **p*< 0.05; @ *p*<0.10; ^*p*<0.20

Data were not available for Medication error (wrong patient).

ALOS = average length of stay, CAUTI = catheter-associated urinary tract infection, CLABSI = central line-associated bloodstream infection, LOS-OE = length of stay observed over expected, NA = not available, NHPPD = nursing hours per patient day

lenging. However, accounting for time and NHPPD, findings indicate an increase in certified nurses is associated with lower readmission rates and higher rank for teaching satisfaction score. Also of potential interest is that higher percentage of certified nurses was associated moderately with lower LOS-OE and CLABSI, and with higher overall care satisfaction, teaching rating, and teaching rank score.

Initial data from this pilot suggest there may be a threshold of nurse certification (around 30%) for which improvements in outcomes may be observable. With only six hospital units in the analysis and with quite different patterns of outcomes and NHPPD, it is premature to establish threshold values. Thresholds may need to be targeted uniquely to specific unit characteristics.

In addition to promoting certification, many organizational leaders

also are encouraging or requiring nurses to obtain a BSN because the proportion of BSN-prepared nurses also has been associated with improved patient outcomes (Blegen, 2012; Lasater et al., 2021).

Limitations

Data were collected prospectively but use of quarterly data may have influenced the results. Monthly data may provide more robust evaluation. Additionally, using unit-level data did not allow variation to be captured across patients and staff. Missing data for certain units for certain quarters may have influenced results and limited the ability to make additional inferences. The relatively small sample also limited the number of observations per quarter.

The certification intervention was not the only ongoing improvement effort at the time of the pilot; other quality improvement projects

such as fall prevention efforts may have had an impact on outcomes of interest. Despite efforts to include as many nurses as possible in this initiative, many nurses were not ready to pursue certification. Some nurses took the review course and then did not take the examination. Their reasons were not identified as part of this study.

Recommendations for Future Research

Further research should explore the extent to which nurses' certification and education can impact outcomes, specifically ALOS, readmissions, falls, CAUTIs, and patient satisfaction with patient education. These important nurse-sensitive indicators should be considered in larger future studies. Future research with larger data sets should include key covariates, such as unit size, patient severity, and staffing

characteristics. The role of unit-based leaders, particularly the CNS, in assisting staff who pursue certification warrants additional study. With preliminary data from this study, future studies with larger samples may be able to quantify the influence of certification more accurately on specific outcomes. The large effect sizes indicate these variables may be of interest for future research.

Nursing Implications

Nurses in this study were supported by leaders financially with time off to take the review course. Nurses reported support from administrators was an important consideration in deciding to pursue certification. Financial support can include pay differential, as well as recognition on the unit and on Certified Nurses Day (Dierkes et al., 2021; Smith et al., 2021). Smith and co-authors (2021) described several areas in which leaders can help improve certification rates, including assisting nurses in identifying the appropriate certification, directing them to resources to offset expenses for the examination and review courses, encouraging the use of study materials, and providing scheduled time for studying for and taking the exam.

Clinical nurses need to be aware of available certifications, and how organizational and unit leaders support specialty nursing certification. These nurses also need to take advantage of any available review courses, examination support, and other incentives (Dierkes et al., 2021). As clinical nurses become more aware of the professional and organizational value of certification, more of them may become certified.

Conclusion

This study showed improvement in certification rates across five of six units (5%-22%), with overall percentage of certified nurses increasing from 23% to 35%. In addition, there was improvement in LOS-OE, patient satisfaction with

teaching, teaching rank score, readmission rates, and CLABSIs. Unexpected increases in CAUTI-SIR and ALOS occurred.

Although results of this pilot study are not unequivocal, hospital leaders and nurses are encouraged to consider further pursuit of certification because of its potential positive impact on patient outcomes. This study has provided avenues for future research. Evaluation of the influence of certification on nurse-sensitive indicators is warranted. **MSN**

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