Nurses' decision making in heart failure management based on heart failure certification status

Check for updates

Nancy M. Albert, PhD, CCNS, CHFN, CCRN, NE-BC, FAHA, FHFSA, FAAN [a,*], James F. Bena, MS [b], Denise Buxbaum, BSN, RN, CHFN [c], Linda Martensen, MA [d], Shannon L. Morrison, MS [b], Marilyn A. Prasun, PhD, CCNS, CHFN, CNL, FAHA [e], Kelly D. Stamp, PhD, ANP-C, RN, CHFN-K, FAHA [f]

[a] Office of Nursing Research and Innovation and the George M. and Linda H. Kaufman Center for Heart Failure, Cleveland Clinic, 9500 Euclid Avenue, Mail code J3-4, Cleveland OH, 44195, USA
[b] Quantitative Health Sciences, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH 44195, USA
[c] Heart & Vascular Center, Essentia Health, Duluth, MN, USA
[d] Emeritus, Spring Lake Heights Board of Education, Spring Lake Heights, NJ, USA
[e] Heart Failure Disease Management Program, Memorial Medical Center, University of Illinois Chicago, Springfield, IL, USA
[f] Family & Community Nursing Department, University of North Carolina at Greensboro, Greensboro, NC, USA

ARTICLE INFO

ABSTRACT

Background: Research findings on the value of nurse certification were based on subjective perceptions or biased by correlations of certification status and global clinical factors. In heart failure, the value of certification is unknown.
Objectives: Examine the value of certification based nurses' decision-making.
Methods: Cross-sectional study of nurses who completed heart failure clinical vignettes that reflected decision-making in clinical heart failure scenarios. Statistical tests included multivariable linear, logistic and proportional odds logistic regression models.
Results: Of nurses (N = 605), 29.1% were heart failure certified, 35.0% were certified in another specialty/job role and 35.9% were not certified. In multivariable modeling, nurses certified in heart failure (versus not heart failure certified) had higher clinical vignette scores ($p = 0.002$), reflecting higher evidence-based decision making; nurses with another specialty/role certification (versus no certification) did not ($p = 0.62$).
Conclusions: Heart failure certification, but not in other specialty/job roles was associated with decisions that reflected delivery of high-quality care.

© 2018 Elsevier Inc. All rights reserved.

Introduction

Certification credentialing formally recognizes nurses' clinical knowledge, clinical experience in a specific specialty or job role, and clinical judgment.[1] When certified nurses hold an externally validated qualification, they are assumed to be more competent. Further, symbolization of certification on work badges allows the public to identify nurse competence.[2] The value of certification was enhanced when states defined advanced practice nurses' scope of practice by education preparation and certification status,[3] and when the American Nurse Credentialing Center Magnet®-recognition program requested applicant organizations to meet targeted goals for certification and identify certifications held by their nursing staff.[4] However, the true value of specialty/job role certification is unclear.

Multiple papers assessed the value of certification using the Perceived Value of Certification Tool, a subjective survey of the intrinsic and extrinsic value of certification as well as barriers and benefits.[5–8] In one report, 61% of the variance in value statement scores were

based on 3 factors: personal value of certification by nurses, recognition by others and professional commitment,[5] reflecting that value was related more to intrinsic perceptions. Since research results were based on statements that reflected subjective perceptions, it was difficult for investigators to truly determine value. Nurses with one or more certifications may believe they are more competent or that they produce better patient outcomes than colleagues without certification, and certainly, they may have higher self-confidence in their professional ability,[9] but rationale for being certified is not based on competence alone. When perceived value survey scores were compared between nurses in non-Magnet and Magnet-designated facilities, there were no differences in intrinsic and extrinsic certification value perceptions, even though certified nurses had higher intrinsic value perceptions of certification.[10] Further, in many reports, researchers failed to control for factors that differed by certified and non-certified nurses, such as highest nursing degree and number of years of nursing experience, both of which could influence competence.

Some authors used hospital databases of patient satisfaction and quality metrics to examine associations between nurses' certification status and clinical outcomes[11–13] or adherence to national guidelines.[14] In perioperative units, higher certification rate was associated with higher rates of hospital acquired pressure injury,[11] in intensive care units, certification was associated with fewer fall events but not with medication administration errors, skin breakdown or hospital acquired infections,[13] and among hospital nurses from multiple units, certification was not associated with failure to rescue.[12] Although authors reported some outcomes that represented the value of certification, there were limitations to findings, including the influence of nurse characteristics (for example, highest nursing degree/education level and experience level), work factors (hours worked), and factors external to nurses and patients, such as other healthcare providers and leadership support for optimal quality metric outcomes. Finally, in a literature review of the impact of nurse certification, quantitative evidence that supported an association between certification and patient satisfaction and outcomes was limited.[15] Ultimately, it has been difficult to objectively validate the value of certification, since a randomized controlled study methodology is not feasible.

In heart failure (HF), there were no reports in the literature on the value of certified HF nurse (CHFN) status. Managing HF is costly and burdensome due to high hospitalization and mortality rates,[16] but national recommendations are available to nurses to guide clinical decision-making known to optimize clinical outcomes.[17,18] The CHFN examination was developed through a rigorous process of psychometric testing by clinical and academic HF experts, based on national management guidelines and psychometrician recommendations. Leaders of the organization that supports the CHFN program hypothesized that certified nurses in HF were more likely than non-certified nurses to make clinical decisions based on national guidelines, especially related to 4 domains: chronic HF medication management, acute-care HF medication management, self-care education and evaluation of patients' adherence to self-care behaviors.

The purpose of the research study was to examine nurses' decision-making that reflected clinical performance/quality of delivery of nursing care, based on certification credential status. This study was guided by 1 primary research question: Does HF decision-making differ among nurses with HF certification versus without HF certification? There were 5 secondary research questions; the first 2 were: (a) Does HF decision-making differ among nurses with HF or any other specialty/job role certification versus no certification? And (b) Does decision making in HF differ among nurses with 1 or more non-HF specialty/job role certification versus no certification? Since CHFN status could be associated with nurse characteristics, work factors and professional factors, 3 other research questions were developed: After controlling for nurse characteristics, work factors and professional factors, does decision-making in HF by nurses without certification differ from nurses who were (a) certified in HF, (b) certified in HF or any other specialty/job role, and (c) certified in a non-HF specialty/job role? The term specialty/job role certification, which is used throughout this paper, refers to certification in a specialty area (for example, critical care, progressive care, telemetry, and pediatrics) or certification in a job role (for example, advanced practice, case management, and leadership).

Methods

This research study used a cross-sectional, descriptive design. The study was approved by the principal investigator's hospital Institutional Review Board. Potential participants read a research information sheet before deciding to participate. Clinical vignettes were used to examine nurses' decision-making.

Setting and sample

Since the research was conducted via an on-line survey, nurses in the United States and Canada could participate. Participants were an anonymous convenience sample of nurse members of the American Association of Heart Failure Nurses (AAHFN) and nurses from 2 Midwest (Illinois and Ohio) and 1 Northeast (Washington District of Columbia) hospital in the United States. Inclusion criteria were that nurses provided direct clinical care in HF in any environment of care or provided patient-related HF services, such as education, quality monitoring, case management, research and other functions that required direct patient interaction. There were two potential exclusion criteria: not having clinical contact with patients or not having clinical decision-making in HF; for example, administrative work, academic work outside of a clinical setting or company representative.

Clinical vignettes and other survey items

Clinical vignettes were used to examine nursing judgments and decision-making processes. Each vignette was developed based on the 2013 American Heart Association/ American College of Cardiology HF management guidelines[17] and consisted of a scenario about a fictional patient with HF. Subjective and objective data were provided that included laboratory, hemodynamic and physical examination findings. Medication history was included when applicable. A question was posed and participants chose the best response from multiple choice response options. The clinical vignette methodology was selected to examine nurses' decision-making in HF clinical performance and quality of delivery of nursing care since vignettes disentangle multiple predictors of clinician behavior; they minimize threats of internal validity seen with experiments and threats to external validity seen with survey research.[19] When clinical vignettes are well designed to test specific questions, they can be highly generalizable to real-life behavior, and they overcome ethical, practical and scientific limitations that occur with observation, perception surveys, standardized patients and analyses of retrospective data.[19]

In total, 7 clinical vignettes were used. They involved 4 domains important to nurses' decision-making and clinical management of HF: 2 on chronic- and 1 on acute-care medication management, 2 on self-care education and 2 on evaluation of self-care adherence. Originally, 12 vignettes were created by investigators. After investigators refined vignette content, they were reviewed by an education expert and content validity assessment was performed

by 10 national HF experts. Based on expert feedback, asking nurses to respond to 12 vignettes was too burdensome; thus the 5 vignettes with the lowest content validity scores were removed. Item relevance was assessed using the Lynn[20] methodology. All retained items were deemed important and had high clarity. The content validity index of the 7 retained vignettes was 0.984 and validity of response options was 1.00, well above the content validity index cut-point of 0.80 that reflected content relevance with a *p* value of 0.05.

Nurses also responded to 19 unique investigator-developed questions. Questions encompassed 4 themes: (1) nurse certification(s); (2) nurse characteristics- 7 items that included age, gender, race, highest nursing degree, advanced practice nurse status, certificate to prescribe status, advanced practice nurse certification and state of residence and practice; (3) work characteristics- 8 items that included years as a nurse, years caring for patients with HF, years in current position; primary clinical setting, if clinical setting what was their primary role, work setting, and hospital type; (4) professional characteristics-2 items that included being a member of AAHFN and nurse professional activities in 2016 (research and quality initiatives). Item response options included check-all-that-apply, check the correct response and fill-in-the-blank.

Data collection

Requests to participate were sent via electronic mail to all members of the AAHFN (approximately 2000 participants, not all of whom met inclusion criteria) 3 times, 3 weeks apart and 1 time to hospital nurses of 3 sites, in Illinois, Ohio and the Washington District of Columbia (approximately 250 nurses), by members of the AAHFN board of directors. The electronic mail message described the research and contained a link to the Research Electronic Data Capture (REDCap) web-based survey.

Data analysis

Categorical variables were described using frequencies and percentages; continuous variables were described using means and standard deviations when normally distributed or medians and quartiles when non-normally distributed. Statistical tests were performed using two-sample t-tests when variables were normally distributed or Wilcoxon rank sum tests when continuous variables were non-normally distributed and Pearson chi-square tests or Fisher's exact tests for categorical variables. Associations between total vignette score and factors were evaluated with t-tests, ANOVA, or Pearson correlations, as appropriate. Multivariable linear, logistic, and proportional odds logistic regression models were fit for total vignette scores and for scores of each of the 4 decision-making theme scores after adjusting for overall years of nursing experience, years of experience in HF, and years of experience in the current position; highest nursing degree, research/quality experience, and primary clinical role. Age, advanced practice nurse status, and AAFHN membership, which were significantly associated with CHFN and certification status univariably, were not included as adjustment factors in multivariable models due to their collinearity with other predictors. Multicollinearity was assessed using variance inflation factors and condition indices from regression models, as well as through correlations among continuous predictors, and univariate associations between CHFN and certification status with all other factors. Analyses were performed using SAS® Software (version 9.4; Cary, NC). A significance level of 0.05 was assumed for all tests.

Results

Overall, 606 people completed surveys; one was removed as it was completed by a pharmacist. Of 605 participants, mean (SD) nurse age was 44.6 (12.4) years, 93.7% were female, 92.1% were White, and of participant locations, 3 were from Canada, 2 were from other countries and the others came from 47 of 51 states, including the District of Columbia. Although nurses had many years in nursing, median [interquartile range] years in HF were 6.0 [2.0, 16] years and about 50% of participants had a bachelor's degree. Of participants, 136 were in advanced practice roles and nearly all advanced practice nurses were certified. Of work settings, highest prevalence was in HF clinics within hospitals and cardiology offices and of primary job roles, highest prevalence was clinical nurse in the settings above. Only 22.5 % of participants were advanced practice nurses and very few were involved in professional research or quality initiatives; **Table 1.** By certification status, 176 (29.1%) had CHFN credentials, 388 (64.1%) had either CHFN or another certification (or both), 212 (35%) were certified, but not in HF and 217 (35.9%) were not certified.

The mean (SD) correct score for the 7 clinical vignettes, after standardizing on a 0–100 scale, was 56.4 (18.9). Of the 7 clinical vignettes, correct response scores ranged from 27.1% to 84.6%, with

Table 1
Characteristics of participants

Personal, Nursing and Work Characteristics; N = 605	n (%) unless stated
Age, years	44.6 (12.4)[a]
Gender, Female (versus male)	567 (93.7)
Race, White (versus others)	557 (92.1)
Registered nurse; years	18 [6.0, 30.0][b]
Heart failure; years	6.0 [2.0, 16.0][b]
Current job; years	4.0 [2.0, 10.0][b]
Highest degree	
Associate	129 (21.3)
Bachelors	298 (49.3)
Masters	154 (25.5)
Doctorate	24 (4.0)
Advanced practice nurse, yes	136 (22.5)
Primary setting	
Heart failure hospital-based clinic or cardiology office	255 (42.1)
Hospital medical unit	124 (20.5)
Home care or cardiac rehabilitation	31 (5.1)
Emergency, critical-care, stepdown or telemetry cardiac unit	79 (13.1)
Medical office practice	116 (18.3)
Clinical job is primary job, yes	536 (88.6)
Work setting	
Urban	142 (23.8)
Community	403 (67.5)
Rural	52 (8.7)
Completes professional roles initiatives	
Research	39 (6.4)
Quality improvement	309 (51.1)
Both research and quality improvement	50 (8.3)
American Association of Heart Failure Nurses, member	305 (50.4)
Participant location, US individual states represented[c]	47 (92.2)
Primary job role; N = 316	
Outpatient or hospital clinical nurse	141 (44.6)
Advanced practice nurse in outpatient or hospital setting	81 (25.6)
Leader, manager, assistant manager, coordinator	33 (10.4)
Educator, care manager, social worker, transition coach	61 (19.3)
Advanced Practice Nurse Characteristics; N = 136	**n (%)**
Certificate to prescribe, yes	124 (91.2)
Advanced provider certification, yes	131 (96.3)

[a] mean (standard deviation).
[b] median [quartiles].
[c] reflects 50 states plus the District of Columbia; US, United States.
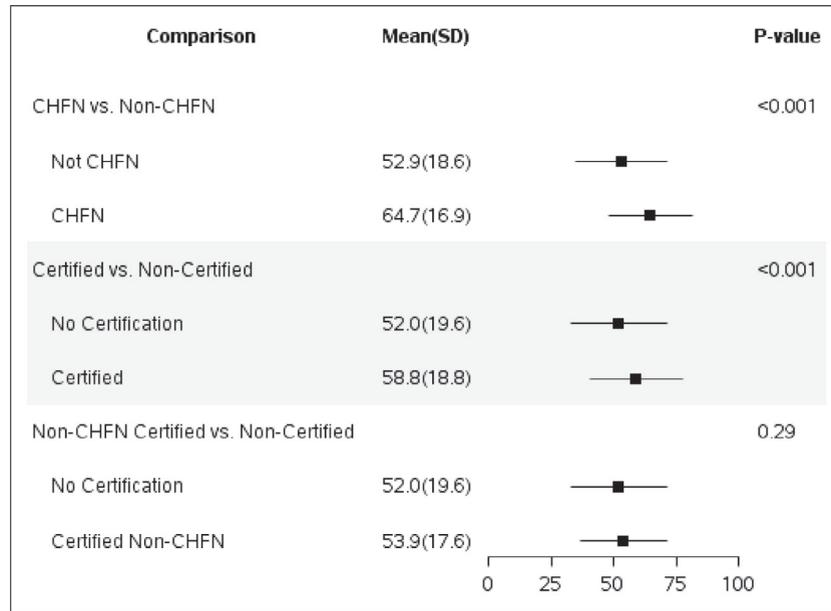
CHFN, certified heart failure nurse

Fig. 1. Forest plot of heart failure clinical vignette mean scores by heart failure and other certification status.

the highest scores in the self-care education domain and lowest scores in the evaluation of self-care adherence domain, in which the topic of responses reflecting best decision-making involved the theme activity and exercise recommendations. Nurses' responses to the chronic medication management questions were variable at 74.4% and 41.7%. The high scoring medication management vignette focused on identification of the right medication to be held based on the patient's status and the lower scoring medication vignette focused on the best medication plan that day. Finally, the vignette in the acute-care medication management domain had a correct response score of 37.7% and focused on a change in the acute pharmacological plan.

Nurse certification credentials and evidence-based decision making (by clinical vignette scores)

We provide the differences in mean totals clinical vignette scores by certification credentials and univariate linear regression estimates (95% confidence intervals [CI]) to show the association (and variance) of total clinical vignette scores between nurses with and without certification credentials. Mean clinical vignette scores were higher for nurses with CHFN credentials compared to nurses without CHFN credentials, 64.7 (16.9) versus 52.9 (18.6); estimate (95% CI) was 11.74 (8.69. 14.80), $p < 0.001$. Mean clinical vignette scores were higher for nurses with CHFN or another specialty/job role certification compared to nurses without any certification credentials, 58.8 (18.0) versus 52.0 (19.6); estimate (95% CI), 6.79 (3.62, 9.97) $p < 0.001$. When nurses with a non-HF specialty/job role certification were compared with nurses without any certification credentials, there was no significant difference in mean total clinical vignette scores, 53.9 (17.6) versus 52.0 (19.6); estimate (95% CI), 1.90 (-1.63, 5.43), $p = 0.29$; **Fig. 1**. Of the 4 decision-making domains, nurses with CHFN status had higher chronic medication management ($p < 0.001$), acute-care medication management ($p < 0.001$) and evaluation of self-care adherence ($p = 0.005$) vignette scores, but there was no difference in self-care education domain by CHFN status ($p = 0.088$); **Fig. 2**.

*Predictors of heart failure evidence-based decision making*

Tables 2–4 show the predictors of a total vignette score (reflecting the level of HF evidence-based decision making), including certification status, after adjusting for personal, nursing, work, and professional role characteristic confounders that were associated with certification classifications on univariate analyses. In each model, the adjusted estimates provide the independent association of total clinical vignette score and certification status, as well as all other factors included in the model.

Nurses with and without CHFN credentials

Of 17 personal, work and professional characteristics (nurses' state of residence was not included), 10 differed based on CHFN versus no CHFN credentials: age, length of time being a nurse, length of time working in HF and length of time working in current job, highest nursing degree, primary clinical setting, primary job role, quality/research initiative experience, advanced practice nurse status and being a member of AAHFN. In a multivariable model that adjusted for the 10 characteristics that differed in nurses with and without CHFN credentials, nurses with CHFN status continued to have higher total vignette scores; adjusted estimate (95% confidence intervals), 5.84 (2.20, 9.48), $p = 0.002$; reflecting that nurses with a CHFN credential had 5.84 points higher total score, holding all other factors constant; see **Table 2**. In addition to CHFN status, nurses with a master's degree and more years working in HF also had higher vignette scores and nurses working on a hospital medical unit and more years in their current job had lower clinical vignette scores.

Nurses with CHFN credential or certification in at least 1 other specialty/job role and those without a certification credential

Of personal, work and professional characteristics, 9 differed based on CHFN or at least 1 other certification versus no certification credentials: age, length of time being a nurse, length of time
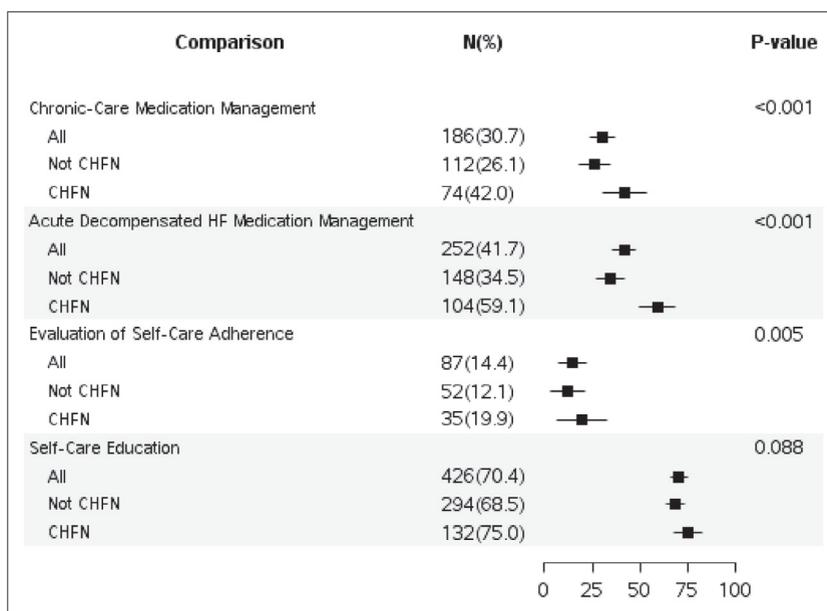
CHFN, certified heart failure nurse

Fig. 2. Forest plot of heart failure clinical vignette mean domain scores by heart failure certification status.

working in HF, length of time working in current job, primary clinical setting, primary job role, quality/research initiative experience, advanced practice nurse status, and being a member of AAHFN. After adjusting for the 9 characteristics that differed, total clinical vignette scores were no longer higher for nurses with a CHFN or other certification credential versus no certification credential; see **Table 3**. Similar to the previous model, nurses with a master's degree and more years working in HF had higher total vignette scores and nurses working on a hospital medical unit and those with more years in their current job had lower clinical vignette scores.

Nurses with a non-HF specialty/job role certification and those without a certification credential

Of personal, work and professional characteristics, 2 differed based on a non-HF certification versus no certification creden-

tials: length of time (years) as a nurse and length of time working in HF. In the adjusted model, non-HF certification was not associated with clinical vignette score, see **Table 4**; however, nurses with a master's degree and more years working in HF had higher vignette scores and nurses working on a hospital medical unit had lower clinical vignette scores.

Multivariable models of the association between CHFN status and clinical vignette domain scores

Participants' personal, nursing and work characteristics that were associated with each clinical vignette domain score were controlled in logistic regression models and the odds that the domain score remained associated with CHFN credential status were assessed. After adjustment of all potential confounders, the

Table 2
Multivariable model of differences between HF certification (Yes versus No) on mean total vignette score

Effect	Level	Adjusted Results[a]	
		Estimate (95% CI)	P value
Intercept		52.46(47.41,57.51)	<0.001
CHFN Status	CHFN, yes	5.84(2.20,9.48)	**0.002**
Experience in Professional Project Work	Quality Initiative, yes	−1.27(−4.70,2.17)	0.47
	Research Initiative, yes	−2.52(−8.94,3.89)	0.44
	Research and Quality Initiatives, yes	−1.16(−7.06,4.73)	0.70
Highest Nursing Degree	Bachelor's	0.27(−3.46,3.99)	0.89
	Master's	4.90(0.40,9.40)	**0.033**
	Doctorate (PhD or DNP)	3.53(−4.22,11.27)	0.37
Clinical Setting	HF Hospital-based /Cardiology Clinic/Office	1.85(−2.57,6.27)	0.41
	ED/Critical Care/Stepdown/Telemetry Care	−2.59(−7.90,2.72)	0.34
	Medical Office Practice	−11.90(−26.28,2.47)	0.10
	Home Care/Cardiac Rehab Care	0.03(−7.18,7.25)	0.99
	Hospital Medical Unit	−5.53(−10.19,−0.88)	**0.020**
Current Job, Years	per year	−0.24(−0.44,−0.03)	**0.023**
Nurse, Years	per year	0.00(−0.17,0.17)	0.96
HF Nurse, Years	per year	0.40(0.22,0.58)	**<0.001**

[a] the estimate of categorical and multilevel data reflects the mean change in total vignette score for people with the factor, relative to people without the factor; holding all other factors constant; the estimate of continuous data (years) reflects the mean change in the total vignette score for a 1 unit increase in the factor listed, holding all other factors constant.
CHFN, certified heart failure nurse; CI, confidence interval; DNP, doctorate of nursing practice; HF, heart failure; PhD, doctorate of philosophy.

Table 3
Multivariable model of differences between HF nurse certification or at least 1 other specialty/Job role certification versus No certification credentials on mean total vignette score

Effect	Level	Adjusted Results[a]	
		Estimate (95% CI)	*P* value
Intercept		50.24(44.98,55.50)	<0.001
Any Certification	Certification	2.60(−0.61,5.81)	0.11
Experience in Professional Project Work	Quality Alone, yes	−1.09(−4.54,2.36)	0.53
	Research Alone, yes	−1.26(−7.66,5.15)	0.70
	Research & Quality, yes	−0.26(−6.18,5.65)	0.93
Highest Nursing Degree	Bachelor's	1.05(−2.69,4.78)	0.58
	Master's	5.79(1.30,10.28)	***0.012***
	Doctorate (PhD or DNP)	4.80(−2.91,12.52)	0.22
Clinical Setting	HF Hospital-based /Cardiology Clinic/Office	3.27(−1.03,7.58)	0.14
	ED/Critical Care/Stepdown/Telemetry Care	−2.21(−7.50,3.08)	0.41
	Medical Office Practice	−10.15(−24.71,4.40)	0.17
	Home/Cardiac Rehabilitation Care	0.13(−7.06,7.31)	0.97
	Hospital Medical Unit	−5.10(−9.77,−0.43)	***0.033***
Current Job, Years	per year	−0.25(−0.45,−0.04)	***0.017***
Nurse, Years	per year	0.04(−0.13,0.21)	0.67
HF Nurse, Years	per year	0.41(0.23,0.58)	***<0.001***

[a] the estimate of categorical and multilevel data reflects the mean change in total vignette score for people with the factor, relative to people without the factor; holding all other factors constant; the estimate of continuous data (years) reflects the mean change in the total vignette score for a 1 unit increase in the factor listed, holding all other factors constant.
CI, confidence interval; DNP, doctorate of nursing practice; ED, emergency department; HF, heart failure; PhD, doctorate of philosophy.

acute-care and chronic medication management decision-making domains remained significantly associated with CHFN credentials; adjusted odds ratios (OR) and 95% CI were 1.68 (1.08, 2.61), $p = 0.021$ and 1.55 (1.02, 2.33), $p = 0.038$, respectively. After adjustment of all potential confounders, evaluation of self-care adherence decision-making was no longer different between nurses with and without CHFN credentials; adjusted OR (CI) 1.39 (0.93, 2.09), $p = 0.11$ and self-care education decision-making remained similar between nurses with and without CHFN credentials; OR (CI) 1.05 (0.64, 1.72), $p = 0.85$.

Discussion

Assessing decision-making using clinical vignettes is different than assessing knowledge, where response choices reflect 1 correct answer and multiple incorrect options. In this research, the total vignette correct response score was under 60%, reflecting the difficulty of decision-making when nurses tried to understand and

respond to multiple pieces of data (for example, objective assessment, subjective assessment, hemodynamics and laboratory and other diagnostic testing). After controlling for personal, nursing and work characteristics of participants, CHFN status was associated with clinical decisions that reflected higher-quality clinical management of patients with HF, based on clinical vignette scores. This finding is important, since each vignette "best" response option was based on published, high-quality, evidence-based practices.[17,18] Presence of certifications other than CHFN for example, other specialty care or job role certifications were not associated with high-quality clinical management of patients with HF.

This is the first report to show a direct association between decision-making in clinical HF care, via clinical vignette scores, and CHFN status. It is important to ensure that a certification credential can differentiate decision-making in nurses' clinical specialty, even if overall decision-making scores and domain scores are lower than desired. In other research that assessed outcomes based on certification status, some investigators were unable to control for

Table 4
Multivariable model of differences between non-HF specialty/Job role certification versus No certification credentials on mean total vignette score

Effect	Level	Adjusted Results[a]	
		Estimate (95% CI)	*P* value
Intercept		50.38(44.57,56.18)	<0.001
Certification	Non-CHFN certified	0.77(−2.69,4.24)	0.66
Experience in Professional Project Work	Quality Initiative, yes	−0.37(−4.16,3.42)	0.85
	Research Initiative, yes	1.67(−8.18,11.53)	0.74
	Research and Quality Initiatives, yes	−2.53(−11.17,6.11)	0.57
Highest Nursing Degree	Bachelor's	2.07(−2.10,6.24)	0.33
	Master's	10.08(4.24,15.91)	***<0.001***
	Doctorate (PhD or DNP)	0.42(−12.36,13.21)	0.95
Clinical Setting	HF Hospital-based /Cardiology Clinic/Office	0.82(−4.35,5.98)	0.76
	ED/Critical Care/Stepdown/Telemetry Care	−4.14(−9.90,1.63)	0.16
	Medical Office Practice	−17.76(−38.83,3.31)	0.098
	Home Care/Cardiac Rehab Care	−0.16(−8.45,8.14)	0.97
	Hospital Medical Unit	−5.71(−10.68,−0.75)	***0.024***
Current Job, Years	per year	−0.16(−0.42,0.10)	0.22
Nurse, Years	per year	0.01(−0.21,0.22)	0.94
HF Nurse, Years	per year	0.32(0.10,0.54)	***0.004***

[a] the estimate of categorical and multilevel data reflects the mean change in total vignette score for people with the factor, relative to people without the factor; holding all other factors constant; the estimate of continuous data (years) reflects the mean change in the total vignette score for a 1 unit increase in the factor listed, holding all other factors constant.
CI, confidence interval; DNP, doctorate of nursing practice; ED, emergency department; HF, heart failure; PhD, doctorate of philosophy.

personal, nursing, or work characteristics of nurses, or patient characteristics that could have affected results. In one report, certification was unexpectedly associated with higher rates of hospital-acquired pressure injuries[11] and in another report, after authors controlled for potentially confounding factors, certification was no longer associated with mortality and failure to rescue.[12] In oncology care, certification was associated with chart audit findings of adherence to national guidelines for chemotherapy-induced nausea and vomiting management[14]; however, results could have been based on important non-studied factors, such as patients' desire to be treated for nausea or vomiting, which may not have been documented. Research that focused on perceptions of internal or external value of certification provided information about factors that led to becoming and maintaining certification,[5,7,8] but did not support value of certification in terms of decision-making.

When CHFN status was assessed based on the 4 clinical vignette domains of decision-making in HF care delivery, 2 domains, acute-care and chronic medications were associated with CHFN status, even though total domain scores were generally low. In previous research, hospital-based nurses provided perceptions of their comfort in delivering HF self-care education.[21] Of 8 self-care themes assessed, medication management- that included "why taking", "expected effects", and "adverse events" of medications, had the second lowest overall standardized mean score,[21] reflecting that hospital-based nurses caring for patients with HF may not have a strong self-understanding of medication management application and analysis details, even if they are able to recall simple medication facts. Similarly, among nurses who worked in hospital or home care settings, total score on HF knowledge of self-care principles were low and by theme, HF medication management scores were the lowest.[22] In Europe, nurse leaders of the HF Association of the European Society of Cardiology developed a HF curriculum that provides a framework aimed at improving nurses' HF knowledge, skills and behaviors used in delivery of complex HF care.[23] Although nurses with CHFN status were better prepared to make high quality HF management decisions, overall, more educational resources and opportunities are needed to assure optimal patient outcomes. Nurses with CHFN credentials may have spent time studying HF medications when they prepared for the examination and knowledge gained may have been retained and used frequently in clinical care. The exact mechanism that links nurses with CHFN status and better decision-making in acute-care and chronic HF medications are uncertain and require further exploration through research. Findings are important since prescription of and patients' adherence to guideline-recommended HF medications is the most valuable medically-based treatment available to manage HF,[17,18] and in retrospective research, healthcare providers failed to consistently prescribe optimal HF pharmacological classes of therapy.[24–26]

After controlling for nurses personal, work and professional characteristics, CHFN status was not associated with nurses' decision-making in patient care related to evaluation of self-care adherence or self-care education. The self-care education domain score was very high regardless of certification status, and reflects that nurses understand global HF themes related to delivering self-care. Self-care education is an important part of nursing work in HF. Being able to make clinical decisions related to the need to educate patients requires insights about individual patient needs, preferences, barriers and opportunities for change and the HF topic of discussion. The domain score reflected nurses' ability to make best-practice decisions about next steps in educating patients.

Nurses' ability to evaluate patients' self-care adherence based on verbalized messages is important in decision-making, and in this research, the domain score was very low. Nurses may be more comfortable in evaluating some aspects of patients' self-care adherence, such as dietary sodium restriction and HF medication messages

rather than evaluating physical activity. In the vignettes used in this research, the themes of both correct responses were related to physical activity. Since all nurses had low correct decision-making response scores, a better system (for example, using simulation) may be needed to assure that nurses are able to evaluate physical activity/exercise expectations in HF management. Our results are similar to previous research of hospital-based nurses perceptions of the frequency of and comfort in educating patients about physical activity/exercise, as that theme scored the lowest in both frequency of and comfort in delivering education.[21] More research is needed to learn if greater emphasis on this theme in CHFN preparation and testing would lead to greater understanding of its importance by all nurses who care for patients with HF.

Limitations

This research project had some limitations. The number of subjects making up the total population is unknown as the AAHFN database contained both clinical and non-clinical nurses and when 2 hospital-based nurses made a request to forward the electronic mail request locally, they could not provide a valid total number of their total population of potential subjects who met criteria. Data was collected using a secure database designed for research; however, nurses could have opened books or reviewed subject matter by internet or other means when completing clinical vignettes. Further, a nurse could have decided to participate or not participate based on their comfort in completing a survey that used vignettes and requiring response options involving decision-making. Although there was very little missing data in nurse, work and professional characteristics and no missing data in clinical vignettes, missing data or data entered erroneously could have decreased the generalizability of findings. Data related to primary job setting and job role were diverse and were condensed in analysis. Different combinations of settings or job roles could alter findings. Finally, for the group of nurses with CHFN credential or certification in at least 1 other specialty/job role who were compared to those without a certification credential, the finding that nurses with more years in their current job had lower clinical vignette scores could reflect collinearity among measures that assessed years of experience since in univariate analysis, years as a nurse was not associated with total vignette score.

Conclusions

This research is the first report of use a clinical vignette methodology to assess if CHFN credentials were associated with nurses' decision-making in HF clinical care. Nurses with CHFN credentials had higher overall clinical vignette scores than nurses without CHFN credentials on both univariate and multivariate analyses. Thus, nurses with CHFN credentials (and also those with a master's degree and more years working in HF) are more likely to have superior decision-making in HF clinical care, especially related to acute-care and chronic medication management.

References

1. American Board of Nursing Specialties. A position statement on the value of specialty nursing certification. 2005. https://www.abcgn.org/Portals/0/value_certification.pdf. Accessed 31 August 2016.
2. Kaplow R. The value of certification. *AACN Adv Crit Care*. 2011;22:25–32.
3. Blackwell CW, Neff DF. Certification and education as determinants of nurse practitioner scope of practice: an investigation of the rules and regulations defining np scope of practice in the united states. *J Am Assoc Nurse Pract*. 2015;27:552–557.
4. American Nurses Credentialing Center. *2014* Magnet® Application Manual. Silver Springs. American Nurses Association; 2013.
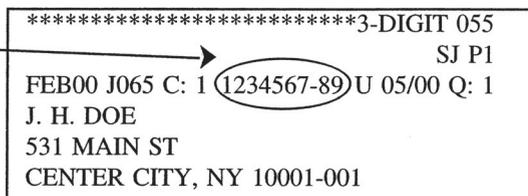
5. Gaberson KB, Schroeter K, Killen AR, Valentine WA. The perceived value of certification by certified perioperative nurses. *Nurs Outlook*. 2003;51:272–276.
6. Fitzpatrick JJ, Campo TM, Lavandero R. Critical care staff nurses: empowerment, certification, and intent to leave. *Crit Care Nurse*. 2011;31:e12–e17.
7. Brown CG, Murphy CM, Norton V, Baldwin PD, Ponto J. The value of oncology nursing certification. *Clin J Oncol Nurs*. 2010;14:E63–E69.
8. Niebuhr B, Biel M. The value of specialty nursing certification. *Nurs Outlook*. 2007;55:176–181.
9. Schroeter K. The value of certification. *J Trauma Nurs*. 2015;22:53–54.
10. McLaughlin A, Fetzer SJ. The perceived value of certification by magnet(r) and non-magnet nurses. *J Nurs Adm*. 2015;45:194–199.
11. Boyle DK, Cramer E, Potter C, Gatua MW, Stobinski JX. The relationship between direct-care rn specialty certification and surgical patient outcomes. *AORN J*. 2014;100:511–528.
12. Kendall-Gallagher D, Aiken LH, Sloane DM, Cimiotti JP. Nurse specialty certification, inpatient mortality, and failure to rescue. *J Nurs Scholarsh*. 2011;43:188–194.
13. Kendall-Gallagher D, Blegen MA. Competence and certification of registered nurses and safety of patients in intensive care units. *Am J Crit Care*. 2009;18:106–113, quiz 114.
14. Coleman EA, Coon SK, Lockhart K, et al. Effect of certification in oncology nursing on nursing-sensitive outcomes. *J Nurs Adm*. 2010;40:S35–S42.
15. Martin LC, Arenas-Montoya NM, Barnett TO. Impact of nurse certification rates on patient satisfaction and outcomes: a literature review. *J Contin Educ Nurs*. 2015;46:549–554, quiz 555-546.
16. Benjamin EJ, Blaha MJ, Chiuve SE, et al. Heart disease and stroke statistics-2017 update: a report from the american heart association. *Circulation*. 2017;135:e146–e603.
17. Yancy CW, Jessup M, Bozkurt B, et al. 2013 accf/aha guideline for the management of heart failure: a report of the american college of cardiology foundation/american heart association task force on practice guidelines. *J Am Coll Cardiol*. 2013;62:e147–e239.
18. Yancy CW, Jessup M, Bozkurt B, et al. 2017 acc/aha/hfsa focused update of the 2013 accf/aha guideline for the management of heart failure: a report of the american college of cardiology/american heart association task force on clinical practice guidelines and the heart failure society of america. *Circulation*. 2017;136:e137–e161.
19. Evans SC, Roberts MC, Keeley JW, et al. Vignette methodologies for studying clinicians' decision-making: validity, utility, and application in ICD-11 field studies. *Int J Clin Health Psychol*. 2015;15:160–170.
20. Lynn MR. Determination and quantification of content validity. *Nurs Res*. 1986;35:382–385.
21. Albert NM, Cohen B, Liu X, Best CH, Aspinwall L, Pratt L. Hospital nurses' comfort in and frequency of delivering heart failure self-care education. *Eur J Cardiovasc Nurs*. 2015;14:431–440.
22. Mahramus TL, Penoyer DA, Sole ML, Wilson D, Chamberlain L, Warrington W. Clinical nurse specialist assessment of nurses' knowledge of heart failure. *Clin Nurse Spec*. 2013;27:198–204.
23. Riley JP, Astin F, Crespo-Leiro MG, et al. Heart Failure Association of the European Society of Cardiology heart failure nurse curriculum. *Eur J Heart Fail*. 2016;18:736–743.
24. Deschaseaux C, McSharry M, Hudson E, Agrawal R, Turner SJ. Treatment initiation patterns, modifications, and medication adherence among newly diagnosed heart failure patients: a retrospective claims database analysis. *J Manag Care Spec Pharm*. 2016;22:561–571.
25. Bress AP, King JB, Brixner D, et al. pharmacotherapy treatment patterns, outcomes, and health resource utilization among patients with heart failure with reduced ejection fraction at a U.S. Academic Medical Center. *Pharmacotherapy*. 2016;36:174–186.
26. Albert NM, Drzayich Antol DA, DeClue RW, et al. Pharmacotherapy choice is associated with 2-year mortality for patients with heart failure and reduced ejection fraction. *Adv Ther*. 2017;34:2345–2359.