J Nurs Care Qual
Vol. 21, No. 2, pp. 160-167

Evidenced-based Factors in Readmission of Patients with Heart Failure

Mary Ann Anderson, PhD, RN; Janice Levsen, MA, RN; Marie E. Dusio, DC, RN; Paula J. Bryant, BSN, RN; Sarah M. Brown, BSN, RN; Cynthia M. Burr, BSN, RN; Carrie Brown-Benn, BSN, RN

The purpose of this project was to organize the variables associated with the hospital readmission of patients with heart failure (HF) into a usable framework to inform clinical practice and facilitate administrative decision making. An integrated, systematic review of the literature was used as the research approach. A content analysis of the sample (31 research reports from the years 1986-2004) yielded multiple factors associated with the hospital readmission of HF patients. Factors and their definitions were extracted, grouped into like categories, and eventually classified into 5 domains—*demographic*, *physiologic*, *psychosocial*, *patient functioning*, and *resource utilization*. The resulting framework has clinical, research, and administrative implications in the delivery of care to HF patients. **Key words:** *hospital readmission, integrative literature review, patients with heart failure*

THE care of patients with heart failure (HF) consumes a large portion of healthcare expenditures, particularly, in later stages of the disease.[1] Annual medical expenses involve billions of dollars.[2-5] For hospitals, the expense is estimated to be $23 billion and for home care $17.8 billion.[6,7] In Medicare patients alone, HF expenditures exceed the combined costs of myocardial infarction and all types of cancer.[6]

Heart failure is the most common discharge diagnosis in patients older than 65 years. More than 11 million office visits and 3.5 million hospitalizations are attributed to the HF, with one third of hospitalized patients readmitted 3 to 6 months after discharge.[4,8] Episodes of hospitalization for the HF patient are frequent, expensive, and, possibly, preventable in about 40% of the cases.[8] Although the rates of other cardiovascular diseases have stabilized or decreased, that of HF continues to rise.[4,9-12]

The complex, progressive nature of the HF often results in adverse outcomes; the most costly being hospital readmission. Long lists of variables that may or may not be associated with or predictive of hospital readmission for HF patients have been generated. The purpose of this project was to organize the variables associated with the hospital readmission of HF patients into a usable framework to inform clinical practice and facilitate administrative decision making.

METHODS

Design

An integrated, systematic review of the literature was conducted. An *integrated*

From the College of Nursing, University of Illinois at Chicago (Drs Anderson and Dusio and Mss Bryant, Brown, Burr, and Brown-Benn); and the Genesis Medical Center, Davenport, Iowa (Ms Levsen).

Corresponding author: Mary Ann Anderson, PhD, RN, College of Nursing, University of Illinois at Chicago, 1515 Fifth Ave, Suite 400, Moline, IL 61265 (e-mail: MAA928@uic.edu).

Accepted for publication: February 24, 2005

literature review is a nonexperimental design in which information obtained as a result of primary research is systematically categorized. Guidelines mandating the same rigorous methodology required of the primary researcher[13] were followed. Reviewers summarized past research by drawing overall conclusions from different studies. An integrated review of the literature presents the state of knowledge about the topic and highlights additional areas for research.[14]

Sample

A search of the MEDLINE and the CINAHL databases was conducted using the linked terms "hospital readmission" and "Heart Failure." In addition, the terms "compliance or adherence," "prediction," "risk," and "self-care ability" were also searched. Citations retrieved had to reflect research findings. A *research article* was defined as having a stated purpose, research question, or hypothesis; a literature review; description of methods; presentation of data; analysis of data; and discussion and conclusions. The article was included if it defined predictive or descriptive factors that contributed to readmission in HF patients. Initially, the searches were limited to the past 10 years, although this was modified as the project progressed. The final sample spanned 15 years (1986-2004). Prescriptive literature, nonresearch-based reports or discussions, unpublished manuscripts, books, tapes, electronic media, and editorial articles were excluded from the sample. Approximately 41 articles were retrieved, and 31 articles comprised the final sample.

Procedure

A content analysis of the retrieved articles was conducted by a doctorally prepared nurse and a master's prepared nurse with a specialty in the care of HF patients. Each primary research study was treated as a single datum. Sample articles were reviewed twice by both the nurses, and the factors associated with the hospital readmission of HF patients were extracted. A factor associated with hospital readmission in HF patients was defined as a variable with reported statistical significance or strong clinical significance. Not all variables studied were found to be statistically significant and therefore did not receive mention in the various sources contained within the literature review.

Factors and their definitions as reported in the literature were written on index cards. When all factors had been extracted from the sample articles by the research team, they were grouped into like categories. The categories were further refined. This process of classification continued until the research team conceptualized and defined 5 domains—*demographic*, *physiologic*, *psychosocial*, *patient functioning*, and *resource utilization*.

Placement of the factors into the domains was based on the working definitions of the domains. However, a single factor could logically have been placed in more than one domain. For the sake of clarity, the research team decided not to duplicate factors in multiple domains.

Five additional nurses who have expertise in the care of HF patients reviewed the initial framework. Refinement and clarification of the definitions of factors were done. The outcome, a revised framework, is presented in Table 1.

FINDINGS: EVIDENCE-BASED FRAMEWORK

Factors in the *demographic domain* such as age, gender, and marital status are associated with the basic identifying factors of a readmitted patient. Almost all research reports reviewed included such fundamental data about the subjects in their samples. Statistical significance accompanied these factors.

Factors in the *physiologic domain* involve biophysical health exemplified by cardiac pathologies, comorbidities, and polypharmacy. Not surprisingly, presenting symptoms and biophysical markers associated with the HF characterized definitions of the factors in this domain. Atrial fibrillation, an elevated serum sodium level, and an elevated

Table 1. Hospital readmission factors in heart failure*,†

Domain and factors	Definition
I. Demographic domain: Factors associated with basic identity	
Age (older)	Chronological, in years
Marital status	Primary, legal, partnered, relationship
Widowed	Death of spouse
Gender (males)	Male or female identity (based on genetics)
Socioeconomic status	Relative level of income
Race (African American)	Using US Census Bureau categories
Destination	Place patient will live after hospital discharge
Living alone	Absence of others in primary residence
II. Physiologic domain: Factors associated with biophysical health	
Atrial fibrillation	Atria beat asynchronously; no discernable P wave on electocardiogram
Elevated BUN	Blood urea nitrogen levels exceed normal threshold of 8–20 mg/dL
Systolic B/P (higher)	Sustained systolic pressure in excess of 140 mm Hg
Elevated serum sodium level	Blood sodium level exceeds normal threshold of 135–148 mEq/ L
Ischemic (coronary artery disease) etiology	Cardiac cell death related to inadequate perfusion because of clogging, scarring, and/or rigidity of vessels
Serum creatinine level	Blood creatinine levels outside normal threshold of 0.7–1.5 mg/ dL
Presence of diabetes mellitus	Comorbidity of inadequate glucose metabolism
Comorbidities (renal failure and cardiac myopathy)	Concurrent diagnoses of deteriorating, inadequate kidney function, and loss of heart muscle integrity due to a primary abnormality in the myocardium
Weighted severity of illness; diseased severity	Author-designed scale indicating level of health compromise
Presence of chronic illness	Having a diagnosis and/or signs and symptoms of incurable, progressive disease or disorder
Polypharmacy	More than 9 medications taken daily
On an ACE inhibitor or not	Inhibits angiotensin-converting enzyme; interferes with conversion of Angiotensin I to Angiotensin II
Current smoking/alcohol use	Use of tobacco during study/consumption of alcohol during study
III. Psychosocial domain: Factors associated with mental, emotional health, and social functioning	
Absence of patient motivation	Lack of patient desire to engage in plan of care
Life Satisfaction Index (given to patient)	Standardized measure with range of scores from 0 to 26
Depression/patient mental status	Psychological disorder often characterized by sadness or detachment, emotional state of patient
Noncompliant or nonadherent with medications	Unwilling/incapable of following medication regimen
Dietary nonadherence	Unwilling/incapable of following nutrient regimen
Patient knowledge about disease	Level of patient understanding concerning the HF
Patient misperceptions about disease	Misinformation regarding diagnosis, treatment, outcomes

(*continues*)

Table 1. Hospital readmission factors in heart failure*,† (*Continued*)

Domain and factors	Definition
IV. Patient functioning domain: Factors associated with daily living	
Low self-confidence in self-care	Lack of perception by patient that capable of meeting own needs
Dependent in self-care	Requires assistance to meet ADL
Impaired senses (hearing, vision)	Vision or hearing at less than ideal levels (regardless of use of assistive devices)
Functional capacity	Ability to meet needs independently as measured by the Self-Management of HF Questionnaire
Cognitive status	Mental acuity as measured by Mini-Mental State Examination (range 0–21)
Functional ability prehospitalization	Ability to care for self before acute HF episode requiring inpatient care (author-designed tool)
Severity of illness combined with functional status	Illness severity level on NYHA Classification combined with scores on ADL and instrumental ADL
NYHA Classification	Score on 4-level progressive scale related to symptoms and function
V. Resource utilization domain: Factors associated with personal, community, and healthcare environments	
Absence of strong social support	Lack of companionship or meeting of emotional, psychological, and/or social needs by others
Caregiver capacity and willingness	Ability and desire of others (on whom patient is dependent) to assist patient in meeting needs
Caregiver stress and depression	Psychosocial-spiritual toll on supports for patient/diagnosis and/or signs and symptoms of depression
Medication supply	Lack of access to medication(s) required by regimen
Time frame since hospital discharge	Number of days since discharged from last HF-related inpatient stay
Previous hospitalization	Number of heart-related admissions prior to current one
Total number of hospitalizations in past 12 mo	Sum of all hospitalizations in days, in one calendar year (includes partial stays of 23-h admissions)
Length of most recent hospitalization	Number of days hospitalized in each admission through discharge episode, in the past calendar year
Primary care physician vs cardiologist	Type of physician serving as primary care physician for patient
Higher the total number of physicians during an episode of care	Total number of physicians contributing to planning and/or executing care per episode
Case management	Whether or not hospital uses case management and discipline(s) of case managers (RN, social worker, etc)
Home care services (none) discharge to home care increased chance of readmission	Whether or not patient received professional healthcare in residence after discharge
Lack of multidisciplinary intervention that is nurse directed	Whether or not an RN directs postdischarge care team made up of providers from 2 or more disciplines
Cardiac education	Whether or not patient receives information about the HF
Disease management clinic vs a primary care physician	Postdischarge patient receives care from primary care physician or from HF clinic

*HF indicates heart failure; ADL, activities of daily living; and NYHA, New York Heart Association.
†Contact Dr Anderson at MAA928@uic.edu for literature support for domain and factors.

brain-type natriuretic peptide level were typical examples found in the current literature. Experienced clinicians will quickly recognize the absence of other physiologic indicators common in practice yet lacking in the research literature on the hospital readmission of HF patients. Many diseases, such as cardiomyopathy, diabetes, and renal failure, precipitate the HF and are present on readmission. Concomitantly, a higher severity of illness measurement is a factor in HF readmission.

The mental/emotional health and social functioning of readmitted HF patients define the *psychosocial domain*. This domain was less well delineated when compared with the physiologic and demographic domains. The psychosocial domain encompassed such factors as patient motivation, depression, compliance, and knowledge. In the sample articles, many of these factors had been elicited through standardized testing.

Factors associated with general living are in the *patient functioning domain*. How well HF patients were able to manage their lives within the context of their daily medical regimen was the organizing idea underlying this domain. Items such as a patient's self-care abilities, cognitive status, and understanding and acceptance of the diagnosis characterized the patient functioning domain. Since the New York Heart Association (NYHA) Classification reflects physical functional ability, this factor was placed in the patient functioning domain. Measurement of these factors in the sample articles was generally through the use of standardized instruments.

Finally, the *resource utilization domain* includes factors associated with personal, community, and healthcare environments such as presence of a caregiver or hospital case management services. This was a broad domain, encompassing the healthcare delivery system continuum. Issues less directly dependent on the HF patient such as human, financial, and social resources were included. Some items in this domain such as days to readmission, overall length of hospital stay, and the total number of hospitalizations in a 1-year period were uniformly measured in sample research articles. Others such as social support and caregiver capacity were less easily defined.

DISCUSSION

The purpose of this project was to systematically review and organize the considerable literature concerning the hospital readmission of HF patients into a usable framework. The outcome is a classification of the significant factors reported in the research literature. Application of the framework may inform clinical practice, stimulate further research, and facilitate administrative applications.

Clinical practice

The practice of nursing, specifically in the care of HF patients, may be dramatically improved through the application of innovative evidence-based models.[15] This evidence-based framework may be a useful adjunct to patient assessment at several points in an episode of care. The framework can provide early identification of potential problems. On admission, these factors could be used to adjust the clinical pathways to be more sensitive to prevention of hospital readmission. Nurses can use it to individualize care planning and identify "red flags" for HF patients. For example, an elderly male HF patient with diabetes, who lives alone, and has mild dementia is at greater risk for hospital readmission. Several factors from the framework are present in this patient. Interventions appropriate for these factors could be implemented during the inpatient and discharge planning phases to decrease the risk of subsequent readmission.

At hospital discharge, factors present in the patient provide a basis for individualized discharge planning. If the patient lives alone, extensive community services could be arranged for inhome care. Home care could be initiated for patients who require assistance in managing their care regimen; such interventions are designed to prevent the patient from making an unplanned return to the hospital.

The framework would be useful to nurses across the continuum of care. Community-based care delivery services could use the framework as a risk-assessment tool. Heart failure patients with literacy, cognition, or sensory challenges may need specialized interventions to avoid readmission. Clinics or telephone monitoring services might find the framework useful in determining how frequently to schedule the patient and, possibly, the amount and type of teaching that needs to be done. Use of the framework as the basis for scripts and algorithms for community-based providers would allow providers to make meaningful assessments and implement effective interventions continuous with care initiated in the acute care setting.

At any point in the care continuum, the framework may be used as the basis for development of evidence-based practice protocols and measurement of these outcomes. The framework provides a common language for providers across the continuum to communicate about their shared patients.

Risk-assessment research

Development of an HF patient's "risk of hospital readmission" assessment tool is another important application of the framework. The assessment tool could be designed in several ways. Individual factors could be extracted, weighted, and grouped to provide risk scores. The 5 domains of the framework could serve as the categories for general patient assessment. In either scenario, an HF patient could earn a "score" for potential risk of hospital readmission. Clinicians could then identify interventions to reduce the risk of readmission. With testing and validation, such a risk-assessment tool could be linked with both the amount and the type of interventions that are most effective with a particular level of risk.

To develop this risk-assessment tool, items in the framework would first need to be prioritized or weighted. Some factors are likely more important than others and thus need to have more significance placed on them. Factors must be weighted so that the actual predictive influence of each factor is accurately captured. Furthermore, the essential factors need to be elicited and stratified in order of importance. These will be the factors on which the majority of care is based. There were no reports of weighting of factors in the literature. With the addition of a Likert-type scale of "not very important" to "very important," clinicians could be asked to rate the items in terms of prediction of readmission of HF patients.

Administrative applications

The framework also has administrative applications. Certain items could be selected for quality improvement purposes. These indicators could be used at the unit level or, in a broader scope, throughout the healthcare system. Furthermore, the framework could be used to organize resource allocation. For example, patients with psychosocial domain factors such as depression may benefit from pharmacological and counseling interventions, potentially improving outcomes for both the depression and the HF.

A weighted risk-assessment tool based on the framework provides a way of describing the aggregate risk of patients who are cared for in the healthcare system and justification for decisions about major purchases. For example, purchasing decisions related to home vital sign monitors, software programs, clinical pharmacy equipment, or outpatient clinic services could be supported by data amassed from the use of such a tool.

Moreover, administrators could use the framework to organize staff development including staff education, orientation programs, and continuing education offerings. The "dosage of care" feature could assist administrators in decisions related to staffing, mentoring, and resource allocation.

FUTURE PERSPECTIVES

The basic function of the framework will continue to be a foundation for healthcare professionals in various work environments to assess and care for HF patients. This framework will need to be refined as new factors

emerge and updated to keep pace with advances in the technology and understanding of treatment for the HF. There are several areas of current speculation about the contribution of specific factors to hospital readmission of HF patients. For example, patient literacy and the design and delivery of HF patient education need further evaluation. The roles of B-type and atrial-type natriuretic peptides as predictors of outcomes are continually evolving. Dysrhythmias and electrolyte imbalances, individually and in concert, must be weighted accurately in this framework. Bioimpedence testing; ejection fraction measured by echocardiogram, radionuclide ventriculogram, or isotope ventriculogram; and abnormal chest x-ray radiographs may also provide predictive clues. The impact of being newly diagnosed versus in a chronic state may affect motivation, depression, compliance, and knowledge. The way these articles are coded for retrieval in large databases can have an effect on the information to which the practitioners have access.

One domain should not be viewed artificially in isolation from the other domains. A demographic factor (advanced age) with a physiologic factor (comorbidities) may both contribute to the readmission of the HF patient. Further work needs to be done to determine combinations of factors in the readmission of HF patients as well as the timing of these factors.

Limitations of the framework are related to the body of literature on the HF. One such limitation is the gap in time between recognition of important factors by experienced practitioners and publication of their implications. Another limitation is the incomplete description in the research literature of the wealth of knowledge, the "know how," of expert clinicians. The biases of areas of interest to researchers, availability and distribution of funding, and feasibility of study also limit which factors are described in the research literature. Furthermore, subtle signs and HF symptoms exist that have not yet been addressed thoroughly in the considerable amount of literature reviewed.

Nurses, clinicians, researchers, and administrators can both use this framework and contribute to its refinement. Nurses and other healthcare providers across the care spectrum encounter HF patients and their families and can develop, implement, and refine tools to help address this growing healthcare concern.

REFERENCES

1. Anderson MA, Pena R, Helms LB. Home care resource utilization by congestive heart failure patients: a pilot study. *Public Health Nurs.* 1998;15(2):146-162.
2. Blaha C, Robinson JM, Pugh LC, Bryan Y, Havens DS. Longitudinal nursing case management for elderly heart failure patients: notes from the field. *Nurs Case Manag.* 2000;5(1):32-36.
3. Thomas DJG, Harrah BF. A new look at heart failure. *Home Healthc Nurse.* 2000;18(3):164-170.
4. Todero CM, LaFramboise LM, Zimmerman LM. Symptom status and quality of life outcomes of home-based disease management program for heart failure patients. *Outcomes Manag.* 2002;6(4):161-168.
5. Welsh JD, Heiser RM, Schooler MP, et al. Characteristics and treatment of patients with heart failure in the emergency department. *J Emerg Nurs.* 2002;28(2):126-131.
6. Fonarow GC, Stevenson LW, Walden JA, et al. Impact of a comprehensive heart failure management program on hospital readmission and functional status of patients with advanced heart failure. *J Nurs Care Qual.* 1997;13(6):68-82.
7. US Department of Health and Human Services. National Heart, Lung and Blood Institute. *Congestive Heart Failure in the United States: A New Epidemic.* Washington, DC: US Dept of Health and Human Services; 1996.
8. Hoyt R, Bowling L. Reducing readmissions for congestive heart failure. *Am Fam Phys.* 2001;63:1593-1598.
9. Callahan HE. Families dealing with advanced heart failure: a challenge and an opportunity. *Crit Care Nurs Q.* 2003;26(3):230-243.
10. Mitchell J, Caboral M. Prevention is focus of new guidelines for heart failure. *Phys Assist.* 2003;27(2):20-22, 24-25.
11. Rogers AE, Addington-Hall JM, Abery AJ, et al. Knowledge and communication difficulties for patients with chronic heart failure: qualitative study. *BMJ.* 2000;321(7261):605-607.

12. Thomas SA, Friedman E, Khatta M, Cook LK, Lann AL. Depression in patients with heart failure: physiologic effects, incidence and relation to mortality. *AACN Clin Issues*. 2003;14(1):3-12.
13. Ganong LH. Integrative reviews of nursing research. *Res Nurs Health*. 1987;10:1-11.
14. Cooper HM. *Integrating Research: A Guide for Literature Reviews*. 2nd ed. Newbury Park, Calif: Sage; 1989.
15. Duffy JR, Hoskins LM, Chen M. Nonpharmacological strategies for improving heart failure outcomes in the community: a systematic review. *J Nurs Qual Care*. 2004;19:349-360.