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Effectiveness of integrated program on clinical care pathway for patients with heart failure upon competency of nurses

Kanchana. G *, Vijayalakshmi. K and Merlin. A

[1] Apollo College of Nursing, India.
[2] Head of Research and Development, Apollo College of Nursing, India.
[3] Apollo College of Nursing, The Tamil Nadu Dr. M. G. R Medical University, Chennai, India.

Abstract

Cardiovascular disease is still the most common cause of death and disability in industrialized nations, and its prevalence is rising rapidly. Heart failure (HF) is increasingly common and incurs a substantial cost, both in terms of quality and length of life. Clinical pathways provide a means of implementing the most up-to-date guidance into clinical settings to improve the value and efficiency of the care provided.

Methods: This study was conducted using the A Quasi-Experimental Time series Research design to assess the level of competency and to determine the effectiveness of clinical care pathway on management of patients with heart failure among 60 nurses (30 in Control and 30 in Intervention Group) from selected hospitals who were selected by consecutive sampling technique. The data was collected using pretested and validated tools such as background variables proforma of nurses, structured knowledge questionnaire and Observation Checklist on Practice of Integrated Program on Clinical Care Pathway for Heart Failure through self-administration method.

Results: The study findings revealed that the mean knowledge score for heart failure management was significantly higher in the intervention group (25.50 ± 1.61) compared to the control group (17.87 ± 1.83). Additionally, their practice scores also were significantly higher across all components, days, and global scores in the intervention group (127.97 ± 3.43) than the control group (76.90 ± 7.60) with a $p < 0.001$.

Conclusion: An empowerment of nurses focusing on clinical pathway could improve knowledge on heart failure, which could lead to better patient care including patient education and could reduce patient readmission for heart failure.

Keywords: Integrated program; Clinical care Pathway; Competency; Knowledge; Practice and Nurses

1. Introduction

The cardiovascular disease (CVD) burden in India is increasing. Globally, CVDs are the number one cause of death, and more people die annually from CVDs than from any other cause. (12).Heart failure (HF) as the "end stage" of CVD requires chronic illness care as the prevalence of the disease is rising. The global burden of HF is affecting at least 26 million people worldwide, and its incidence and prevalence are increasing. In India, the estimated range of HF is between 1.3 and 4.6 million, with a prevalence of 0.12%–0.44%, and coronary artery disease is the leading cause of HF [Joseph et al.2020][1]. This chronic condition causes an enormous strain on patients, carers, and healthcare providers, highlighting the critical significance of adequate management methods [Sav ,2015][2].

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* Corresponding author: Kanchana. G

Acute decompensated HF (ADHF) represents one of the leading causes of hospital admissions of the elderly population despite the advanced treatment both in the medical and device therapy field. ADHF is defined as the acute onset or gradual progression of HF, which necessitates immediate medical attention and hospitalization. More than 80% of patients with ADHF present to the emergency department, and only selected patients are eligible to receive care for ADHF in a cardiac observation unit [Fermann , 2010][3].

A clinical pathway (CP) is a multidisciplinary management tool which is based on the evidence-based practices for the provision of quality health care concerning the standardization of care processes [Kinsman, 2010][4]. The implementation of pathways reduces the variability in clinical practices and in-hospital complications, fosters communication among different disciplines, enhances documentation, and improves the outcome[Rotter, 2010][5].

Heart failure poses a significant global health burden, with increasing prevalence and mortality, particularly in low- and middle-income countries like Pakistan. Nurses' knowledge in heart failure management is crucial for effective patient care and education. Nurse-led heart failure inpatient hospital education has been demonstrated to improve knowledge, self-care behaviors and to reduce 30-day readmissions [Ghani,2023][6].

The estimated prevalence of HF in India is about 1% of the population or about 8–10 million individuals. Recent studies have indicated that the heart failure burden in the young may be increasing. The estimated mortality attributable to HF is about 0.1–0.16 million individuals per year. In an HF registry, mean age of patients was 56 years for women and 58 years for men. Of the 714 participants, 43% were women. CAD as a cause of HF was more frequent in men (67.4% of total vs. 46% of total in women) [Chaturvedi, 2018][7].

 Multidisciplinary HF disease management programs have been established to improve results through a structured follow-up based on patient education, optimization of medical treatment and improved access to care [Commin, 2017][8].Evidence has shown that HF programs improve quality of life for HF patients and successfully reduce 30-day readmission and its associated healthcare costs. [Pacho et al. 2017][9].

Nurses have more patient contact opportunities and are more holistic in all aspects of disease management; therefore, the implementation of a HF CP had improved the knowledge of nurses related to the management of ADHF patients. HF specialist nurses can help to reduce hospital admissions and improve quality of life and adherence to treatment for HF patients [Jiang, 2018][10].

Nurses play a vital role in caring for HF patients. Specialized care provided by HF nurses in outpatient settings with a structured follow-up focused on the optimization of therapy and education for self-care has reported a reduction in the risk of hospital readmission. [Riley, 2017][11].Nurses in inpatient setup providing clinical nursing care to a patient suffering from heart disease require the application of knowledge of the disease process.

A comprehensive education intervention with continued reinforcement may prove useful in increasing the knowledge of acute HF management principles, among experienced acute care nurses. Nursing education is an essential factor that needs to be addressed before the implementation of CP.

The implementation of the CP through the education program for nurses when performed in an interactive environment offers nurses a chance to learn and utilize the scenarios before its initiation into clinical practice. The key to the success of CPs is through nursing engagement and its implementation.[Morton, 2018 ,Barton ,2022][12,13]

In view of the identified gaps and reviewing the previous studies on ADHF in the in-hospital setting, there is a paucity of evidence-based practice in this area, especially in Indian context. Therefore, this study was conducted to develop the clinical care pathway for patients with heart failure and assess its effectiveness of Integrated Program on Clinical Care Pathway for Patients with Heart Failure upon competency of nurses and patient outcomes .

2. Materials and Methods

This study utilized a quasi-experimental research design conducted at two selected hospitals in Chennai. The settings were chosen based on the feasibility of obtaining adequate samples and the cooperation of the relevant authorities. The study was approved by the Institutional Ethics Committee, and permission was obtained from the hospital settings. The groups were randomly assigned as control and intervention groups.

Sixty nurses (30 in the control group and 30 in the intervention group) who met the inclusion criteria were selected using a consecutive sampling technique. The nurses in the intervention group were divided into three batches of ten

each. Informed consent was obtained from all individual participants included in the study. Baseline data were collected using pretested and validated tools, including a background variables proforma that captured information on age, gender, professional qualification, total years of experience, and years of experience in the cardiac unit.

A pretest was conducted using a 30-MCQ-items structured knowledge questionnaire focused on general information about heart failure, assessment, investigation, medication adherence, diet, deep breathing exercises, six-minute walking, fluid volume management, recognition of warning signs, health education, and follow-up care. The total obtainable knowledge score ranged from 0 to 30. Scores were converted into percentages and categorized as adequate (> 22), moderately adequate (15–22), and needs improvement (< 15).

An observation checklist was used to assess nursing practices on the Clinical Care Pathway for Heart Failure, which included general and cardiac assessments, investigations, medication administration, diet and fluid balance, activity levels, recognition of warning signs, health education, follow-up, and infection control measures. An educational intervention on an Integrated Program for the Clinical Care Pathway was administered to the intervention group over three days in batches.

Post-tests I and 2 were conducted for both groups using the same tools as the pretest after one week and one month of the intervention respectively. The collected data were analyzed using descriptive statistics, including frequency distribution and mean standard deviation, as well as inferential statistics such as the chi-square test, utilizing SPSS version 20.

3. Results

In this study most of the nurses were aged ≤ 25 years (56.7 & 93.3), females (76.7%, 93.3%,), with a B.Sc. Nursing Qualification (90%,100%), had less than 1 year of total experience (36.7%, 83.3%) and had less than 1 year of experience in cardiology unit (66.7%, 83.3%) in control and experimental group respectively.

There is no significant difference between Control and Intervention groups regarding background variables (such as age, qualification, total years of experience, total years of experience in cardiology unit at P> 0.05. Therefore, Control and Intervention groups were comparable and homogenous regarding background variables.

Table 1 Frequency and Percentage Distribution of Levels of Knowledge on Management of Patients with Heart Failure in Control and Intervention Group of Nurses.   **(N=60)**

Levels of Knowledge (Scores)	Control Group (n=30)		Intervention Group (n= 30)	
	f	%	f	%
Pretest				
Adequate (23-30)	-	-	-	-
Moderately Adequate (15-22)	15	50.0	19	63.3
Needs Improvement (< 15)	15	50.0	11	36.7
Post Test 1				
Adequate (23-30)	0	0.0	15	50.0
Moderately Adequate (15-22)	20	66.7	15	50.0
Needs Improvement (< 15)	10	33.3	0	0.0
Post Test 2				
Adequate (23-30)	0	0.0	30	100.0
Moderately Adequate (15-22)	30	100.0	0	0.0
Needs Improvement (< 15)	-	-	-	-

Regarding the level of knowledge in control group, half of the nurses were in category of needs improvement in pretest (50%), majority of them had moderately adequate knowledge in posttest 1(66.7%) and all of them had moderately adequate knowledge in posttest 2 (100%). Whereas in Intervention group in pretest majority of the nurses were in category of needs improvement (63.3%), in posttest 1, half of them had moderately adequate knowledge (50%) and in posttest 2, all of them gained adequate knowledge regarding on Management of Patients with Heart Failure (100%).

Table 2 Frequency and Percentage Distribution of Levels of Practice in Posttest on Management of Patient with Heart failure in Control and Intervention Group of Nurses**.**   **(N=60)**

Levels (Scores)	Control Group (n=30)		Intervention Group (n= 30)	
	f	%	f	%
Posttest				
Adequate Practice 75-100 %	0	0.0	30	100.0
Moderately Adequate 50-75 %	20	66.7	0	0.0
Needs Improvement < 50 %	10	33.3	0	0.0

Majority of the nurses' practice was moderately adequate (66.7%), 33.3% of them need improvement and none of their practice was adequate on management of patient with heart failure. Whereas, in Intervention group of all of their (100%) practice was adequate on management of patient with heart failure.

Table 3 Comparison of Mean Knowledge Scores on Management of Patient with Heart Failure Between Assessments in Control Group of Nurses (Using RM ANOVA) and Post Hoc Analysis   **(n=30)**

Components	Max Score	Pretest	Post Test 1	Post Test 2	F & p value		Post Hoc Analysis	P Value
		Mean± SD	Mean± SD	Mean± SD	Within Subjects	Between Subjects	Comparison	
General Information on Heart Failure	12	6.47± 1.31	6.83± 1.32	7.00± 1.20	4.108 0.021	1085.43 0.000	Pretest Vs Post Test1	0.032
							Pretest Vs Post Test2	0.018
							Post Test 1 Vs Posttest2	0.393
Management of Heart Failure	18	8.07± 1.70	9.10± 1.77	10.87± 1.70	58.421 0.000	1149.14 0.000	Pretest Vs Post Test1	**0.000**
							Pretest Vs Post Test 2	**0.000**
							Post Test 1 Vs PostTest2	**0.000**
Global Knowledge Score	**30**	**14.40± 1.96**	**15.77± 2.05**	**17.87± 1.83**	**95.236 0.000**	**2439.060 0.000**	**Pretest Vs Post Test1**	0.000
							Pretest Vs Post Test 2	0.000
							Post Test 1 Vs Post Test 2	**0.000**

Table 3 demonstrates a significant difference in global and subcomponents of knowledge scores between the pretest, posttest 1, and posttest 2 in the control group, both within subjects (p > 0.05) and between subjects (p > 0.001). Post hoc analysis (pairwise comparison) of knowledge scores in the control group indicates significant differences within groups across all comparisons: pretest versus posttest 1, pretest versus posttest 2, and posttest 1 versus posttest 2 for

both components and global knowledge scores (p < 0.001). However, there was no significant difference between posttest 1 and posttest 2 in the component of general information (p > 0.05). Overall, mean knowledge scores were higher in the posttests compared to the pretest scores which can be attributed the intervention on clinical pathway.

Table 4 Comparison of Mean Knowledge Scores on Management of Patient with Heart Failure Between Assessments in Intervention Group of Nurses (Using RM ANOVA) and Post Hoc Analysis **(n=30)**

Components	Max Score	Pretest	Post Test 1	Post Test 2	F & p value		Post Hoc Analysis	P Value
		Mean± SD	Mean± SD	Mean± SD	Within Subjects	Between Subjects	Comparison	
General Information on Heart Failure	12	7.03± 1.27	9.07± 1.51	9.90± 1.40	83.65 0.000	1885.00 0.000	Pretest Vs Post Test1	**0.000**
							Pretest Vs Post Test2	**0.000**
							Post Test 1 Vs Post Test 2	**0.000**
Management of Heart Failure	18	8.13± 1.46	15.60± 1.98	15.60± 1.43	440.77 0.000	2198.90 0.000	Pretest Vs Post Test1	**0.000**
							Pretest Vs Post Test 2	**0.000**
							Post Test 1 Vs Post Test 2	**0.000**
Global Knowledge Score	**30**	**15.17± 1.86**	**25.50± 2.24**	**25.50± 1.61**	**750.12 0.000**	**4435.82 0.000**	**Pretest Vs Post Test1**	0.000
							Pretest Vs Post Test 2	0.000
							Post Test 1 Vs Post Test 2	0.000

Table 4 shows a significant difference in global and subcomponents of knowledge scores between the pretest, posttest 1, and posttest 2 in the intervention group, both within subjects (p < 0.001) and between subjects (p < 0.001). Post hoc analysis (pairwise comparison) of knowledge scores in the intervention group indicates significant differences within all pairs: pretest versus posttest 1, pretest versus posttest 2, and posttest 1 versus posttest 2, for both components and the global knowledge score (p < 0.001). Overall, mean knowledge scores were higher in the posttests compared to the pretest scores.

Table 5 Comparison of Knowledge Scores on Management of Patient with Heart Failure Between Control and Intervention Group of Nurses

Assessments	Max Score	Control Group (n=30)	Intervention Group (n=30)	Mean Dif	Ind t & p value
		Mean±SD	Mean±SD		
General Information on Heart Failure	12	6.47±1.31	7.03±1.27	-.57	-1.70 0.094
Management of Heart Failure	18	8.07±1.70	8.13±1.46	-.07	0.16 0.871
Global Knowledge Score	30	14.40±1.96	15.17±1.86	-.77	-1.56 0.125

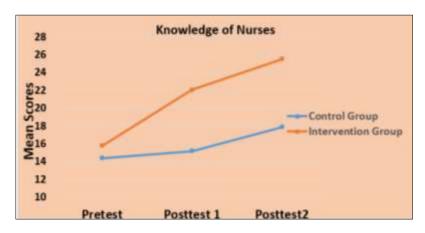| General Information on Heart Failure	8	6.83±1.32	9.07±1.51	-2.23	-6.12 0.000
Management of Heart Failure	12	9.10±1.77	13.00±1.98	-3.90	-8.04 0.000
Global Knowledge Score	30	15.77±2.05	22.07±2.24	-6.30	-11.37 0.000
General Information on Heart Failure	8	7.00±1.20	9.90±1.40	-2.90	-8.61 0.000
Management of Heart Failure	12	10.87±1.70	15.60±1.43	-4.73	-11.69 0.000
Global Knowledge Score	**30**	**17.87±1.83**	**25.50±1.61**	**-7.63**	**-17.12 0.000**

Table 5 and Figure 1 indicates that, in the pretest, there is no significant difference between the control and intervention groups in general information, management of heart failure, and global knowledge scores (p > 0.05). However, in posttest 1 and posttest 2, there is a significant difference between the control and intervention groups across all components and mean global knowledge scores (p < 0.001).

Table 6 Comparison of Mean Practice Scores on Management of Patient with Heart failure Between Control Group and Intervention Group of Nurses

Practice Score	Max Score	Control Group (n=30) Mean±SD	Intervention Group (n=30) Mean±SD	Mean Diff	Ind t value	P value
Day 1- Total Practice Score	45	26.57± 4.11	42.50±1.43	-2.80	-15.86	**0.000**
Day 2- Total Practice Score	45	26.30±2.82	42.93±1.36	-2.73	-22.48	**0.000**
Day 3- Total Practice Score	45	24.03±2.79	42.53±1.87	-18.50	-30.20	**0.000**
Grand Total (Global- All 3 Days)	**135**	**76.90±7.60**	**127.97±3.43**	**51.07**	**33.53**	**0.000**

Tab 6 reveals that, there is significant difference between Control and Intervention Group in all the days, and global practice scores (p < 0.001), which can be attributed to the effectiveness of Integrated Program on Clinical Care Pathway initiatives on knowledge of nurses.

Figure 1 Mean and SD of Knowledge Scores on Management of Patient with Heart Failure in Control and Intervention Group of Nurses

4. Discussion

One crucial issue that must be addressed to lower the mortality and morbidity of HF patients is the management of ADHF patients in a hospital setting. It was determined that using a CP for early assessment and management of ADHF patients through a nursing education session was a suitable approach that may be used going forward to handle these patients with sound understanding.

Effective management of acute decompensated heart failure (ADHF) is critical in reducing patient mortality and morbidity. This study demonstrates the effectiveness of implementing a Clinical Pathway (CP) combined with educational interventions to enhance nurses' knowledge and skills in heart failure (HF) management. Initially, a significant portion of nurses in the intervention group required improvement (63.3% in the pretest), but after the intervention, all nurses demonstrated adequate knowledge. This outcome underscores the importance of targeted professional development in HF care, bridging knowledge gaps and promoting optimal patient care practices.

These findings align with Albert et al. [2013][14], who reported that standardized CP initiatives improve adherence to HF management guidelines, resulting in better patient outcomes. Such initiatives enhance the quality of care for HF patients by ensuring systematic adherence to best practices, which, as evidenced by this study, improves both knowledge and practical application among nurses . McEntee, Cuomo and Dennison [2009][15]further highlighted the positive impact of nurse-led education on patient adherence to lifestyle and medication regimens essential for HF management, which reduces HF exacerbations. Our findings echo these benefits, showing that structured training empowers nurses to bridge gaps between patient needs and evidence-based HF care [15].

Lavenberg et al. [2014][16] found that structured nurse education significantly reduced hospital readmissions for HF patients, suggesting that well-educated nurses can effectively guide patients in self-care, directly influencing readmission rates. This study confirms the importance of ongoing professional development in enhancing the quality and consistency of care provided to HF patients [16]. Additionally, Miller, Whitlatch, and Lyons (2015) advocated for nurse-patient collaboration through shared decision-making, emphasizing that nurses well-versed in HF principles can foster patient engagement in self-management practices, which contributes to better patient adherence and overall outcomes [17].

Sundel [2018][18] conducted a one-group pretest-posttest study among staff nurses, showing that HF knowledge improved significantly post-intervention, supporting our finding that focused education positively impacts HF management knowledge. Similarly, Wang et al. [2023][19] conducted a survey among nurses to identify HF knowledge gaps, highlighting the need for regular education to maintain nursing competency in HF care. This study's results reflect that ongoing education can meaningfully address these gaps and ensure that nursing staff remain competent in evidence-based HF care practices [18, 19].

The study utilized repeated measures ANOVA to assess the differences in knowledge scores over time. Results showed significant improvements in global knowledge scores from pretest to posttest 1 and posttest 2 in the intervention group (p < 0.001). This indicates that the educational intervention had a sustained impact on knowledge retention and application, a finding corroborated by the post hoc analysis, which revealed significant differences between each assessment period (p < 0.001).

Supporting this finding, a quasi-experimental study by Joseph et al. [2020][20] assessed the effectiveness of a structured heart failure CP among 71 nurses in a cardiac care unit and found that prior to the intervention, 80% of nurses had average knowledge scores. Post-intervention, 79% achieved good knowledge scores, indicating the positive impact of structured educational initiatives.

Likewise, Rasmusson et al. [2015][21] emphasized the need for consistent HF management training to maintain high standards of nursing practice, with findings indicating long-term benefits in nurse competency and HF patient care [21].

The literature further supports the need for simulation-based and interactive training methods. Fonarow et al. [2017][22] argued that hands-on training can significantly enhance nursing competency and confidence, an approach that could be integrated into nursing curricula to further improve patient outcomes in HF care [22]. Cobb [2006][23]emphasized that educational programs bridge the gap between evidence-based recommendations and clinical practice, an insight supported by our findings on the benefits of a structured CP in enhancing HF care [23].

Other studies also demonstrated that, educational interventions are well known for their effect to improve knowledge in various conditions [Turan , 2017][24]. In other study that evaluated the effect of education on knowledge, it was reported that the number of correct answers to each item increased after education [Alberto, 2018][25].

Most nursing personnel demonstrated moderately adequate practices in managing patients with heart failure, with 66.7% achieving a moderate level of proficiency, while 33.3% required improvement, and none displayed fully adequate practice levels. In contrast, all participants (100%) in the intervention group demonstrated adequate practices in heart failure management.

Gnanarani et al. [2022][26] conducted an experimental pre-test and post-test study to evaluate the effectiveness of a clinical pathway for nursing care of patients undergoing lung transplantation. The study involved 100 nurse internship students, selected through purposive sampling, and divided into a control group and an experimental group. Findings indicated that in the experimental group, over half of the nurses (56%) demonstrated adequate knowledge, and 44% had moderately adequate knowledge regarding the clinical pathway. In contrast, all nurses in the control group (100%) displayed inadequate knowledge on the subject. This suggests that implementing a clinical pathway can significantly improve knowledge among nurse interns on specialized care requirements for lung transplant patients.

Addressing needs and challenges in health care professions while providing care to the patients requires multifaceted approaches, including comprehensive training programs and supportive workplace policies within healthcare settings Pandiselvi et al. [2024][27, 28].

5. Conclusion

The study provides strong evidence that integrating CPs with educational interventions significantly improves nurses' knowledge and skills in management of Heart Failure. Prioritizing regular training and CP implementation within healthcare institutions can enhance care quality, reduce hospital readmissions, and improve patient outcomes. Healthcare institutions should consider implementing CPs and annual training as part of standard nursing practices; Structured CPs and educational interventions allow nurses to remain knowledgeable about best practices and to engage patients in their care effectively.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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