

## Accuracy in inference of nursing diagnoses in heart failure patients

*Acurácia na inferência de diagnósticos de enfermagem de pacientes com insuficiência cardíaca*

*La precisión en inferencia de diagnóstico de enfermería en pacientes con insuficiencia cardíaca*

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### ABSTRACT

Heart failure (HF) is a common cause of hospitalization and requires accuracy in clinical judgment and appropriate nursing diagnoses. **Objective:** to determine the accuracy of nursing diagnoses of fatigue, intolerance to activity and decreased cardiac output in hospitalized HF patients. **Method:** descriptive study applied to nurses with experience in NANDA-I and/or HF nursing diagnoses. Evaluation and accuracy were determined by calculating efficacy (E), false negative (FN), false positive (FP) and trend (T) measures. Nurses who showed acceptable inspection for two diagnoses were selected. **Results:** the nursing diagnosis of fatigue was the most commonly mistaken diagnosis identified by the nursing evaluators. **Discussion:** the search for improving diagnostic accuracy reaffirms the need for continuous and specific training to improve the diagnosis capability of nurses. **Conclusion:** the training allowed the exercise of clinical judgment and better accuracy of nurses.

**Key words:** Nursing Processes; Nursing Diagnosis; Heart Failure.

### RESUMO

Insuficiência cardíaca (IC) é causa frequente de internação exigindo do enfermeiro precisão na conduta clínica e adequado julgamento dos diagnósticos de enfermagem. **Objetivo:** verificar acurácia na determinação dos diagnósticos de enfermagem fadiga, intolerância à atividade e débito cardíaco diminuído em paciente com IC hospitalizados. **Método:** estudo descritivo aplicado aos enfermeiros experientes em diagnósticos de enfermagem NANDA-I e/ou IC. Avaliação da acurácia foi realizada a partir do cálculo das medidas: eficácia (E), falso negativo (FN), falso positivo (FP) e tendência (T). Foram aptos os enfermeiros com inspeção aceitável para dois diagnósticos. **Resultados:** o diagnóstico de enfermagem fadiga foi o mais erroneamente identificado pelos enfermeiros avaliadores. **Discussão:** a busca pelo aperfeiçoamento da acurácia diagnóstica reafirma a necessidade de treinamento contínuo e específico para a melhora da capacidade diagnosticadora do enfermeiro. **Conclusão:** o treinamento permitiu o exercício do raciocínio clínico e melhor acurácia dos enfermeiros.

**Descritores:** Processos de Enfermagem; Diagnósticos de Enfermagem; Insuficiência Cardíaca.

### RESUMEN

Insuficiencia cardíaca (IC) es causa frecuente de ingresos hospitalarios exigiendo del enfermero precisión en la conducta clínica y adecuado juzgamiento de los diagnósticos de enfermería. **Objetivo:** verificar la precisión en la determinación de los diagnósticos de enfermería fatiga, disminución del gasto cardíaco e intolerancia a la actividad en pacientes con IC ingresos en hospitales. **Método:** estudio observacional, con enfermeros docentes y experientes en diagnósticos de enfermería NANDA-I y/o IC. Evaluación y precisión fueron realizadas por través del cálculo: eficacia (E), falso negativo (FN), falso positivo (FP) y tendecia (T). Fueron aptos los enfermeros con inspección aceptable para dos diagnósticos. **Resultados:** el diagnóstico de enfermería

fatiga fue identificado erróneamente como por evaluadores enfermeras. **Discusión:** la búsqueda de la mejora de la precisión diagnóstica reafirma la necesidad de una formación continua y específica a la mejora de la capacidad del diagnosticador enfermera. **Conclusión:** la capacitación permitió el ejercicio del raciocinio y mejor precisión de los enfermeros. **Palabras clave:** Procesos de Enfermería; Diagnósticos de Enfermería; Insuficiencia Cardíaca.

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## INTRODUCTION

Heart failure (HF), which is considered to be an increasing epidemic condition, is one of the major current clinical challenges<sup>(1)</sup>. This syndrome results from a heart damage caused by other cardiovascular diseases (CVD) related to risk factors such as sedentary life, smoking, alcohol consumption, high blood pressure, diabetes and dyslipidemia, aging and the genetic component<sup>(1)</sup>.

Nurses who care for chronic heart failure patients have difficulty in reading the signs and symptoms of patients related to the physiopathological process, and in dealing with the disruption resulting from the disease and treatment.

Qualified care is based on critical reasoning and standardized communications made up by organized systems of titles, definitions and description of the three elements of nursing practice, namely diagnoses, results and interventions<sup>(2)</sup>.

Nursing diagnoses (ND) stand for the clinical judgment of nursing professionals regarding the responses of individuals, families or the community to vital processes or current or potential health conditions, which help the nurse select proper nursing interventions to achieve the best results<sup>(2)</sup>. The use of nursing diagnoses in care makes clear the course of interventions and measurement of results, improving communications between the nursing team and the remainder professionals. Moreover, it provides information on contributions regarding healthcare quality.

The NANDA-I (International NANDA) is an international language of nursing diagnoses which has been translated into several languages. Every two years specialized nurses assemble to review nursing diagnoses (ND) based on scientific papers in the field; and nursing diagnoses may be added, removed or changed<sup>(2)</sup>.

A nursing diagnosis is defined in clinical practice and ensues from critical reasoning and analysis of data extracted from interview, physical exams and interpretation of exams. This process of diagnostic thinking involves coordination of interpersonal, technical and intellectual processes by nurses. Interpersonal processes are the actual communication with patients and other health professionals for data collection and analysis, and the decision making as well. Technical processes involve the recording of the individual's health history; evaluation of individuals, families and the community; and, physical exams. Intellectual processes include data analysis and decision making<sup>(3)</sup>.

Based on the hospitalized patient's responses to HF and treatment, the establishment of good clinical indicators provides nurses with the capability of judging nursing diagnoses (NANDA-I) with lower possibility of error, that is, with higher accuracy. Therefore, the use of diagnoses as health indicators for these patients requires reducing the factors that hamper the selection of a proper diagnosis.

The question raised in this study is whether nurses are accurate when defining NANDA-I nursing diagnoses directly related to the cardiovascular function of hospitalized HF patients notably regarding fatigue, intolerance to activity and decreased cardiac output. These three diagnoses are part of the activity/rest domain, and could be responses of fatigue and shortness of breath by hospitalized HF patients that hardly perform activities of daily living. These diagnoses are defined by the presence of specific characteristics in patients; however, due to similarities and subjective aspects, these characteristics could lead nurses to errors. Furthermore, these share similar characteristics that hinder establishing diagnoses, thus demanding a high degree of accuracy.

A nursing diagnosis of decreased cardiac output (DCO) is given when the heart pumps insufficient blood to meet the body's metabolic demands<sup>(2)</sup>. It is defined by fatigue, dyspnea, and edema, among others. Therefore it could stand for the clinical judgment of responses by patients with HF decompensation. Decreased cardiac output prevailed in studies with hospitalized patients with decompensated HF mostly (95.7%) in emergency rooms<sup>(4-5)</sup>. The following symptoms prevailed: dyspnea (91.4%), fatigue (67.3%) and edema (63.7%). Moreover, these were the main defining characteristics: dyspnea, orthopnea, paroxysmal nocturnal dyspnea, fatigue, edema, distension of the jugular vein, and decreased ejection fraction<sup>(4)</sup>.

Nonetheless, the nursing diagnosis of intolerance to activity (IA) could be directly related to the prognostic evaluation of HF patients, as the IA is defined as insufficient physiologic or psychological energy to cope with or complete the required or desired daily activities<sup>(2)</sup>. Therefore, the diagnosis analyzes the tolerance to physical efforts and, thus, the functional class defined by the New York Heart Association (NYHA) based on how limited patients are during physical activity and on their life quality in face of the disease<sup>(6)</sup>.

A multicenter research trial comparing the 10 most common nursing diagnoses, interventions and results in 302 electronic records found that intolerance to activity prevailed<sup>(5)</sup>, with frequency of 15%<sup>(7)</sup> among 40 patients assisted in emergency care units.

Fatigue was the most frequent symptom cited by hospitalized HF patients and, thus, it was selected to be studied. Likewise, it is a nursing diagnosis defined as an oppressive and sustained feeling of exhaustion and decreased capacity of performing usual physical and mental activities<sup>(2,8-10)</sup>. In this classification, fatigue is an isolated diagnosis described as a characteristic that defines decreased cardiac output and intolerance to activity<sup>(2)</sup>. In a study with 30 hospitalized HF patients, nursing diagnoses of fatigue were found in more than 90% of the sample with the following prevailing characteristics: "need for

extra energy" (100%) and "incapacity of performing routine activities" (83%)<sup>(11)</sup>.

The objective of this study was to verify the accuracy in the establishment of nursing diagnoses of fatigue, intolerance to activity and decreased cardiac output in hospitalized HF patients.

## METHOD

Descriptive study with six nurses belonging to the Group of Systematization of Heart Failure Nursing Care (GESAE\_IC) of the Fluminense Federal University, comprising one PhD nurse, five nurses with a master's degree, three nurses who are taking a master's program, two graduated nurses and five nursing academics. The GESAE\_IC develops the following lines of research on heart failure: studies on prevalence, incidence and validation of nursing diagnoses; care protocols for HF patients; and, clinical trials of nursing interventions proposed by the NIC (Nursing Interventions Classifications).

To participate in the study, members should hold a university degree and have studies published in one of the aforementioned research fields, additionally to having at least one year of teaching or clinical experience.

The nurses' profile at the Lattes Platform was evaluated according to the aforementioned criteria. Six nurses were invited

to participate in the study by e-mail, where the objectives and methods of the study were explained, the time scheduled for training was informed, and data confidentiality was ensured. Those who agreed on participating signed a free and informed consent form (FICF) stating their understanding about the ethics of the procedure and authorizing the use of information with due care. Participants were then submitted to a 12-hour on-site training as described in Box 1. A PhD nurse with expertise in heart failure nursing diagnoses, who also served as adviser to this study, prepared and delivered the training to the participants.

Training was required to standardize contents and facilitate the interpretation and further diagnosis of clinical cases.

In this study, the nurses' accuracy in diagnosing fatigue, IA and DCO was evaluated based on the method proposed by Lopes et al (2012) using previous studies on identification of nursing diagnoses<sup>(12-14)</sup>. This method was firstly described by Hradesky (1989) to evaluate the capacity of correctly classifying compliant and non-compliant items to assess inspection processes quality<sup>(15)</sup>. The study adopted the Lopes et al. (2012) approach, as nursing lacks perfect reference standards for nursing diagnoses. The measuring tools available cannot accurately measure the human responses surveyed, neither precisely identify the presence or absence of these responses<sup>(14)</sup>.

**Box 1** - Training plan to the nurses participating in the study

Topic	Date	Time	Class load	Training Plan
Presentation of the study Systematization of nursing care	10/24/2011	1pm to 5pm	4h	Clarification about objectives and methods Clarification about the training plan for diagnosticians and evaluation. Theoretical class about systematization of nursing care at theoretical-practical and legal levels
Nursing process Heart failure nursing diagnosis	03/23/2012	1pm to 5pm	4h	Theoretical class about the nursing process and its phases Background of nursing diagnoses in clinical practice; diagnostic judgment and accuracy; background of nursing diagnoses of fatigue, IA and DCO in heart failure; debate about studies on heart failure; discussion of clinical cases.
Nursing background Heart failure nursing diagnosis	04/13/2012	1pm to 5pm	4h	Presentation of the study data collection instrument Background of nursing diagnoses in clinical practice; diagnostic judgment and accuracy; background of nursing diagnoses of fatigue, IA and DCO in heart failure; debate about studies on heart failure; discussion of clinical cases.
Heart failure nursing diagnosis	04/20/2012	3pm to 5pm	4h	Background of nursing diagnoses in clinical practice; diagnostic judgment and accuracy; background of nursing diagnoses of fatigue, IA and DCO in heart failure; debate about studies on heart failure; discussion of clinical cases.
Evaluation of the capability of providing nursing diagnoses	04/25/2012	9am to 5pm	8h	Application of clinical cases and performance of statistical calculations to evaluate the diagnostic accuracy of nurses.

This approach calculates four measures to evaluate the capability of diagnostic inference: efficacy (E), false negative (FN) rate, false positive (FP) rate and trend (T)<sup>(14-15)</sup>. Efficacy (E) refers to the capacity of the evaluator of correctly identifying the presence or absence of nursing diagnoses<sup>(14)</sup>. The false negative (FN) rate stands for the chance of rebutting the presence of diagnoses as in fact these are nothing but leads of their presence<sup>(14)</sup>. The false negative rate happens when a patient does not present leads enough to justify the diagnosis, but is erroneously classified with that diagnosis<sup>(14)</sup>. Trend (T) is the evaluator's propensity to determine the presence or absence of the diagnosis<sup>(14)</sup>.

Ideally, there should be at least 12 items to be analyzed by three or more examiners, i.e., each item would be evaluated three times<sup>(14-15)</sup>. Thus, 12 clinical cases with three repetitions were applied to the six nurses selected. The study adviser had previously designed the 12 clinical cases with nursing diagnoses of FA, IA, DCO for nurses to perform the diagnosis process.

The clinical cases were designed based on the transcription of actual nursing records of patients hospitalized in the healthcare center ward of a teaching hospital in the municipality of Niterói, in the state of Rio de Janeiro, with confirmed medical diagnosis of decompensated heart failure. Patients signed a Free and Informed Consent Form (FICF) prior to the nursing records. The instrument used comprised closed- and open-ended questions depending on the NANDA-I nursing classification domains, i.e., the spheres of activity. It includes information on patients' identification (age, gender, per capita income, schooling years, self-declared race, time of disease, time of treatment, history of former disease, history of disease in the family, and municipality of origin), review of symptoms and systems, laboratory exams, echocardiogram report, and medications being used during hospitalization. Data were collected by the same person that designed the clinical cases.

Diagnoses of FA, IA and DCO were present in half of the cases, as recommended by the method<sup>(14-15)</sup>. For all cases there was no less than one and no more than two diagnoses to be studied and identified.

The researcher distributed the 12 clinical cases to the participating nurses for them to determine the presence or absence of FA, IA and DCO nursing diagnoses, one at a time and in separate sheets. Anonymity was ensured identifying participants with Arabic numerals in the order of application of clinical cases.

The clinical cases were then randomly submitted two additional times to the evaluation of the nurses, in a different order from the first time, thus completing 36 (12x3) evaluations by each nurse. The researcher gathered the answer sheets as diagnostic evaluations were performed to prevent nurses from being influenced by their previous inferences.

The responses to the clinical cases were typed in a computer and stored in a database using *Microsoft® Excel 2007* software and further compared against the template prepared by the PhD researcher, and calculated according to the measures described. After analysis, responses were classified as

**Table 1 -** Adapted parameters of evaluation of inspection capacity with attributes<sup>(14-15)</sup>

Standards	Acceptable	Marginal	Unacceptable
Efficacy	0.8 or above	-	Below 0.8
False positive	Up to 0.1	-	Above 0.1
False negative	Up to 0.1	-	Above 0.05
Trend	0.8-1.2	1.2-1.5	Below 0.5 or above 1.5

acceptable, marginal or unacceptable following the parameters disclosed in Table 1. Diagnostic evaluations should be considered acceptable in the three diagnoses for the nurses to be considered as apt.

The study was approved by the Research Ethics Committee of HUAP/UFF (Protocol 011/2011). Ethical aspects were observed as per the Brazilian National Health Council, resolution 196/96.

**RESULTS**

The mean age of the participants was 31.3 ± 7.4 years, and mean training time in nursing was 5.5 years. All nurses had published articles regarding nursing care systematization, nursing diagnoses and heart failure, and also participated in research groups in these fields, besides working in hospitals.

Table 2 displays the results achieved by the six nurses after training. The sample was made of nurses who achieved acceptable diagnosis evaluation in the tests. Only one nurse met this criterion in the first round. After undergoing new training, the remainder nurses were submitted to a new test with different clinical cases designed by the study adviser.

**Table 2 -** Results of the tests performed after the training on the nursing diagnoses of fatigue, intolerance to activity and decreased cardiac output (N = 6)

Criteria	Efficacy	False positive	False negative	Trend
<b>Fatigue</b>				
<b>Evaluator 1</b>				
Round 1	0.97	0.00	0.03	0.00
<b>Evaluator 2</b>				
Round 1	1.00	0.00	0.00	1.00
<b>Evaluator 3</b>				
Round 1	0.89	0.00	0.11	0.00
Round 2	1.00	0.00	0.00	1.00
<b>Evaluator 4</b>				
Round 1	0.92	0.00	0.08	0.00
Round 2	1.00	0.00	0.00	1.00

**Evaluator 5**

Continues

Table 2 (cont.)

Criteria	Efficacy	False positive	False negative	Trend
Round 1	1.00	0.00	0.00	1.00
Round 2	1.00	0.00	0.00	1.00
<b>Evaluator 6</b>				
Round 1	0.92	0.00	0.08	0.00
Round 2	1.00	0.00	0.00	1.00
<b>Intolerance to activity</b>				
<b>Evaluator 1</b>				
Round 1	1.00	0.00	0.00	1.00
<b>Evaluator 2</b>				
Round 1	1.00	0.00	0.00	1.00
<b>Evaluator 3</b>				
Round 1	0.69	0.58	0.39	*
Round 2	1.00	0.00	0.00	1.00
<b>Evaluator 4</b>				
Round 1	0.69	0.58	0.39	*
Round 2	1.00	0.00	0.00	1.00
<b>Evaluator 5</b>				
Round 1	1.00	0.00	0.00	1.00
Round 2	1.00	0.00	0.00	1.00
<b>Evaluator 6</b>				
Round 1	1.00	0.00	0.00	1.00
Round 2	1.00	0.00	0.00	1.00
<b>Decreased cardiac output</b>				
<b>Evaluator 1</b>				
Round 1	1.00	0.00	0.00	1.00
<b>Evaluator 2</b>				
Round 1	1.00	0.00	0.00	1.00
<b>Evaluator 3</b>				
Round 1	0.97	0.00	0.03	0.00
Round 2	1.00	0.00	0.00	1.00
<b>Evaluator 4</b>				
Round 1	0.89	0.17	0.15	1.12
Round 2	1.00	0.00	0.00	1.00
<b>Evaluator 5</b>				
Round 1	0.97	0.05	0.00	0.00
Round 2	1.00	0.00	0.00	1.00
<b>Evaluator 6</b>				
Round 1	1.00	0.00	0.00	1.00
Round 2	1.00	0.00	0.00	1.00

The highest rate of wrong diagnoses by nurses was found in the nursing diagnosis of fatigue ( $n = 3$ ). Evaluators 4 and 6 got similar values of false negative (0.8). After new training and a second round they were considered to be apt, and presented trend value of 1.0.

Evaluators 3 and 4 failed in identifying the nursing diagnosis of intolerance to activity, with high scores for the parameters of false positive and false negative (0.58 and 0.39, respectively) and, after a new round of training and tests, were considered to be apt.

Evaluator 4 got the highest rates of false positive and false negative (0.17 and 0.15 respectively) for decreased cardiac output, and improved standards after undergoing new training and test.

Evaluators 1 and 2 were the only ones to reach satisfactory results in the first round according the study parameters.

## DISCUSSION

The study verified the nurses' accuracy regarding the establishment of nursing diagnoses of fatigue, intolerance to activity and decreased cardiac output in hospitalized HF patients. Nurses had more difficulty in establishing right nursing diagnoses of fatigue, notably by denying the presence of this diagnosis even in the presence of signs or symptoms to identify it (false negative).

The search for diagnostic accuracy in nursing issues is a common subject in literature, since its use in a valid and reliable way could strengthen the professional practice and evidence-based nursing research, besides supporting professional responsibility in nursing care based on consolidated rather than only empirical data<sup>(14,16-19)</sup>.

Nonetheless, when compared to the biomedical literature, evidences that nursing diagnoses are accurate and result in effective decisions on interventions of nursing care are still weak. Diagnosis accuracy requires a well-structured network of theoretical and practical knowledge, competence and skills of nurses to perceive the most complex problems faced by patients<sup>(3,19)</sup>.

Despite the training on diagnosing FA, IA and DCO and their previous experience with NANDA-I diagnoses in their work or research settings, four participating nurses had to pass by the second round to be considered apt. This could be explained by the subjectivity of the patients' complaints, notably in the diagnosis of fatigue, as to be considered apt they should achieve acceptable indexes for the three diagnoses.

Fatigue is considered to be a subjective and multi-causal phenomenon, whose origin and expression involves physical, cognitive and emotional aspects, and that depends on self-report to be identified. Due to this subjectivity, the professional could classify fatigue based on other manifestations like lack of energy or tiredness that are attributes of fatigue and crucial to the accurate diagnosis. Regarding HF, the manifestation of short breath is also frequent and makes the interpretation of the patients' reports even more complex. The difficulty in distinguishing intolerance and fatigue is of utmost relevance to the care for heart failure patients<sup>(10-11,19)</sup>.

The attempt to improve diagnostic accuracy according to the method proposed herein restates the need for continued and specific training to improve nurses' diagnostic capability, as evidenced by the results achieved. The reduction of false negative and false positive rates, and the increased efficacy and trend observed throughout the rounds allowed inferring that the use of this rationale could provide more accuracy to diagnoses.

Several studies use the Fehring's clinical validation model to evaluate the presence or absence of nursing diagnoses in a given population<sup>(17)</sup>. This method performs statistical calculations based on the inference of two experts only, while the method employed herein, named Evaluation of Attributes Classification Systems adjusted to evaluate nursing diagnoses, weights the individual capacity of each nurse in relation to four attributes, as previously explained<sup>(14-16)</sup>. Therefore, it ensures the efficacy of each professional evaluated and engages more diagnosticians to evaluate a research case or situation, enhancing diagnostic security.

A limitation to this study is the small sample of nurses used to confirm an efficient method to evidence diagnostic accuracy, although the number of participants meets the requirement of the method adjusted and described by Lopes et al. (2012)<sup>(15)</sup>. Ideally, the method should be applied on larger samples of professional nurses to disclose the difficulties related to the interpretation of human responses to eventually unclear nursing diagnosis characteristics. Moreover, it would allow to identify deficits of knowledge on NANDA-I domains, and to plan training programs to nurses to make them more

familiar to the taxonomy of nursing diagnoses.

The capacity-building process favored clinical judgment and clarified doubts about the diagnoses to be studied aiming at better diagnostic accuracy for nurses to establish the absence or presence of fatigue, intolerance to activity and decreased cardiac output in clinical practice.

## CONCLUSION

The development of training programs and methods to improve nursing diagnosis accuracy will favor more conscious reading of signs and symptoms reported by patients and, thus, the correct prediction of decompensation or healing events. This would facilitate setting more tangible goals and more reliable care.

The participation of nurses with capacity of providing accurate nursing diagnostic evaluation, notably in hospital settings where the recognition of characteristics reported and related factors is crucial, could lead to lower indexes of hospitalization.

The method of Evaluation of Attributes Classification Systems proved to be effective to find nurses bearing accurate diagnostic evaluation for HF patients, but should be further improved to reduce the number of training programs required, and to make it applicable to different strands of nursing diagnosis.

Despite the similarity of the FA, DCO and IA diagnoses, these could be identified in separate in the cases applied and their efficacy could be ensured by statistics.

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