

## Decreased cardiac output: a systematic review of the defining characteristics

*Débito cardíaco diminuído: revisão sistemática das características definidoras*

*Débito cardíaco disminuído: revisión sistemática de las características definidoras*

Vanessa de Souza<sup>1</sup>, Sandra Salloum Zeitoun<sup>2</sup>, Alba Lucia Bottura Leite de Barros<sup>3</sup>

### ABSTRACT

**Objectives:** To characterize the scientific articles related to the NANDA-I nursing diagnosis, decreased cardiac output. Verify those articles that describe the behavior of the defining characteristics of this diagnosis, identifying those that occur with the highest frequency. **Methods:** A systematic review of literature published between the years 1985 – 2008 was conducted, using the following databases: Lilacs, SciELO, EMBASE, Medline, Pubmed and Cochrane. **Results:** The sample included 13 articles which identified 50 defining characteristics. Ten characteristics were noted to occur with high frequency: altered heart rate/rhythm, dyspnea, labile blood pressure, rales, oliguria / anuria, edema, cold skin, fatigue / weakness, decreased peripheral pulses and decreased peripheral perfusion. **Conclusion:** This subject has not been explored in depth in the literature. The importance of physical examination, the use of less invasive techniques, and the need to review the proposed defining characteristics to provide clarity and objectivity in the identification of this nursing diagnosis was identified.

**Keywords:** Nursing diagnosis; Low cardiac output; Cardiac output

### RESUMO

**Objetivos:** Caracterizar os artigos científicos relacionados ao diagnóstico de enfermagem débito cardíaco diminuído. Verificar os artigos que descrevem o comportamento das características definidoras deste diagnóstico, identificando aquelas que ocorrem com maior frequência. **Métodos:** Trata-se de uma revisão sistemática realizada nas bases de dados: Lilacs, SciELO, Embase, Medline, Pubmed e Cochrane, no período de 1985 a 2008. **Resultados:** Foram selecionados 13 artigos, identificando 50 características definidoras, sendo dez com maior frequência: alteração da frequência/ritmo cardíaco, dispnéia, labilidade da pressão arterial, estertores, oligúria\ anúria, edema, pele fria, fadiga/fraqueza, diminuição dos pulsos periféricos e diminuição da perfusão periférica. **Conclusão:** A temática vem sendo pouco explorada. Constatou-se a importância do exame físico, a utilização de técnicas menos invasivas e a necessidade de rever as características definidoras propostas a fim de proporcionar clareza e objetividade na identificação desse diagnóstico de enfermagem.

**Descritores:** Diagnóstico de enfermagem, Baixo débito cardíaco, Débito cardíaco

### RESUMEN

**Objetivos:** Caracterizar los artículos científicos relacionados al diagnóstico de enfermería débito cardíaco disminuído. Verificar los artículos que describen el comportamiento de las características definidoras de este diagnóstico, identificando aquellas que ocurren con mayor frecuencia. **Métodos:** Se trata de una revisión sistemática realizada en las bases de datos: Lilacs, SciELO, Embase, Medline, Pubmed y Cochrane, en el período de 1985 al 2008. **Resultados:** Fueron seleccionados 13 artículos, identificando 50 características definidoras, siendo diez con mayor frecuencia: alteración de la frecuencia/ritmo cardíaco, disnea, labilidad de la presión arterial, estertores, oliguria\ anuria, edema, piel fría, fatiga/debilidad, disminución de los pulsos periféricos y disminución de la perfusión periférica. **Conclusión:** La temática viene siendo poco explorada. Se constató la importancia del examen físico, la utilización de técnicas menos invasivas y la necesidad de revisar las características definidoras propuestas a fin de proporcionar claridad y objetividad en la identificación de ese diagnóstico de enfermería.

**Descriptorios:** Diagnóstico de enfermería; Bajo gasto cardíaco; Gasto cardíaco

<sup>1</sup> Brotherhood of Santa Casa de Misericórdia de São Paulo - ISCMSP - São Paulo (SP), Brazil.

<sup>2</sup> Faculty of Medical Sciences of Santa Casa de São Paulo - FCMSCSP - São Paulo (SP), Brazil.

<sup>3</sup> Paulista School of Nursing, Federal University of São Paulo - UNIFESP - São Paulo (SP), Brazil.

## INTRODUCTION

Identification of a nursing diagnosis is the step in the nursing process, following assessment, which enables the nurse to describe a specific human response of an individual, family, group or community. If a terminology is used that includes a standardized definition, signs/symptoms and etiologic factors derived from assessment, it also provides a standardized language for use by nurses in identifying and communicating patient responses and for driving patient care, becoming a vehicle of communication that can be recognized globally. In North American literature.

MacManus (1950) suggested the term “diagnosis” as an activity that outlines the responsibilities of nurses. Since then, studies have been developed with the aim of establishing an international classification of nursing diagnoses. The North American Nursing Diagnosis Association (NANDA), established in 1982, (known as NANDA International since 2002), assumed responsibility for continuing this work<sup>(1-3)</sup>.

The nursing diagnosis, *decreased cardiac output (DCO)*, commonly found in critically ill patients admitted to the ICU, requires specific treatment including immediate nursing interventions. To this end, knowledge of cardiovascular pathophysiology is critical in clinical practice, along with the nurse’s ability to identify this response. Therefore, there is a clinical need for a comprehensive literature review that can guide nursing knowledge in terms of the evolution of this concept<sup>(4-5)</sup>.

The literature shows that previous nursing studies on this cardiovascular concept are predominantly discussed within the physiologic context, with the diagnosis of *DCO* used to guide the role of the nurse. It is important to note that the latest publication on this concept occurred almost a decade ago, so it is necessary to unite these studies and review existing information methodically, in order to guide future studies.

A trend to change therapeutic interventions in critically ill patients was observed in the literature, which suggests there is a need to seek grants to develop further knowledge of nursing practice related to the use of the nursing diagnosis of *DCO*<sup>(6)</sup>. In order to improve the knowledge of this subject, this research was conducted with the following guiding questions: Which defining characteristics (DCs) are identified for the *DCO* nursing diagnosis within national and international scientific publications? What are the technological resources needed to measure these DCs?

## OBJECTIVES

- Characterize the scientific articles related to the nursing diagnosis, *DCO*.
- Identify those DCs of the nursing diagnosis, *DCO*,

that occur with the highest frequency.

## METHODS

A systematic review of research literature was conducted, using a descriptive, exploratory method but without meta-analysis. A systematic review is a planned review which answers a specific question and uses explicit and systematic methods to identify, select and critically evaluate studies. This method diminishes the bias in the selection of articles to be reviewed, permitting the synthesis of studies about relevant problems in a reproducible and objective manner, by means of the scientific method<sup>(6)</sup>.

In this study, we sought to transform information retrieved from basic studies on the applicability to scientific knowledge, to clarify answers to the theoretical questions guiding the clinical practice of nurses<sup>(7)</sup>.

The nursing diagnosis, *decreased cardiac output (DCO)*, is defined by NANDA International (NANDA-I) as “inadequate blood pumped by the heart to meet metabolic demands of the body (p. 139).” The nursing diagnosis contains the diagnostic concept (label), definition, DCs and related factors. Currently, the nursing diagnosis *DCO* includes 38 DCs and six related factors<sup>(4)</sup>.

The study was conducted in compliance with the following methodological steps: definition of the problem/object of study, inclusion criteria, literature searches for appropriate research publications, critical review of those studies, data collection, and synthesis of the data.

The online databases used in this study conducted between September-December, 2008, included: LILACS, SciELO, EMBASE, MEDLINE, PUBMED, and COCHRANE. The search terms used were: *cardiac output (Gasto Cardíaco)* and *low cardiac output (Bajo Gasto Cardíaco)*, crossed with the descriptor, *nursing diagnosis (diagnóstico de enfermagem)*.

The selection of articles published between 1985 and 2008, was based on titles and abstracts using the following inclusion criteria: *indexed publications in national and international journals, written in English or Portuguese; accessible in full text*, and those that were *related to DCs of the NANDA-I nursing diagnosis, DCO*. We excluded articles that focused exclusively on cardiac pathophysiology and techniques of obtaining the numeric value of cardiac output.

To evaluate the level of evidence of each article - LoE (conditioned by the study design and intensity of the observed effects) and the degree of recommendation - DoR (which indicate the measures to be adopted by the professional), we used a reference for later analyzing and classifying selected studies, presented in Figure 1<sup>(8-9)</sup>.

For data collection, we developed an instrument to

**Figure 1** - Degree of recommendation and levels of evidence by study type, according to *Oxford Centre Evidence-Based Medicine*<sup>(9)</sup>.

GR	NE	Types of study
A	1 A	Systematic reviews and meta-analysis of comparable clinical trials. Well-designed randomized controlled trials with relevant clinical outcomes.
	1B	Randomized controlled trials with narrow confidence intervals
	1C	Results of the "all or nothing" study of case-control series.
B	2 A	Homogeneous systematic review of cohort studies (with comparison groups and control variables).
	2B	A cohort study with poor quality of randomization, control or unattended long, cross-sectional cohort study.
	2C	Results of research (observation of treatment results or clinical outcome).
	3 A	Homogeneous systematic review of case studies with a control group.
	3B	Case studies with a control group.
C	4	Case reports and series without a case-control setting
D	5	Opinion of respected authorities or experts. Non-systematic literature reviews

ensure transcription of the following items: *Identification of the article*: title, journal (year, volume, issue, pages), authors (including country of origin) and language (English, Portuguese); *Data for the survey*: type of study, purpose, study population, data collection procedures, results and conclusion; *Classification of studies*: (LoE, DoR).

We identified 90 abstracts, using the descriptors noted previously, within the following databases – Lilacs (4), Cochrane (5), Embase (5), SciELO (8), Medline (19), and Pubmed (49).

After reading each abstract, 55 potentially relevant articles were identified, and were then read carefully in their entirety. Ultimately, only 13 studies were selected based on their ability to meet all of the inclusion criteria, and which had results that were judged to be sufficiently valid.

The selection of these studies was determined through expert judgment and analysis by three nurse specialists in the nursing care of cardiac patients and management of the nursing diagnosis, *DCO*. One of these specialists was an expert in clinical practice, and the other two were experts in the scientific and theoretical knowledge related to *DCO*.

After analyzing the studies, the *DCs* found in the articles were organized into a spreadsheet to enable identification of their frequency.

## RESULTS

The data in Figure 2 present the studies included in the survey.

It is worth noting that the United States of America has the largest number of nursing research articles in this topic area; only two studies were found in Brazil that met inclusion criteria, which suggests that this topic has not been the focus of much research in our country.

It was noted that most articles were published in the 1980s and 1990s; there were only two studies found within the current decade.

A review of the study design for these 13 articles

indicated that ten were prospective and three were retrospective. Of the ten prospective studies, four were validation studies, four were case studies and two observational/analytical; two were retrospective studies and one was a review of literature.

There was a range of content discussed in the research literature reviewed for this study: 13 articles (100%) focused on the *DCs*/symptoms of *DCO*, and of these, six (46.1%) addressed aspects of cardiovascular pathophysiology related to the diagnosis *DCO*, 11 articles (84.6%) addressed related factors / etiology of *DCO*, and six articles (46.1%) addressed nursing interventions.

The data in Figure 3 demonstrates that the articles in the literature review have a relatively low level of evidence and grade of recommendation, according to the hierarchical classification of reliability attributed to the studies<sup>(8-9)</sup>. The *DCs* found in the articles with scores equal to or greater than 45% were considered relevant to this study; their data is listed in Figure 4 along with the technological resources required for measurement.

Those *DCs* appearing with the highest frequency were: alterations in heart rate/rhythm (76.9%), dyspnea (76.9%), lability of arterial pressure (69.2%), rales (69.2%), oliguria/anuria (61.5%), edema (61.1%), cool skin (53%), fatigue/weakness (46.1%), decreased peripheral pulses (46.1%) and decreased peripheral perfusion (46.1%). The *DCs* noted in bold print are NANDA-I *DCs*, whereas the others were identified in the literature but are not present in the NANDA-I taxonomy for the nursing diagnosis, *DCO*.

After a review of the articles, those *DCs* appearing with the lowest frequency were: orthopnea (30,7%), nausea/vomiting (23%), acidosis (23%), drowsiness/confusion/restlessness (23%) paroxysmal nocturnal dyspnea (23%), altered heart sounds (S3 & S4 sounds) (23%) oxygen pressure changes (15,3%), change in body temperature (15,3%), cough (15,3%), chest pain (15,3%) changes in renal perfusion (15.3%), decreased level of consciousness (15.3%), palpitations (15.3%), anorexia (7.6%), hyperglycemia (7.6%), abnormal chest

**Figure 2** - Selected studies on nursing diagnoses DCO. Sao Paulo 2009.

Author (s)	Title	Regular / Year	Country
APV Oliva <sup>(10)</sup>	Decreased Cardiac Output: Validation Patients with postoperative heart surgery	IJNTC, 2003.	BRA
Dougherty CM <sup>(11)</sup>	The nursing diagnosis of Decreased Cardiac output.	Nurs Clin No Amer 1985.	USA
Futrell AG <sup>(12)</sup>	Decreased cardiac output: the case for collaborative diagnosis.	Dimensions of Critical Care Nursing, 1990.	USA
Kern L, Omery A <sup>(13)</sup>	Decreased Cardiac Output in the critical care setting	Nursing Diagnosis, 1992.	USA
Bumann R, Speltz M <sup>(14)</sup>	Decreased Cardiac Output: A nursing diagnosis	Dimensions of Critical Care Nursing, 1989.	USA
Dougherty CM <sup>(15)</sup>	Reconceptualization of the Nursing Diagnosis: Decreased Cardiac Output	Nursing Diagnosis, 1997.	USA
Just G <sup>(16)</sup>	You make the diagnosis: Case Study	Nursing Diagnosis, 1994.	USA
Eill MF <sup>(17)</sup>	Low Cardiac Output Following Cardiac Surgery: Critical thinking steps	Dimensions of Critical Care Nursing, 1997.	USA
Barbosa PMK <sup>(5)</sup>	Decreased Cardiac Output: Diagnosis and Nursing Intervention patients hospitalized in intensive care.	Nursing Journal, 2003.	BRA
Dougherty CM <sup>(18)</sup>	Decreased Cardiac Output: Validation of the nursing	Dimensions of Critical Care Nursing, 1986.	USA
Smith DF, Bumann R <sup>(19)</sup>	Assessing and treating Decreased cardiac output.	Med Surg Nursing, 1993.	USA
Dalton JA <sup>(20)</sup>	Descriptive study: Defining Characteristics of the nursing diagnosis cardiac output.	Image J Nurs Sch, 1985	USA
Scanlon LM <sup>(21)</sup>	The nursing diagnosis: Decreased cardiac output clinical diagnosis validation study.	Military Medicine.1992	USA

**Figure 3** - Drawings of the studies on the nursing diagnosis of DCO, sample size, level of recommendation (GR) and levels of evidence (NE).

Authors	Type of study	Sample	GR	NE
APV Oliva <sup>(10)</sup>	Results of research, observation of treatment results or clinical outcome.	49 patients	B	2C
Dougherty CM <sup>(11)</sup>	Results of research, observation of treatment results or clinical outcome.	33 patients	B	2C
Futrell AG <sup>(12)</sup>	Case report	1 case	C	4
Kern L, Omery A <sup>(13)</sup>	Results of research, observation of treatment results or clinical outcome.	69 professionals	B	2C
Bumann R, Speltz M <sup>(14)</sup>	Expert opinion based on practical experience or non-systematic literature review.	-	D	5
Dougherty CM <sup>(15)</sup>	Expert opinion based on practical experience or non-systematic literature review.	-	D	5
Just G <sup>(16)</sup>	Case report	1 case	C	4
Eill MF <sup>(17)</sup>	Case report	1 case	C	4

**Figure 4** - Distribution of the defining characteristics of higher frequency in the reviewed studies, New York 2009.

Defining characteristics (%)	Reviewed articles	Workup / Instruments
Rate changes / heart rate (76.9%)	10, 12, 13, 14, 16, 17, 5, 18, 19, 20	Auscultation (stethoscope bi-auricular) / Palpation
Dyspnea (76.9%)	10, 11, 13, 14, 15, 16, 5, 18, 19, 20	Interview/ Inspection
Labile blood pressure (69.2%)	10, 12, 13, 14, 16, 17, 5, 18, 19, 20	Inspection/Measurement (sphygmomanometer and stethoscope bi-auricular)
Rales (69.2%)	10, 12, 13, 14, 15, 16, 18, 19, 20	Auscultation (stethoscope bi-auricular)
Oliguria / anuria (61.5%)	10, 12, 13, 14, 15, 5, 18, 19	Inspection/Measurement (cup/cups)
Edema (61.1%)	10, 11, 12, 14, 15, 16, 5, 18	Inspection/Palpation
Cold skin (53.0%)	12, 13, 14, 15, 16, 5, 18	Inspection/Palpation
Fatigue / weakness (46.1%)	11, 15, 16, 18, 19, 20	Inspection
Decreased peripheral pulses (46.1%)	10, 12, 5, 18, 19, 20	Inspection/Palpation
Decreased peripheral perfusion (46.1%)	10, 12, 13, 14, 15, 18	Inspection/Palpation

**Figure 5** - Studies reporting defining characteristics found in patients with pulmonary artery catheter. Sao Paulo 2009.

Revised manuscript	Defining characteristics
Futrell <sup>(12)</sup>	Cardiac output <4 l / m, cardiac index <2.5 l/m/m <sup>2</sup> , systolic blood pressure <90 mmHg, mean arterial pressure <70 mmHg, pulmonary artery pressure systolic <20 mmHg, pulmonary artery diastolic <10 mmHg, pressure occlusion pulmonary capillary <4 mmHg, central venous pressure <2 mmHg, systemic vascular resistance > 1400 dynes/s/cm.
Kern <sup>(13)</sup>	Cardiac output <4l/m.
Dougherty <sup>(18)</sup>	Cardiac output 3.7 l/mit; cardiac index 1.7 l/mit/m <sup>3</sup> .
Smith <sup>(19)</sup>	Cardiac output of 3.6 l/mit, cardiac index 2.4 l/min/m <sup>3</sup> .

radiographs (7.6%), altered sodium and potassium (7.6%), foamy sputum (7.6%), hypoxemia (7.6%), hepatomegaly / ascites (7.6%), decreased ejection fraction (7.6) and depression (7.6%). The DCs noted in bold print are NANDA-I DCs, whereas the others were identified in the literature but are not present in the NANDA-I taxonomy for the nursing diagnosis, *DCO*.

Figure 5 shows the studies that report the following DCs found in patients with a pulmonary artery catheter (PAC). The DCs related to the PAC showed no significant relevance: cardiac output <4l / m (38.4%), decreased/increased pulmonary artery wedge pressure (30.7%) change in pulmonary capillary wedge pressure (23.0%), cardiac index <2.5l / m / m<sup>2</sup> (23.0%), increased systemic vascular resistance (15.3%), mixed venous oxygen saturation less than 60% (15.3%), increased pulmonary vascular resistance (7.6%). The DCs noted in bold print are NANDA-I DCs, whereas the others were identified in the literature but are not present in the NANDA-I taxonomy for the nursing diagnosis, *DCO*.

The DCs that required invasive measurement, exclusively as related to the PAC, were found on less than one-third of the publications reviewed, and included: altered oxygen pressure<sup>(14,18)</sup> altered hemoglobin and hematocrit<sup>(10,13,17,19)</sup>, central venous pressure changes<sup>(10,12,18-19)</sup>, cardiac enzymes changes (from 10.12 to 13.18), hyperglycemia<sup>(10)</sup>, acidosis<sup>(10,13,18)</sup>, altered sodium and potassium<sup>(10)</sup> and, altered renal perfusion<sup>(10,14)</sup>. The DC noted in bold print is a NANDA-I DC, whereas the others were identified in the literature but are not present in the NANDA-I taxonomy for the nursing diagnosis, *DCO*.

## DISCUSSION

Scientific publications in national and international journals indicate the movement toward new trends in diagnostic techniques with respect to less invasive procedures, such as the use of pulmonary artery catheters (PACs).

Thus, the frequency of use of PACs in hospitalized patients in critical care units is declining, and the DCs

related to this catheter that are listed by NANDA-I tend not to be identified as frequently in clinical practice. The clinical management of these patients relies on other parameters to confirm the adequacy of cardiac output, such as oxygen saturation, verification of pulse pressure, measurements of the partial oxygen pressure, increased levels of serum lactate and base excess, which are obtained from venous blood and central venous access to the superior vena cava or right atrium<sup>(22)</sup>.

According to the authors reviewed, it is observed that in nine<sup>(5,10-11,14-17,20-21)</sup> of the 13 articles selected, it can be inferred that, when the nurse is working in an intensive care unit with modern facilities technology – as opposed to nurses in intensive care units without the same resources – they will identify the diagnosis using more of the DCs related to the invasive techniques, according to the prevalence of DCs in this study.

The DCs *decreased peripheral pulses* and *decreased peripheral perfusion* (46.1%) were judged as relevant to this study, as they appeared in high frequency in a clinical validation study of *DCO* in patients after cardiac surgery with PAC in a specialty cardiology hospital<sup>10</sup>. Among the 32 DCs identified as independent variables, for this study the DCs with a score of 45% or greater were considered to be relevant DCs. Oliva (2003) found DCs with a score of 46% to be significant in that study; using this work as reference, the authors chose 45% as a significant score for this study.

The limitations of this study include the lack of literature, the heterogeneity of studies in the absence of some variables such as age, sex and sample size, which prevented us from conducting a meta-analysis. We chose to identify the frequency of DCs and the synthesis of the studies, because the choice of the methodology for systematic literature review corresponds to the goals of this work.

According to the authors referenced for the methodology of systematic review, it is important that the studies selected for review are classified according to level of evidence and grade of recommendation<sup>8</sup>. The results demonstrate the need to conduct studies that have a greater strength of evidence, based on the national

and international articles reviewed. However, all evidence is useful. The lack of systematic review methodology used in publications on this topic lends credence to the importance of this research.

## CONCLUSION

It appears that nurses are researching and / or publishing little about this topic, as evidenced by the lack of literature available for this literature synthesis, signaling a need for further national studies and trials. Systematic reviews are extremely relevant for providing evidence on this area of concern, and it is important to have a strong level of evidence and grade of recommendation for interventions used in clinical practice.

The differential for the identification of the defining

characteristics is entirely based on scientific knowledge of cardiovascular pathophysiology and the clarity of the conceptual and operational definitions for each diagnosis. We conclude that with these grants, the nurse will use the therapeutic techniques safely, thus allowing the identification of nursing diagnosis, *DCO*.

The evidence indicates the need for precise data obtained through less intrusive instruments from new studies to justify their inclusion as DCs in NANDA-I, as more and more minimally invasive hemodynamics appears to be present in clinical practice, as there is an increased focus on the need to reduce hospital costs and infectious risk to the patient caused by highly invasive catheters. It is known that the assistance provided by intensive care nurses to patients in critical condition must be based on knowledge through studies with high scientific recommendation.

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