ORIGINAL RESEARCH

Validation of an instrument to assess fluid control in outpatient hemodialysis patients

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ABSTRACT

Purpose: To validate an instrument to assess fluid control in outpatient hemodialysis patients, using the NANDA International (NANDA-I), Nursing Interventions Classification (NIC), and Nursing Outcomes Classification (NOC) terminologies.
Methods: A methodological study was carried out in two steps: (1) construction of an instrument composed of operational definitions of the defining characteristics of the nursing diagnosis Excess fluid volume, indicators of the NOC outcome Fluid balance, and activities of the NIC intervention Fluid management, from a narrative literature review, and (2) content validation of the instrument by five experts through a focus group.
Results: The instrument was composed of operational definitions of 27 defining characteristics of Excess fluid volume, 23 Fluid balance indicators, and 13 Fluid management activities. Twenty-five out of the 27 defining characteristics were considered valid. Two defining characteristics were excluded from the instrument, as they were considered unsuitable for assessing outpatients on hemodialysis. Thirteen out of the 23 indicators of Fluid balance were reformulated, and two were removed. Thirteen activities of Fluid management were reformulated.
Conclusions: An instrument was built incorporating components of the nursing diagnosis Excess fluid volume, the nursing outcome Fluid balance, and the nursing intervention Fluid management. The instrument was considered valid in terms of content and can be used to assess outpatients on hemodialysis. *Implications for nursing practice:* The instrument created may contribute to the standardization, qualification, and improvement of nursing practice in outpatient hemodialysis facilities.

Key Words: Nursing care, Renal dialysis, Chronic kidney failure, Patient outcome assessment, Standardized nursing terminology

1. INTRODUCTION

Patients with chronic kidney disease need systematic nursing care, which can be achieved through the use of the NANDA International (NANDA-I), Nursing Outcomes Classification (NOC), and Nursing Interventions Classification (NIC) ter- minologies also known as the NNN system.[1]

Studies have shown that the nursing diagnosis Excess fluid volume (00026) is prevalent in hemodialysis patients.[2–5] The NANDA-I 2018-2020 version used in the present study defines Excess fluid volume as "surplus intake and/or reten-

tion of fluid", and its related factors are excessive fluid intake and excessive sodium intake. The defining characteristics of Excess fluid volume are adventitious breath sounds, alteration in blood pressure, alteration in mental status, alteration in pulmonary artery pressure (PAP), alteration in respiratory pattern, alteration in urine specific gravity, anasarca, anxiety, azotemia, decrease in hematocrit, decrease in hemoglobin, dyspnea, edema, electrolyte imbalance, hepatomegaly, increased central venous pressure (CVP), intake exceeds output, jugular vein distension, oliguria, orthopnea, paroxysmal nocturnal dyspnea, pleural effusion, positive hepatojugular reflex, presence of S3 heart sound, pulmonary congestion, restlessness, and weight gain over short period of time.[6]

Fluid balance is one of the NOC outcomes linked to Excess fluid volume, defined as the "balance of water in the intracellular and extracellular compartments of the body". The indicators of Fluid balance are blood pressure, radial pulse rate, mean arterial pressure, central venous pressure, pulmonary artery pressure, peripheral pulses, 24-hour intake and output balance, stable body weight, skin turgor, moist mucous membranes, serum electrolytes, hematocrit, urine specific gravity, orthostatic hypotension, adventitious breath sounds, ascites, neck vein distension, peripheral edema, soft, sunken eyeballs, confusion, thirst, muscle cramps and dizziness.[7]

One of the goals of nursing care for patients with Excess fluid volume is to prevent the consequences of human responses (changes in blood pressure, cardiac arrhythmias, changes in body temperature, headache, nausea, vomiting, and itching). Thus, it is important to implement nursing interventions that provide the regulation of body fluids within the standards closest to normal for patients on hemodialysis. Among the nursing interventions proposed in the NIC, for Excess fluid volume, there is Fluid management. This intervention contributes to monitoring fluid balance and, consequently, to the prevention of complications in outpatient hemodialysis patients.

Studies validating instruments for the operationalization of the NNN system in clinical practice are essential to increase the reliability and applicability of such taxonomies.[8] Instruments have been tested in hemodialysis settings related to the measurement of patient satisfaction,[9] quality of life,[10] and fluid control[11] and depressive symptoms.[12] However, no studies were identified on the development and validation of instruments that address fluid control in outpatient hemodialysis patients using the NNN system.

Given the above, the development of this study was guided by the following questions: Are the operational definitions constructed for the defining characteristics of the nursing diagnosis of Excess Fluid Volume valid for patients with chronic kidney disease on hemodialysis? Are the selected nursing activities of the nursing intervention Fluid Volume Control valid for patients with chronic kidney disease on hemodialysis and with the nursing diagnosis Excess Fluid Volume? Are the operational definitions of the nursing activities of the nursing intervention Fluid volume control valid for patients with chronic kidney disease on hemodialysis? The Water Balance Nursing Outcome indicators are valid for patients with chronic kidney disease on hemodialysis and with the nursing diagnosis Fluid Volume excessive? Are the operational definitions constructed from the nursing outcome indicators Water balance valid for patients with chronic kidney disease on hemodialysis?

This study aims to fill the knowledge gaps mentioned above, contribute to the standardization of clinical judgments made by nephrologist nurses, and reinforce the importance of using the NNN system. In addition, the instrument created in the study and validated by experts is a source of evidence for the nursing care provided to outpatient hemodialysis patients.

Purpose
This study aimed to validate an instrument to assess fluid control in outpatient hemodialysis patients using the NANDA-I, NIC, and NOC terminologies.

2. METHODS

2.1 Study design
A methodological study was carried out in two stages: (1) Construction of the Instrument for assessing fluid control in outpatient hemodialysis patients and (2) Validation of the instrument's content through a focus group. The methodological study design encompasses the organization of data by rigorous investigation methods and addresses the development, validation, and assessment of research tools and methods.[13]

2.2 Instrument construction
The first stage of the study required the creation of operational definitions of the defining characteristics of Excess fluid volume, Fluid balance indicators, and Fluid management nursing activities through a narrative literature review.

The search for bibliographic materials was carried out from May to August 2020. The search strategy was created using the following DeCS (Portuguese Health Sciences Descriptors) terms in Portuguese and MeSH terms in English: "Cuidados de Enfermagem" and "Diálise Renal" and "Insuficiência Renal Crônica", and "Nurse Care" and "Renal Dialysis" and "Chronic Renal Failure". The following databases and virtual libraries were consulted: Medline, Lilacs, Cinahl,

and the Capes Catalog of Dissertations and Theses. The selection, classification, and extraction of data from the selected articles were performed by two researchers, using a guiding instrument formulated by the authors. A third researcher was consulted in case of doubts or divergences.

The following inclusion criteria were used: studies related to the theme and full-text available. Duplicate studies and those that did not meet the research questions were excluded. In addition, the NANDA-I, NIC, and NOC terminologies were consulted.[6, 7, 14]

The instrument was built and divided into three parts: (1) Operational definitions of each defining characteristic of Excess fluid volume, (2) Operational definitions of Fluid balance indicators; and (3) Operational definitions of Fluid management nursing activities relevant to outpatient hemodialysis patients.

2.3 Instrument validation

In the second stage of the research, the constructed instrument was submitted for the content validation by experts through a focus group (FG). The focus group consists of a data collection technique used in qualitative research, in which the participants interact and discuss a certain topic. The FG approach can be used for the content validation of instruments. The group interaction is encouraged by a moderator.[15] Previous studies in the nursing field have used focus groups to perform a content analysis of nursing diagnoses,[16] for consensus validation of nursing outcomes and NOC indicators, for the validation of nursing diagnoses, interventions, and outcomes, and instrument validation.[17, 18]

The experts' recruitment was made through a consultation in the Lattes Platform of the National Council for Scientific and Technological Development (CNPq, Brazil). The following criteria for recruiting experts were adopted: being a nurse and having a minimum degree of Master of Science in Nursing or health-related fields. Five experts with clinical experience in nursing taxonomies and practical experience in nephrology were selected.

The instrument was sent to the experts for analysis 20 days before the focus group meeting. The data collection took place through a semi-structured script and responses to the instrument sent by the experts during the focus group. A 5-point Likert scale was used to confirm the relevance of the operational definitions of each defining characteristic of Excess fluid volume. The assessment of the operational definitions of Fluid balance indicators and Fluid management activities, in turn, was made using a scale with only two categories, "not adequate" and "adequate". Content, form, clarity, and objectivity were the validity indicators used in the assessment.

The operational definitions describe how indicators should be assessed in a clinical setting, including the different magnitudes related to the patient's clinical status, organized into five levels according to their degree of compromise.

The focus group was held in June 2021 remotely using the Google Meet tool and lasted approximately 150 minutes. The five experts presented their assessments and discussed all the instrument items, led by the moderator. The moderator and observer of the focus group accepted the suggestions given by the experts and, after adjusting the instrument, resubmitted it to them by e-mail for the reassessment and approval of the final version.

2.4 Data analysis

Data analysis was conducted in Microsoft Office Excel 2013 using descriptive statistics, and the arithmetic weighted average of the scores assigned by the experts was calculated. The qualitative analysis, in turn, took place through the focus group discussion, in which each expert expressed his/her opinion. They appreciated the content of the definitions and the adequacy of the defining characteristics, indicators and nursing activities to the instrument in the outpatient hemodialysis patients. Qualitative assessment was carried out until consensus among nurses in the focus group. There was a consensus among the experts concerning the exclusion of some defining characteristics, NOC indicators, and nursing activities that could not be analyzed or implemented in outpatient settings. The researchers accepted all suggestions given by the experts for modifying, adding, or removing items.

2.5 Ethical considerations

The Ethical Committee of the university in which the research took place authorized the development of this study. All subjects eligible to participate in the research were informed about the purpose of the study, received an invitation letter, and signed a consent form.

3. RESULTS

The instrument for assessing fluid control in outpatient hemodialysis patients is available in the Appendix.

Most of the experts that participated in the focus group were women (80%) and earned doctor's degrees in nursing (60%). In addition, 100% of the experts had experience in nursing terminologies or classification systems, developed theses, scientific articles, and term papers to disseminate research results in the field, and participated in research groups on nursing terminologies.

Regarding the quantitative assessment of the instrument by

the experts, the weighted average of the scores of the defining characteristics and their operational definitions are presented in Table 1. It is worth mentioning that the characteristics that obtained a weighted average below 0.80 underwent changes or were excluded from the instrument. The defining characteristics that cannot be measured in outpatient hemodialysis settings were also excluded considering the instrument's focus.

Table 1. Evaluation of the operational definitions of the nursing diagnosis Excess fluid volume

Defining characteristics	ASMT1	ASMT2	ASMT3	ASMT4	ASMT5	X
Alteration in urine specific gravity	0.75	1	1	1	0.50	0.85
Alteration in blood pressure	0.75	1	1	1	1	0.95
Alteration in pulmonary artery pressure*	0	0.75	1	0.25	1	0.60
Alteration in mental status	0.75	0.75	1	0.75	0.25	0.70
Alteration in respiratory pattern	0.75	0.75	1	1	1	0.90
Anasarca	0.75	0.75	1	1	1	0.90
Anxiety	0.75	0.50	0.75	0.50	0.50	0.60
Increased central venous pressure*	0	0.50	1	0	1	0.50
Azotemia	0.75	0.75	1	0.75	0.75	0.80
Pulmonary congestion	0.75	1	1	1	1	0.95
Pleural effusion	0.75	0.75	1	0.75	1	0.85
Electrolyte imbalance	0.75	0.75	1	0.75	1	0.85
Dyspnea	0.75	1	1	0.75	1	0.90
Paroxysmal nocturnal dyspnea	0.75	0.75	0.75	1	0.75	0.80
Jugular vein distention	0.75	0.75	1	0.75	0.25	0.70
Edema	0.75	0.75	1	0.75	1	0.85
Weight gain over short period of time	0.75	0.75	1	0.75	0.75	0.80
Decrease in hematocrit	0.75	0.75	1	1	0.75	0.85
Decrease in hemoglobin	0.75	0.75	1	1	0.25	0.75
Hepatomegaly	0.75	0.50	1	1	0.50	0.75
Intake exceeds output	0.75	0.75	1	0.50	1	0.80
Restlessness	0.75	0.50	1	0.50	0.75	0.70
Oliguria	0.75	1	1	0.75	0.75	0.85
Orthopnea	0.75	1	0.75	0.75	0.75	0.80
Presence of S3 heart sound	0.75	0.75	1	0.75	0.25	0.70
Positive hepatojugular reflex	0.75	0.75	1	0.75	0.25	0.70
Adventitious breath sounds	0.75	0.75	1	0.75	1	0.85

*Defining characteristics excluded from the instrument after the focus group meeting.

The experts considered that two out of the 27 defining characteristics of Excess fluid volume should be excluded, including "alteration in pulmonary artery pressure" and "increase in central venous pressure". Furthermore, the experts suggested the addition of bibliographic references and changes in the label of some defining characteristics, aiming at a better understanding of the instrument's application.

Regarding the Fluid balance indicators, the averages of the scores given after the focus group are shown in Table 2. The indicators judged as inadequate underwent changes in their labels, and the indicators that could not be measured in the outpatient setting were excluded.

The Fluid management activities were also evaluated, as shown in Table 3. There was a consensus among the experts for excluding the activity "monitor pulmonary artery pressure" due to the difficulty of measurement in the outpatient context.

4. DISCUSSION

The instrument for assessing fluid control comprehended operational definitions of all defining characteristics of Excess fluid volume, Fluid balance indicators, and Fluid man-

agement activities. The focus group discussions led the researchers to incorporate only the defining characteristics, indicators, and activities that can be evaluated/implemented in outpatient hemodialysis settings.

Table 2. Evaluation of operational definitions of the NOC outcome Fluid balance

Indicators	Content	Form	Clarity	Objectivity
Blood pressure	1	1	1	1
Radial pulse rate	1	1	0.8	1
Mean arterial pressure	1	0.8	0.8	1
Central venous pressure*	0.6	0.4	0.4	0.6
Pulmonary artery pressure*	0.6	0.4	0.6	0.6
Peripheral pulses	0.8	0.8	1	0.8
24-hour intake and output balance	1	1	1	0.8
Stable body weight	1	1	1	0.8
Skin turgor	1	1	1	1
Moist mucous membranes	0.8	1	0.6	0.8
Serum electrolytes	0.8	0.8	0.6	0.6
Hematocrit	0.8	0.8	0.8	0.8
Urine specific gravity	0.8	0.8	0.8	0.8
Orthostatic hypotension	1	1	1	1
Adventitious breath sounds	1	1	0.8	1
Ascites	1	1	1	1
Neck vein distension	1	1	0.8	1
Peripheral edema	1	1	1	0.8
Soft, sunken eyeballs	0.8	1	0.6	0.8
Confusion	0.4	0.6	0.4	0.6
Thirst	1	1	0.8	0.8
Muscle cramps	1	0.8	0.8	1
Dizziness	0.8	0.8	0.8	0.8

*Fluid balance indicators excluded from the instrument after the focus group meeting.

Table 3. Evaluation of the activities of the NIC intervention Fluid management

Activities	Content	Form	Clarity	Objectivity
Weigh daily and monitor trends	0.6	1	0.8	1
Maintain accurate intake and output record	1	1	0.8	1
Monitor laboratory results relevant to fluid retention	1	1	0.8	1
Monitor hemodynamic status, including central venous pressure, mean arterial pressure, and pulmonary artery pressure*	1	1	1	1
Monitor vital signs, as appropriate	1	1	0.8	1
Monitor for indications of fluid overload/retention, as appropriate	1	1	1	1
Monitor patient's weight change before and after dialysis, if appropriate	0.8	1	0.8	1
Assess the location and extent of edema, if present	1	1	1	1
Monitor foods/fluids ingested and calculate daily caloric intake, as appropriate	1	1	1	1
Instruct patient on nothing by mouth status, as appropriate	0.8	0.8	0.8	0.8
Distribute the fluid intake over 24 hours, as appropriate	1	1	1	1
Encourage significant other to assist patient with feedings, as appropriate	1	1	1	1
Consult physician if signs and symptoms of fluid volume excess persist or worsen	1	1	1	1

Fluid management activity excluded from the instrument after the focus group meeting.

Of the 27 defining characteristics of Excess fluid volume, 25 were validated and adapted, and two were excluded. In the second part of the instrument, the operational definitions of 21 NOC indicators were validated, 13 were reformulated, and 2 were excluded. In the third part, 13 NIC activities were validated, none was removed, and 5 operational definitions were reformulated. The nursing diagnosis Excess fluid volume was validated as one of the most common diagnoses in hemodialysis patients.[19] The fluid retention leads to chronic hemodynamic stress resulting from fluid overload, predisposing to left ventricular hypertrophy, arterial stiffening, hypertension, arteriosclerosis, stroke, and anemia. Therefore, the adequacy of dialysis, fluid control by the patient, and the adjustment of dry weight must be periodically reassessed.[8, 20]

The authors of a study on nursing interventions for hemodialysis patients have identified Fluid management as one of the most important interventions for patients with Excess fluid volume[21] and prioritized eight activities: monitor vital signs, Maintain accurate intake and output record, assess the location and extent of edema, Consult physician if signs and symptoms of fluid volume excess persist or worsen, distribute the fluid intake over 24 hours, monitor for indications of fluid overload/retention (e.g., crackles, elevated central venous pressure or pulmonary capillary wedge pressure, edema, neck vein distention, and ascites), monitor patient's weight change before and after dialysis, and monitor hydration status (e.g., moist mucous membranes, adequacy of pulses, and orthostatic blood pressure).

A study aiming at achieving the Fluid balance nursing outcome in a hemodialysis setting assessed indicators such as blood pressure, stable body weight, and peripheral edema but had a limited sample and used few indicators.[22] Another research sought to identify the NANDA-I, NIC, and NOC linkage in chronic renal patients using central venous catheters for hemodialysis. However, there was no in-depth analysis of the NOC indicators.[23]

An adequate fluid balance requires nursing actions interconnected with the patient's self-care. At the same time, it is necessary to implement individualized adequacy of dialysis and nutritional monitoring and control of fluid intake to prevent complications. In this context, the nurse's role is to clarify the risks of fluid imbalance and check that the patient understands what is being communicated about the

fluid intake restrictions.[20, 21]

As a limitation of the study, the fact that five experts participated in the focus group may have compromised the calculation of the CVI. Besides, the narrative review method adopted as a step of the instrument's construction is not as rigorous as a systematic review.

The results presented in the study contribute to the refinement process of the NANDA-I, NIC, and NOC terminologies which are broad and cover nursing care in a generalized way. Therefore, tools created specifically to support the nursing care of chronic renal failure patients are of utmost importance to improve the well-being, quality of life, and years of life of these individuals and improve nursing practice in outpatient hemodialysis facilities.

5. CONCLUSION

The instrument constructed and validated in this study was composed of operational definitions for 25 defining characteristics of Excess fluid volume, 19 Fluid balance indicators, and 13 Fluid management activities.

The instrument can serve as a basis for further studies evaluating the effectiveness of Fluid management activities combined with a measurement of the Fluid balance indicators or the absence/decrease in the magnitude of the defining characteristics of Excess fluid volume in hemodialysis patients with chronic renal failure.

Implications for nursing practice

The findings of this study may contribute to improving the clinical practice of nephrologist nurses. In this sense, it is recommended that new studies evaluate the instrument validated in the target audience through clinical research so that the Fluid management activities implemented to achieve the Fluid balance of renal patients with Excess fluid volume are clinically validated. The use of standardized nursing terminologies in clinical practice improves the quality of health care, qualifying and strengthening nursing, especially through the development of validated research. The use of the NNN system offers greater security in diagnostic reasoning, leading to appropriate nursing interventions and optimal nursing outcomes.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare that there is no conflict of interest.

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