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CONTENT VALIDATION OF NURSING DIAGNOSIS OF DEFICIENT FLUID VOLUME [DEHYDRATION] IN THE CONTEXT OF NEONATOLOGICAL NURSING

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Abstract

Aim: The aim of the study consisted in content validation of the defining characteristics, and related factors of the nursing diagnosis of Deficient fluid volume [Dehydration] (00027), from the perspective of neonatal nurses. **Design:** Content validation study. **Methods:** The defining characteristics of the nursing diagnosis of Deficient fluid volume [Dehydration] (00027) were evaluated with the help of the Fehring Diagnostic Content Validity Model. The set consisted of 125 experts/nurses. The significance of the defining characteristics was rated by the nurses on a Likert scale from 1 to 5. Data collection was carried out from March to September 2016. **Results:** seven characteristics from 32 were designated primary defining characteristics by the experts: decreased urine output, sunken fontanelle, change in skin turgor, dry mucous membranes, increased urine concentration, elevated haematocrit, and general appearance of exhaustion. 25 characteristics were designated secondary defining characteristics; 12 of which were characteristics from NANDA–I. Items such as: constipation, decreased pulse volume, cramps, absence of tears, and abdominal distension achieved a weighted score under 0.50. All from the group of related factors were defined as secondary by the experts. **Conclusion:** The set of experts regarded the primary significant characteristics for the determination of the nursing diagnosis of Deficient fluid volume [Dehydration] in newborns to consist in seven defining characteristics. All related factors were regarded to be secondary.

Keywords: nursing diagnosis, Deficient fluid volume [Dehydration], newborn, validation, defining characteristic, related factor, Fehring Diagnostic Content Validity Model (DCV model), expert.

Introduction

Metabolism of water and minerals in newborns is diametrically different to that of older children or adults. The differences are mainly due to excessive metabolic activity caused by expansive growth and development of the organism, and by the related higher basal consumption of water and electrolytes, and decreased production of sodium (Sýkora, Huml, 2008; Wechsler in Fendrychová, 2012). At low age, the proportion of total body water in newborns is elevated (Havránek et al., 2009), amounting to 80–90% of body weight (Wechsler in Fendrychová, Borek et al., 2012). Total body water is made up of several components, including, primarily, the water contained in cells, or intracellular fluid (ICF), constituting 45–55% of the total body water of a newborn. Another component of total body water is extracellular fluid (ECF), which, together with the

fluid circulating in blood vessels, or intravascular fluid (IVF), comprises 5%; and a further 25–30% is made up by the water in intercellular space, known as interstitial fluid (ISF) (Havránek et al., 2009; Wechsler in Fendrychová, 2012). Sodium is the most important cation of extracellular fluid, with physiological values ranging from 135–140 mmol/l; the daily requirement of sodium in a newborn amounts to 2–4 mmol/kg of body weight. The plasmic level of potassium, ranging from 3.5–5.3 mmol/l, plays the most important role in the intracellular fluid. The levels of chlorides and calcium are considered equally important parameters in objectifying the ion management of newborns (Wechsler in Fendrychová, Borek et al., 2012).

Under physiological conditions, the proportion of individual components in total body water is gradually transformed as newborns age. Pathological processes, for example as a result of acute or critical conditions in newborns, may cause the individual components of total body water to shift in a rapid and uncontrolled way, which can result in the development of dehydration (Havránek et al., 2009).

Dehydration is defined as the loss and lack of water in an organism (Schück, 2002; Vokurka, Hugo et al.,

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2004; Fendrychová, 2012). Doležel (2003) describes the deficit of body fluids specifically as the loss of body water from the extracellular space, without distinctive alteration of the intracellular space. Havránek et al. (2009) mentions not only loss of body water, but also loss of substances contained within it. The International Classification of Diseases defines the *Dehydration of newborns* (P74.1) as a transitory disorder of electrolytes and metabolism specific to newborns (ÚZIS, 2014). The NANDA International classification system of nursing diagnoses 2015–2017, in Domain 2: Nutrition; Class 5: Hydration, mentions the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027), defining it as: “the reduction of intravascular, interstitial or intracellular fluids. It is related to dehydration; the actual loss of water is without changes in [concentration of] sodium” (NANDA International, 2015). This diagnosis is recommended for nursing diagnostics by the NANDA International 2015–2017 taxonomy for all age categories, including newborns.

The lack of body water in the organism, i.e., dehydration, can be, according to the state of acid-base balance, particularly the serum concentration of sodium, subdivided into hypertonic, isotonic, and hypotonic dehydration, and further subdivided by degree of seriousness into light, medium, and serious dehydration (Sýkora, Huml, 2008 in Sikorová, Bužgová, 2010). The individual types of dehydration that may be modified by mineral changes, and disorders of acid-base balance complete the clinical and laboratory picture of the newborn (Goldmund, 2001; Fendrychová, Klimovič et al., 2005; Muntau, 2014).

Isotonic dehydration is usually related to loss of the same proportion of water and sodium. The clinical picture includes decreased skin turgor, symptoms of reduction of circulating volume, marked by decreased diuresis, tachycardia, hypotension, and disorder of peripheral blood perfusion. Laboratory tests do not reveal changes in osmolality, and the level of sodium is within standard (Havránek et al., 2009; Fendrychová, Borek et al., 2012).

If the loss of ions, primarily that of sodium, exceeds the loss of water, the dehydration is known as hypotonic dehydration. Laboratory tests reveal obvious decreases in osmolality, and hyponatraemia. In addition to the general symptoms of dehydration (decreased skin turgor, dry mucous membranes, cold and cyanotic skin, only slightly sunken fontanelle), convulsions and loss of consciousness may also occur (Havránek et al., 2009; Fendrychová, Borek et al., 2012).

If loss of water exceeds of ions, hypertonic dehydration develops. Clinically, disruptions in consciousness predominate in the newborn. Laboratory samples are characterized by raised haematocrit, hypernatraemia, and hyperosmolality. The circulating volume in the bloodstream is maintained by higher plasmic level of sodium (Fendrychová, Borek et al., 2012). Havránek et al. (2009) detail the following clinical manifestations: flabby skin turgor, livid colour of mucous membranes, markedly sunken fontanelle, hyperpyrexia, cramps, lethargy, or even unconsciousness. Šebková (in Straňák, Janota, 2014) focuses on the clinical manifestations of hypernatraemia in newborns, the development of which is caused by changes in the volume of body fluids. She mentions general lethargy, or irritability, and disruptions in consciousness. The crying of the newborn is unusually high-pitched, and hyperthermia may occur. Muscle tone increases, and convulsions occur. Symptoms of hypovolaemia, i.e., weight loss, drop in blood pressure, tachycardia, oliguria or even anuria, and flabby hypodermis, may also be observed; haematocrit is elevated in cases of dehydration.

The NANDA International taxonomy lists 17 defining characteristics for the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) (specifically: change in mental status, change in skin turgor, decreased blood pressure, decreased pulse volume, decreased tongue turgor, decreased urine output, decreased venous filling, dry mucous membranes, dry skin, increased body temperature, tachycardia, elevated haematocrit, increased urine concentration, sudden weight loss, thirst, and weakness); and two related factors (specifically: active drop in body fluid volume, and weakened regulation mechanisms) (NANDA International, 2015).

The dynamics of the development of the clinical condition are influenced by etiology and by the associated problems of newborns (Fendrychová, Klimovič et al., 2005; Muntau, 2014). Dehydration or *Deficient fluid volume* is one of the most serious causes of child morbidity and mortality in the world (Sikorová, Bužgová, 2010). The development of dehydration in infant age is most significantly influenced by the occurrence of diarrhoeal conditions. In addition to diarrhoea, Doležel (2003) mentions excessive polyuria, sweating, hypoventilation, febrile conditions, and thermal impairment. An equally serious cause in newborns, and later infant ages is inefficient breast-feeding, and insufficient nutrition of the baby. Straňák (2009) mentions life-threatening hypernatraemic dehydration

caused by inadequate breast-feeding. Doležel et al. (2005) speaks of the consequences and clinical variability caused by insufficient intake of breast milk, mentioning conditions like hyperbilirubinaemia, hunger, slow weight gain, and even fatal dehydration leading to death by starvation. The younger the infant, the more vulnerable they are to dehydration (Goldmund, 2001).

The development of newborn dehydration is often slow and difficult to identify at first, especially for laypeople. The newborn may be silent and still, does not cry, and sleeps continually. Such initial symptoms of abnormal behaviour may quickly become life-threatening (Doležel et al., 2005).

The range of clinical manifestations of newborn dehydration is very diverse; nevertheless, the scope and intensity of the observed symptoms will allow determination of the severity of the dehydration, and the appropriate therapeutic and nursing strategy (Goldmund, 2001).

Objective nurse assessment and timely detection of such a serious condition requires a knowledge of the clinical manifestations of decreased volume of fluids in newborns. To assess the defining characteristics and related factors efficiently in clinical practice, they should be verified through content and clinical validation in an environment specific to the assessed group of patients.

The article presents the results of content validation of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) in newborns by a selected set of experts (Rabasová, 2016).

Aim

The main study aim consisted in content validation of defining characteristics of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) in newborns by a selected set of neonatal experts/nurses. A secondary goal consisted in determining which defining characteristics and related factors should be considered primary, and which should be considered secondary for objectification of the clinical condition of newborns by neonatal nurses. A further goal consisted in determining the degree of dependence between the variables - the primary defining characteristics of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027).

Methods

Design

The validity of the diagnostic content of the nursing diagnosis of *Deficient fluid volume* [Dehydration]

(00027) from the perspective of neonatal nurses was ascertained with the help of the Fehring *Diagnostic Content Validity* Model – DCV model (Fehring, 1986; Jarošová et al., 2012). Potential strategies for validation of nursing diagnoses are described by Zeleníková and Žiaková (Jarošová et al., 2012).

Sample

The set consisted of 125 nurses/experts, selected according to modified Fehring criteria described by Zeleníková et al. (2010) for the selection of experts. Nurses who scored at least four points were included in the research set. Nurses from clinical practice, working in the field of neonatology, were approached. Within the Czech Republic, 11 hospitals were asked to cooperate with the study. Eight of the hospitals approached were involved in the study (Olomouc University Hospital; The Prague Institute for the Care of Mother and Child; Motol University Hospital – Prague; Regional T. Baťa Hospital – Zlín; Vítkovice Hospital – Ostrava; Nový Jičín Hospital; Třinec Hospital; and Frýdek-Místek Hospital). The completion of the questionnaires was completely voluntary and anonymous. The questionnaire was completed by 223 nurses from the 345 nurses approached – a return rate of 64%. 98 questionnaires were filtered out of the set due to failure to meet the selection criteria (i.e., the failure to achieve a minimum of four points), and also due to partial or incorrect completion of the questionnaire. The final research set consisted of 125 nurses/experts, all women. Six nurses had a Master's degree, 24 nurses had a Bachelor's degree, 35 nurses had received advanced vocational education, and 116 nurses had completed secondary nursing school. 82 nurses had a specialization in their field, and 13 nurses had completed a mentoring course. One nurse had published an article in the field of nursing diagnostics. 115 nurses worked in the position of general (children's) nurse, and ten nurses worked in a managerial position. The median in the category of Age was 41–50 years; the highest number of nurses – 45 (36.0%) – were in the age category 31–40 years; the lowest number of nurses – 4 (3.2%) – were in the age category > 60 years. The median in the category of Number of years of nursing practice was 16–20 years; the highest number of nurses – 41 (32.8%) – were in the category 26 and > years; the lowest number of nurses – 4 (3.2%) – were in the category 1–5 years. The median in the category of number of years of neonatal nursing practice was 16–20 years; the highest number of nurses – 34 (27.2%) – were in the category of 16–20 years; the lowest number of nurses – 12 (9.6%) – were in the category of 1–5 years; and 12 (9.6%)

nurses were in the category 21–25 years. The average score by the modified criteria for the selection of experts was 5.23.

Data collection

An evaluation tool was designed for the collection of data, containing questions to acquire basic sociodemographic data on the general nurses, questions to identify the modified criteria for inclusion of general nurses as experts for the selected content validation of the set of defining characteristics and related factors for *Deficient fluid volume* [Dehydration] (00027). The evaluation tool contained 32 defining characteristics and six related factors of which 17 defining characteristics and two related factors were from NANDA International 2015–2017 (NANDA International, 2015). In addition to the defining characteristics stated by NANDA International, other clinical indicators are sometimes ascribed to newborn dehydration. Other defining characteristics and related factors were selected on the basis of literature analysis. They included the following defining characteristics: sunken fontanelle, general appearance of exhaustion, sleepiness, haloed eyes (sunken, circled eyes), prolonged capillary return, tachypnoea, weak suction, change in skin colour (pale/marbled), dyspnoea (strenuous breathing), restlessness, cold extremities, constipation, cramps, absence of tears, and abdominal distension. The characteristic of abdominal distension was considered neutral. The following factors were added to the group of related factors: inefficient breast-feeding, temperature extremes, weight extremes, and age extremes. The process of selection of characteristics of the target diagnosis (of the defining characteristics and the related factors) that did not come from NANDA International 2015–2017 took the form of a simple literature review. To acquire data from relevant sources, professional literature from the field of neonatology was used, as well as the EBSCO and PubMed professional databases, and the archive of Czech professional periodicals.

NANDA International, the taxonomic system of nursing diagnoses, contains the defining characteristics and the related factors of the selected nursing diagnosis at a general level for all age categories. For our study, the brief for nurses did not state whether the newborns in question were physiological or immature, etc. Although nurses from intensive care units, intermediary care units, and physiological newborn units were approached and subsequently put on record, the goal of this part of the study consisted in assessing the nursing diagnosis of *decreased fluid volume* [dehydration]

(00027) from the perspective of neonatal nurses in general.

The questionnaires were distributed to and collected from the nurses by a manager nurse in charge of the newborn unit of the selected hospitals. The study was conducted from March to September 2016.

Data analysis

The diagnostic significance of the defining characteristics and related factors was assessed by the nurses on a Likert scale from 1 to 5 (1 – not characteristic at all of the diagnosis; 2 – very slightly characteristic of the diagnosis; 3 – slightly characteristic of the diagnosis; 4 – highly characteristic of the diagnosis; 5 – very highly characteristic of the diagnosis). For each defining characteristic and related factor, the following figures were calculated: mean, standard deviation (SD), and weighted score (WS) according to Fehring's recommended procedure. The values of weighted average were assigned to the answers as follows: 5 = 1; 4 = 0.75; 3 = 0.5; 2 = 0.25; 1 = 0 (Fehring, 1986; Fehring, 1987; Jarošová et al., 2012). The primary defining characteristics included the characteristics that achieved a value of weighted score of ≥ 0.75 , and the secondary characteristics included those ranging from < 0.75 –0.50 (Fehring, 1986; Jarošová et al., 2012). The sum of the weighted scores of individual defining characteristics and related factors, and subsequent calculation of the average of the values produced the total DCV score. The total score did not include characteristics with weighted average values of 0.50 and less (Fehring, 1987; Jarošová et al., 2012). The strength of the relationship between the variables, i.e., between the main defining characteristics, was ascertained through calculation of the Pearson correlation coefficient; subsequently, the level of critical statistical significance of the correlation was determined. The correlations are significant at the level of statistical significance $p < 0.05$. Exploration factor analysis, with factor rotation by the Varimax method, helped to ascertain the coefficients of saturation of the primary defining factors. The analysis and processing of the data were performed with the aid of the Statistica 7.0 program and Microsoft Excel.

Results

Seven characteristics from 32 were considered to be primary defining characteristics by the experts: decreased urine output (WS – 0.91), sunken fontanelle (WS – 0.91), change in skin turgor (WS – 0.89), dry mucous membranes (WS – 0.89), increased urine concentration (WS – 0.87), elevated haematocrit (WS – 0.76), and general appearance

(WS – 0.75) (Table 1, Figure 1). All characteristics are based on NANDA–I, except for those of sunken fontanelle and general appearance of exhaustion. The latter characteristics are not included in NANDA–I, but achieved weighted score values of 0.91 and 0.75. 25 defining characteristics, including 12 from NANDA–I, were considered to be secondary characteristics of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) in newborns by the experts: increased body temperature, dry skin,

decreased venous filling, sleepiness, thirst, tachycardia, haloed eyes (sunken, circled eyes), sudden weight loss, weak suction, decreased blood pressure, change in skin colour (pale/marbled), decreased tongue turgor, dyspnoea (strenuous breathing), decreased impulse pressure, restlessness, cold extremities, change in mental status, constipation, decreased stroke volume, cramps, absence of tears, and abdominal distension. The weighted score ranges from 0.73–0.38 (Table 1).

Table 1 Primary and secondary defining characteristics of nursing diagnosis of Deficient fluid volume [Dehydration] (00027)

Defining characteristic	mean	SD	WS	SD of WS	source
decreased urine output	4.66	0.62	0.91	0.16	NANDA
sunken fontanelle	4.63	0.54	0.91	0.14	-
change in skin turgor	4.56	0.73	0.89	0.18	NANDA
dry mucous membranes	4.55	0.75	0.89	0.19	NANDA
increased urine concentration	4.48	0.81	0.87	0.20	NANDA
elevated haematocrit	4.05	0.86	0.76	0.21	NANDA
exhausted general appearance	3.99	0.96	0.75	0.24	-
increased body temperature	3.94	1.02	0.73	0.25	NANDA
dry skin	3.88	1.15	0.72	0.29	NANDA
decreased venous filling	3.85	1.02	0.71	0.26	NANDA
sleepiness	3.82	0.98	0.71	0.25	-
thirst	3.80	1.17	0.70	0.29	NANDA
tachycardia	3.74	1.06	0.69	0.26	NANDA
haloed eyes (sunken, circled eyes)	3.68	1.09	0.67	0.27	-
sudden weight loss	3.67	1.06	0.67	0.26	NANDA
weakness	3.66	1.15	0.67	0.29	NANDA
prolonged capillary return	3.56	0.94	0.64	0.24	-
tachypnoea	3.50	0.98	0.63	0.25	-
bad suction	3.47	1.04	0.62	0.26	-
decreased blood pressure	3.42	1.10	0.60	0.28	NANDA
change in skin colour (pale / marbled)	3.28	0.96	0.57	0.24	-
decreased tongue turgor	3.22	1.17	0.56	0.29	NANDA
dyspnoea (strenuous breathing)	3.18	0.91	0.55	0.23	-
decreased pulse pressure	3.07	1.21	0.52	0.30	NANDA
restlessness	3.03	1.09	0.51	0.27	-
cold extremities	3.02	1.00	0.50	0.25	-
change in mental status	2.99	1.15	0.50	0.29	NANDA
constipation	2.97	1.14	0.49	0.29	-
decreased stroke volume	2.90	1.07	0.47	0.27	NANDA
cramps	2.84	1.15	0.46	0.29	-
absence of tears	2.75	1.15	0.44	0.29	-
abdominal distension	2.54	0.90	0.38	0.22	-

SD – standard deviation; WS – weighted score; NANDA – North American Nursing Diagnosis Association

Items such as constipation, decreased stroke volume, cramps, absence of tears, and abdominal distension achieved a weighted score under 0.50 (Table 1). From the group of related factors, all related factors were considered to be secondary, with a weighted score under 0.75 (Table 2). The total DCV score of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) for the items of NANDA–I

was 0.71, and the DCV score as a whole, including the items stated in the questionnaire, was 0.69.

All significant correlations were positive and ranged between 0.17–0.49. The highest correlations were found between the characteristics of decreased urine output and dry mucous membranes ($r = 0.4915$; $p < 0.001$); change in skin turgor and dry mucous

Table 2 Weighted score of related factors of nursing diagnosis of Deficient fluid volume [Dehydration] (00027)

Related factor	mean	SD	WS	SD of WS	source
inefficient breast-feeding	3.89	1.07	0.72	0.27	-
active decrease of body fluid volume	3.88	0.93	0.72	0.23	NANDA
temperature extremes	3.74	1.10	0.68	0.27	-
weight extremes	3.48	1.09	0.62	0.27	-
weakened regulation mechanisms	3.26	0.97	0.56	0.24	NANDA
age extremes	3.06	1.26	0.52	0.31	-

SD – standard deviation; WS – weighted score; NANDA – North American Nursing Diagnosis Association

membranes ($r = 0.4556$; $p < 0.001$); elevated haematocrit and sunken fontanelle ($r = 0.4152$; $p < 0.001$); and change in skin turgor and decreased urine output ($r = 0.3891$; $p < 0.001$). The above stated correlations may suggest significant relationships between the variables – individual characteristics (Table 3). Exploration factor analysis, by Varimax rotation on the primary defining characteristics in the set of neonatal nursing experts helped to identify two factors with values > 1 . Both factors together accounted for 54.37% of item variability. The first factor accounted for 37.76% of item variability, and it is saturated by the following characteristics: dry mucous membranes, decreased urine output, and change in skin turgor, with factor charge > 0.5 (Table 4). The second factor accounted for 16.61% of item variability, and it is saturated by the following characteristics: sunken fontanelle, elevated haematocrit, general appearance of exhaustion, and increased urine concentration, with a factor charge ≥ 0.5 (Table 4). Individual factors may be associated with the severity of dehydration, expressed by clinical and laboratory indicators.

Diagram 1 Primary defining characteristics of nursing diagnosis of Deficient fluid volume [Dehydration] (00027)**Table 3** Correlation of primary defining characteristics of nursing diagnosis of Deficient fluid volume [Dehydration] (00027)

		Change in skin turgor	Decreased urine output	Dry mucous membranes	Elevated haematocrit	Increased urine concentration	Sunken fontanelle	Exhausted general appearance
Change in skin turgor	r	1.000	0.3891	0.4556	0.2254	0.3177	0.2162	0.2346
	p		0.000	0.000	0.012	0.000	0.015	0.008
Decreased urine output	r		1.000	0.4915	0.2416	0.2500	0.1461	0.0625
	p			0.000	0.007	0.005	0.104	0.488
Dry mucous membranes	r			1.000	0.2317	0.3411	0.2222	0.1058
	p				0.009	0.000	0.013	0.240
Elevated haematocrit	r				1.000	0.3027	0.4152	0.2342
	p					0.001	0.000	0.009
Increased urine concentration	r					1.000	0.2931	0.2740
	p						0.001	0.002
Sunken fontanelle	r						1.000	0.1782
	p							0.047
Exhausted general appearance	r							1.000
	p							

r – Pearson correlation coefficient; p – statistical significance; the correlations are significant at a level of statistical significance $p < 0,05$

Table 4 Factor analysis of primary defining characteristics of nursing diagnosis of Deficient fluid volume [Dehydration] (00027)

Defining characteristic	Factor 1	Factor 2
Change in skin turgor	0.6922	0.2515
Decreased urine output	0.8098	0.0267
Dry mucous membranes	0.8171	0.1322
Elevated haematocrit	0.1890	0.7054
Increased urine concentration	0.3848	0.5553
Sunken fontanelle	0.1210	0.7072
Exhausted general appearance	-0.0037	0.6465

Discussion

The nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) is stated in the international classification system for nursing diagnostics, NANDA International 2015–2017, in domain two: Nutrition; class five: Hydration. For objectification of the diagnosis, NANDA International lists 17 defining characteristics (change in mental status, change in skin turgor, decreased blood pressure, decreased pulse volume, decreased tongue turgor, decreased urine output, decreased venous filling, dry mucous membranes, dry skin, increased body temperature, tachycardia, elevated haematocrit, increased urine concentration, sudden weight loss, thirst, and weakness), and two related factors (active drop in body fluid volume, and weakened regulation mechanisms) (NANDA International, 2015).

Zeleníková and Žiaková (2012) use their study to present an overview of the taxonomic development of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) from its initial adoption in 1973 until 2009. The diagnostic evolution concerned the main name, definition, and specification of the defining characteristics and related factors.

The nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) presents a wide range of defining characteristics for the assessment of the specific condition of newborns. Nevertheless, newborns' clinical conditions such as dehydration also require the assessment of other clinical symptoms to support and objectify nurses' diagnostic conclusions.

The set of experts – neonatal nurses – selected the following seven characteristics as the primary defining characteristics of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027), based on weighted scores: decreased urine output, sunken fontanelle, change in skin turgor, dry mucous membranes, increased urine concentration, elevated haematocrit, and general appearance of exhaustion (Table 1, Figure 1). All defining characteristics,

except for “sunken fontanelle” and “general appearance of exhaustion”, are included in NANDA International. The set of experts considered 25 characteristics to be secondary characteristics by order of weighted score: increased body temperature, dry skin, decreased venous filling, sleepiness, thirst, tachycardia, haloed eyes (sunken, circled eyes), sudden weight loss, weak suction, decreased blood pressure, change in skin colour (pale/marbled), decreased tongue turgor, dyspnoea (strenuous breathing), decreased impulse pressure, restlessness, cold extremities, change in mental status, constipation, decreased stroke volume, cramps, absence of tears, and abdominal distension. Secondary characteristics such as increased body temperature, dry skin, decreased venous filling, thirst, tachycardia, sudden weight loss, weakness, decreased blood pressure, decreased tongue turgor, decreased impulse pressure, change in mental status, and decreased stroke volume are listed in NANDA International 2015–2017. Items such as constipation, decreased stroke volume, cramps, absence of tears, and abdominal distension achieved a weighted score under 0.50 (Table 1). All from the group of related factors were considered to be secondary. The related factor from NANDA International “active drop in body fluid volume” achieved a weighted score of 0.72, and the related factor “weakened regulation mechanisms” achieved a weighted score of 0.56 (Table 2). Factor analysis of the primary defining characteristics (Table 4) suggests that factor one is saturated by three characteristics in total: two from the area of clinical indicators (dry mucous membranes, change in skin turgor), and one from the area of fluid balance (decreased urine output). Decreased skin turgor and decreased urine output are described as isotonic dehydration (Fendrychová, Borek et al., 2012); other authors regard these symptoms as moderate, or slight dehydration (Sikorová, Bužgová, 2010; Muntau, 2014). The second factor is saturated by four characteristics in total: two from the area of clinical indicators (sunken fontanelle, exhausted general appearance), and two from the area of laboratory indicators (elevated haematocrit, increased urine concentration), (Table 4). Clinical characteristics such as elevated haematocrit and increased urine concentration are described as hypertonic dehydration (Fendrychová, Borek et al., 2012). Sunken fontanelle is described as indicating medium to severe dehydration (Sikorová, Bužgová, 2010). General appearance of exhaustion may reflect intensive progression of clinical manifestations of dehydration from moderate to severe dehydration.

No study dealing with the content or clinical validation of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) from the perspective of experts in the field of neonatal nursing could be found in Czech or international periodicals. For purposes of comparison, it is only possible to use validation studies from experts in the field of adult nursing.

Zeleníková and Žiaková (2012) carried out a content validation of *Deficient fluid volume* [Dehydration] (00027) by a set of Slovak nursing experts. The research set consisted of nurses working as teachers at Slovak university centres, and nurses from (unspecified) clinical practice. The content validation resulted in the determination of six defining characteristics of *Deficient fluid volume* [Dehydration] (00027) as primary characteristics (decreased diuresis, dry mucous membranes, decreased skin turgor, decreased tongue turgor, decreased venous filling, and decreased blood pressure), and the determination of ten defining characteristics as secondary (increased specific weight of urine, dry skin, elevated haematocrit, weakness, thirst, weakened pulse, decreased pulse volume, increased pulse rate, change in mental status, and increased body temperature). The correspondence between the primary defining characteristics reported by Zeleníková and Žiaková (2012) and our study can be seen in the characteristics decreased urine output, change in skin turgor, and dry mucous membranes.

Zeleníková, Žiaková and Sikorová (2011) also validated the *deficit of body fluid volume* (00027) by a set of Czech experts in healthcare facilities in the Moravian-Silesian Region. The total of 135 experts included 11 nurses from children's units. The validation resulted in the determination of six primary defining characteristics (decreased diuresis, decreased skin turgor, dry mucous membranes, decreased tongue turgor, decreased specific weight of urine, and decreased venous filling), and in the determination of 11 secondary defining characteristics (thirst, weakness, elevated haematocrit, dry skin, decreased blood pressure, decreased pulse volume, weakened pulse, increased pulse rate, change in mental status, increased body temperature, and sudden weight loss). A review of the reliability of clinical indicators of dehydration in infants and small children was made by Sikorová and Bužgová (2010). Their publication presents a comparison of the results of a systemic survey, and an overview of the work of foreign authors devoted to the issue of clinical and laboratory indicators of dehydration in children. According to Sikorová and Bužgová (2010), the analyzed studies show clear

consensus regarding the reliability of clinical characteristics objectifying dehydration in children. They make particular mention of characteristics such as prolonged capillary return, decreased skin turgor, dry mucous membranes, general appearance of exhaustion, and abnormal (deep) breathing. In comparison with the results of our study, it is obvious that neonatal experts consider the characteristics of change in skin turgor (WS – 0.89), dry mucous membranes (WS – 0.89), and general appearance of exhaustion (WS – 0.75) significant for the objectification of *Deficient fluid volume* [Dehydration] (00027) in newborns. On the other hand, sunken fontanelle, which achieved a weighted score of 0.91 when validated by Czech neonatal nurses, is considered by Porter et al. (2003, in Sikorová, Bužgová, 2010) the least specific, together with irregular respiration.

In a systematic survey, Lavagno et al. (2016) describe the clinical indicators of dehydration, and identify specific risk factors of the selected clinical manifestations. Newborn hypernatraemia induced by inefficient breast-feeding was identified, according to an analysis of 115 studies, in infants aged ≤ 21 days with decreased birth weight $\geq 10\%$. Such newborns further indicated poor nutrition, poor hydration status, hepatitis, hyperthermia, irritability or lethargy, decreased urine output, and epileptic fits. Statistically significant factors influencing hypernatraemia included: Caesarean section, first pregnancy, breast anomaly, breast-feeding problems, excessive body weight before pregnancy, late onset of lactation, lack of breast-feeding experience, and low levels of education in mothers. Weight decrease as one of the potential early indicators of hypernatraemic dehydration is discussed by Konetzny, Bucher, Arlettaz (2009). Their prospective cohort study compared decrease in body weight in relation to sodium level in serum. They consider the monitoring of newborns' weight decrease an important indicator for timely detection of hypernatraemic dehydration and subsequent intervention. In our study, the defining characteristic of sudden weight loss achieved a weighted score of 0.67. A study by Erdemir et al. (2014) presents clinical characteristics accompanying hypernatraemic dehydration in newborns including: fever, hepatitis, weak suction, and restlessness. Similarly, Trotman et al. (2004) and Uras et al. (2007) report fever, weak suction, irritability, lethargy, sleepiness, hepatitis, vomiting, and low urine output. The characteristic of decreased urine output achieved a weighted score of 0.91 in our study. Zeleníková and Žiaková (2012) also mention this characteristic as a primary defining characteristic, with a weighted score of 0.84; the

authors find high concordance with a study by Gershon et al. (1990).

Muntau (2014) reports dependency of the clinical picture on the level or degree of dehydration. The clinical picture may develop from a completely asymptomatic progress to a very serious condition characterized by general symptoms of dehydration, such as decreased skin turgor, haloed eyes, dry mucous membranes, sunken fontanelle, accelerated breath frequency, cold and pale acra, prolonged capillary return, restlessness, apathy, convulsions, or even coma.

Goldemund (2001) mentions the following clinical manifestations: dry mucous membranes, dry skin, reduced sweating, possible weight loss under 3–5 (evidencing light dehydration), under 5–10% (evidencing moderate dehydration), and about 10% and more (evidencing severe dehydration). In addition, he mentions the following symptoms: tachycardia, decreased blood pressure, circulation failures in serious conditions, prolonged capillary filling, decreased skin turgor, haloed and circled eyes (“sunken eyes”), and changes in neurological condition – apathy, “fixed look”, and oliguria. Grym (2005) speaks of a combination of irritability and lethargy, and low number of wet diapers and stools, in addition to icterus, hypothermia/hyperthermia, decreased skin turgor and elasticity, sunken fontanelle, weight loss by more than 10–12% against birth weight, and verified insufficient lactation.

In view of the broad range of clinical indicators of newborn dehydration, and its changeability and intermingling of individual types of dehydration, authors often disagree about the explicit delimitation of the defining characteristics for objectification of dehydration in newborns.

Limitation of study

A limitation may be seen in non-implementation of other simultaneous methodical approaches to verify the validity of the selected defining characteristics and related factors of *Deficient fluid volume* (00027) in newborns, as well as in the non-application of the original Fehring criteria for the selection of experts and non-involvement of a panel of teachers from the nursing field. Another limitation of the study may be seen in the absence of a systematic survey of the most frequent clinical indicators of dehydration in newborns with regard to classification by maturity.

Conclusion

The nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) includes a wide range

of defining characteristics for the assessment of the specific condition of the newborn. Nevertheless, newborns' clinical conditions, such as dehydration, also require the assessment of other specific clinical symptoms to support and objectify nurses' diagnostic conclusions. The study is concluded by a probative statement of sufficient content validity of the nursing diagnosis of *Deficient fluid volume* [Dehydration] (00027) in the context of Czech nursing, which extends into neonatal care, assuming reliable clinical identification of the defining characteristics, such as decreased urine output, sunken fontanelle, change in skin turgor, dry mucous membranes, increased urine concentration, elevated haematocrit, and general appearance of exhaustion. The results of the content validation study may constitute a motive for clinical validation, with subsequent suggestion of additional defining characteristics, such as sunken fontanelle, and general appearance of exhaustion for assessment of *Deficient fluid volume* [Dehydration] (00027) in newborns in the NANDA International classification system. The content validation of the clinical symptoms of dehydration, and their subsequent verification in clinical practice also call for the creation and subsequent validation of a scoring system for the assessment of the dehydration status of the specific group of patients, i.e., newborns.

Ethical aspects and conflict of interest

The author declares that the study has no conflicts of interest, and was conducted according to the principles of ethical research.

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