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Proposal for the testing of a tool for assessing the risk of dehydration in the elderly patient

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Abstract. *Background:* Dehydration is now the most common fluid and electrolyte disorder in older people. Because it is often associated with high rates of morbidity and mortality, it requires careful control and prevention in the context of a thorough primary care. The main risk factor for dehydration was the low intake of water by mouth for several reasons, such as lack of autonomy, altered mental status, decreased sensation of thirst, social and environmental problems. To this may be added an increase in fluid loss caused by fever, vomiting, diarrhoea, bleeding etc., the use of diuretics or laxatives and the onset of diseases that induce an increase in the loss of urine (e.g. diabetes). This paper aims to locate a tool for assessing the risk among those reported in the literature that is easy to use for the nurse and to experiment with it on a sample of patients. *Methods:* An analysis of the literature showed the reliability of an instrument for assessing the risk of dehydration by the name of "Dehydration Risk Appraisal Checklist." In order to verify its usefulness in identifying the risk of dehydration, 2 groups of elderly persons at the OU Geriatrics and long-term care unit of the Azienda USL of Piacenza and the OU complex Geriatric Clinic of the University Hospital of Parma were investigated. Patients in both groups were assessed on admission by the assessment scale MNA (Mini Nutritional Assessment) and by the sheet of quantitative evaluation of the meal consumed. One group was considered as the "control group". Patients belonging to the other group, which was regarded as the "experimental group", in addition to the two above-mentioned instruments, were also assessed by the "Dehydration risk appraisal checklist". In both groups, the presence or absence of four indicators of dehydration measured at the time of and immediately before discharge was then detected. In the presence of each indicator of dehydration one point was awarded for a comprehensive evaluation. The data collected were analyzed using a statistical method. *Results and Conclusions:* The results showed no statistically significant differences in the identification of the risk of dehydration in the two groups. It is believed, however, that the data will guide checklists to consider the above-mentioned instrument valid and useful in nursing practice in order to assess the risk of dehydration in older people and early detection of its onset and thus enable prompt and effective management. It will take more extensive studies of case studies to test this hypothesis.

Key words: dehydratation, elderly, rating scale, prevention

Background

Given the ageing of the population, it would be beneficial to society and, in particular, to the health care system, if specific adjustments in the organization of health services were to be made.

Also in terms of cost containment, the health system must be structured so as to prevent the onset

of disability or impairment in functional status, particularly in the elderly, who make up the bulk of the population and, therefore, of hospital users.

As a result of the progressive reduction in the duration of hospitalization, in most cases, the problem of dehydration is dealt with only in terms of effect without intervening appropriately in terms of prevention and patient education, in relation to both elderly patients and their caregivers.

Dehydration has been defined as the most common imbalance of fluid and electrolytes in the elderly population. It causes the hospitalization of many patients, increases morbidity and mortality, and therefore represents an important socio-medical problem that requires multidisciplinary interventions in terms of prevention, diagnosis and therapy (1).

A persistent state of dehydration impairs both the physical and the mental capacity of our body; in the elderly, in particular, dehydration is associated with impaired general health status (2).

Health professionals should be aware of the risk factors and signs of dehydration and, consequently, should enable effective strategies to ensure good hydration.

During the assessment phase, the nurse collects subjective and objective data for the presence of the defining characteristics and factors related to any state of dehydration, using a variety of assessment tools [eg. Geriatric Depression Scale (3), Barthel Index (4), ADL (5)].

In addition, the operator must take into account the use of drugs, personal habits and socio-environmental factors that can affect the intake of fluids and the water balance of the person. After performing a focused assessment of the state of hydration/dehydration of the patient, the nurse must work out a care plan. The priority health problems identified are addressed by nurses independently and collaboratively through the formulation of objectives and the identification of specific interventions aimed at the prevention, resolution, or at least not to the worsening of the problems detected (6).

This paper aims to locate a tool for assessing the risk among those reported in the literature that is easy to use for the nurse to use and to experiment with it on a sample of patients.

Methods

Bibliographical search

The analysis of the literature for finding a tool for assessing the state of dehydration in the elderly used the following criteria:

Inclusion criteria: guidelines, systematic reviews, primary studies.

Exclusion criteria: gray literature, commentary, letters.

Limits used: studies on adults aged over 65 years.

Keywords used: Dehydration AND elderly.

Analytical studies, Systematic Review, and Review were taken into account in order of priority

The research questions were designed to assess the evidence regarding the assessment and prevention of dehydration in the elderly and to identify a scientifically validated method that can be used in hospital settings to improve the prevention of dehydration in the geriatric patient. The databases used were PubMed and Cochrane.
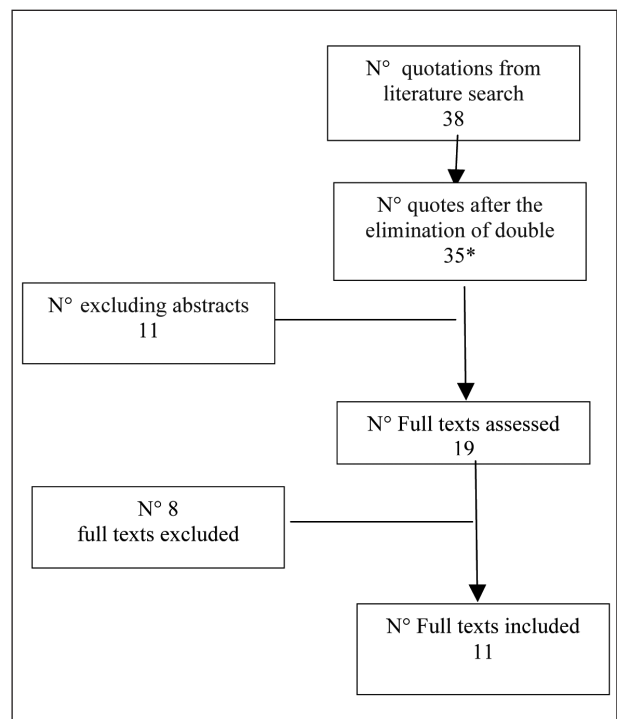

Figure 1. Flow chart selection literature
* Some quotes were devoid of abstract

Initially, 38 items were selected; after the elimination of the double there were only 35, 5 of which were not provided with abstracts and were therefore excluded. Of the remaining 30, 11 were discarded as irrelevant. Of the remaining 19 full-text items, 8 were subsequently excluded and thus 11 in all were analyzed.

The review of the literature thus conducted allowed for the retrieval of a guideline and a systematic review relevant to the subject.

Experimentation

The assessment tool from the literature that seemed most appropriate for the evaluation and prevention of risk of dehydration in the elderly is the "Dehydration Risk Appraisal Checklist". To test this hypothesis we proceeded to an experimental administration of the checklist to assess the impact.

The experimental facilities were the OU Geriatrics and long-term care unit of the Azienda USL of Piacenza and the OU complex Geriatric Clinic of the University Hospital of Parma.

The experimental period was detected in the time interval from the beginning of September 2013 to the middle of the month of October 2013.

Two study groups were identified: an experimental group and a control group, each consisting of 21 patients, all above the age of 65.

The control group was composed of 12 females and 9 males, and the experimental group of 11 females and 10 males. The average age in the control group was 81 years, while in the experimental group it was 80 years.

After authorization for the administration of the "Dehydration Risk Appraisal Checklist" was obtained from the Health Departments concerned, the control group were submitted within 3 days of admission to the MNA (Mini Nutritional Assessment) assessment scale, an instrument whose validity and effectiveness is well documented by the international scientific literature, and to the quantitative evaluation sheet of the meal consumed (7)

The experimental group was administered, in addition to the two above-mentioned instruments and always within 3 days from the time of admission, the "Dehydration Risk Appraisal Checklist". Since the checklist also includes a laboratory analysis, in both groups the presence was verified of four indicators of risk of dehydration, measured at entry and discharge: Urinary Specific Gravity > 1020; Urine colour dark yellow; Serum sodium > 150 mEq/L; Relationship between blood urea nitrogen/creatinine > 20 mg/dl. In the presence of each indicator a score equal to 1 was assigned in order to make an overall assessment of the presence of dehydration. Table 1 shows graphically the structure of the trial.

Table 1. Structure of the experiment

	Experimental group	Control group
Within 3 days of admission, administer:	1) MNA (Mini Nutritional Assessment Short-form) 2) Sheet of quantitative evaluation of the meal consumed (Nutrition Day) 3) Dehydration risk appraisal checklist	1) MNA (Mini Nutritional Assessment Short-form) 2) Sheet of quantitative evaluation of the meal consumed (Nutrition Day) -
Within 3 days of admission, check:	Laboratory tests: - Urine specific gravity; - Serum sodium; - Blood urea nitrogen – creatinine ratio - Colour of urine	Laboratory tests: - Urine specific gravity; - Serum sodium; - Blood urea nitrogen – creatinine ratio - Colour of urine
The day before discharge check:	Laboratory tests: - Urine specific gravity; - Serum sodium; - Blood urea nitrogen – creatinine ratio - Colour of urine	Laboratory tests: - Urine specific gravity; - Serum sodium; - Blood urea nitrogen – creatinine ratio - Colour of urine

At the end of the experimental period, the collected data were entered into a database self with Microsoft Excel. The development provided, in the comparison between the two groups, the calculation of the statistical significance of the differences, in order to deduce the modifications made after the introduction of the "Dehydration Risk Appraisal Checklist". **The x^2 test was used with Yates' correction applied for continuity. The differences were considered significant when p was less than or equal to 0.05.

Results

Analysis of the literature

Here are the essential elements that emerged from the analysis of items considered most relevant: The article by Mentes J. Oral (2006) defines the age-related changes, risk factors, measurements of assessment and treatment interventions for the prevention of dehydration. The author uses a checklist to assess the risk of dehydration (8).

Ferry M. (2005) argues that dehydration is a major health problem and that all the multidisciplinary strategies must be activated for its prevention. His article deals with the clinical signs, risk factors for dehydration in the elderly and practical approaches for implementing prevention (9).

Marin M. (2009) shows that dehydration is an important socio-medical problem that warrants prevention measures. The author emphasizes the importance of a multidimensional assessment that takes into account the personal characteristics, the degree of autonomy of the pathologies in place, the medications administered and the values of laboratory indicators (10).

Shimizu, M. (2012) describes a prospective observational study in which the authors assessed the relationship between the various physical signs and laboratory parameters and identified the most appropriate ones to determine the state of dehydration. The physical signs of dehydration detected in elderly patients showed good specificity but poor sensitivity. The evaluation of axillary moisture and analysis of laboratory data, such as the sodium concentration in serum, may help to evaluate dehydration (11).

Closely related to the concept of underarm wetness is the experimental study of Kinoshita K. (2013) conducted on 29 elderly patients, which confirms that the axillary moisture measurement could help to assess the state of dehydration in the elderly, indicating that it can be excluded when the humidity is equal to or greater than the axillary 50% (12).

Hodkinson B. (2001), speaking of the daily recommended amount of liquids, identifies the risk factors most frequently associated with dehydration and the recommendations for the prevention and management of this condition in elderly patients. The daily intake of liquids should not be less than 1600 ml/24 h (13).

Molaschi M. (1997) conducts a retrospective study on the evaluation of the prevalence of hypertonic dehydration in elderly patients out of 2894 patients hospitalized in an acute ward of the Section of Geriatrics, Department of Medical and Surgical Disciplines, University of Turin from January 1990 to July 1995, which highlights that the prevalence of hypertonic dehydration increases with age and that mortality is correlated to the levels of serum sodium (14).

Maughan RJ. (2012) argues that dehydration, both acute and chronic, can lead to an increased risk of morbidity and mortality especially in the most vulnerable individuals, and that the state of dehydration in the elderly is often caused by reduced fluid intake (15).

Manz F. (2005) points out that maintaining a good state of hydration is indicated to prevent urolithiasis, constipation, asthma, hypertension, acute coronary syndrome, cerebrovascular accident, etc… (16).

Finally, Bossingham MJ. (2005) conducted an experimental study on the influence of age on the management of revenue and expenditure of liquids. The results show that, in the sample studied, the consumption and the introduction of water, water loss through urinary excretion and water balance are no different between young and elderly subjects (17).

The guideline found listed in the National Guideline Clearinghouse database refers to a tool for assessing the risk of dehydration of the elderly called "Dehydration Risk Appraisal Checklist" used in the work of Mentes J. Oral (2006) and consisting of 5 fields of investigation:

- Personal characteristics (age, body mass index, sex)
- Medical Conditions (Dementia, Depression, Diabetes mellitus, cerebral stroke, urinary incontinence etc.)
- Drugs taken (amount exceeding 4, type of medication)
- Fluid intake (amount of fluid intake, pattern of nutrition and hydration, level of autonomy)
- Laboratory indicators (specific weight and colour of urine, serum sodium, the relationship between values of blood urea nitrogen and creatinine).

The higher the number of indicators present in the list (Figure 2), the greater the risk of dehydration.

Experimental Study

Verifying the use of the Checklist

The collection of data in the "Dehydration Risk Appraisal Checklist" was made by observation of the patient and an interview with the latter or with a caregiver; analysis of the clinical administration of this assessment tool enabled us to identify its strengths and weaknesses.

Among the disadvantages highlighted, the analysis emphasizes the unclear interpretation of the results: the checklist does not establish, in fact, the degree of risk of dehydration (e.g. high, medium or low risk) with a specific score; one can only infer that the higher the number of indicators present in the list, the greater the risk of dehydration. Considering that the checklist must be completed using multiple sources of information, another difficulty may arise in cases where there is no cooperation from the person or in the absence of the caregiver. In addition, not all laboratory indicators are always present in the medical record (e.g. specific gravity of the urine).

The strengths of the instrument are its ease of preparation and the possibility of a multidimensional assessment; the latter is very important in care planning, since it leads to a good knowledge of the patient and to a simultaneous evaluation of multiple care issues.

Analysis of the use of indicators

The difference between the values of the indicators of dehydration, calculated at the time of the survey conducted at admittance and the survey conducted at the time of discharge in the two groups was not statistically significant, either in the sample analyzed in Parma or the one analyzed in Piacenza. This can be explained by several considerations:

- The measurement unit attached to the indicators, that is, the assignment of one point in time when it detects the presence, does not allow for a high differentiation of the real state of dehydration. One could think of using the actual values of each indicator, but this was not possible because one of them is not represented by a numerical value.

Besides, at admittance the state of dehydration was not homogeneous throughout the total population: 14 patients had two or more positive indicators, while the remaining 28 had one, in all cases the ratio of blood urea nitrogen to serum creatinine. (positive when more than 20 mg/dl). The Figure 2, from a review of the literature, is almost always positive in the elderly population due to changes in renal function resulting from the physiological ageing process. Thus, an altered ratio of blood urea nitrogen and creatinine, although it is considered an indicator of dehydration, may also be present in people who are not dehydrated. It was only in the comparison between the control group and that of the experimentation group of OU complex Geriatric Clinic of the University Hospital of Parma that a slightly significant difference was observed (p 0.03), probably due to the fact that in the experimental group there were some patients in whom at the time of admittance it a severe state of dehydration was noted, who thus deviated from all other patients observed, in whom, as mentioned above, there was not a serious state of dehydration.

In Figures 3 and 4 are graphically represented the data (Table 2 and 3) divided into two structures identified for testing.

DEHYDRATION RISK APPRAISAL CHECKLIST
The greater the number of characteristics present, the greater the risk of hydration problems.

Personal Characteristics

Age > 85 years
Female sex
Body-mass index < 21 or > 27

Significant Health Conditions

Dementia or positive screening for cognitive impairment
Depression or positive screening for depression
Cerebrovascular accident
Diabetes
Urinary incontinence
Renal disease
Cardiac arrhythmia
Malnutrition
History of dehydration
History of repeated infections

Medications

> 4 medications
Laxatives
Angiotensin-converting enzyme inhibitors
Steroids
Diuretics
Psychotropics: antipsychotics, antidepressants, anxiolytics

Intake

Requires assistance to drink
Has dysphagia or chokes
Can drink independently but forgets
Semidependent, regarding feeding
Poor eater (eats < 50% of food given)
Fluid intake of < 1,500 mL/day
Spills while drinking
Receives tube feedings

Laboratory Abnormalities

Urine specific gravity > 1.020

Figure 2. Reprinted with permission from Mentes JC and the Iowa Veterans Affairs Nursing Research Consortium. Evidence-based protocol: hydration management. In Titler MG, series editor. *Series on evidence-based practice for older adults.* Iowa City, IA: the University of Iowa College of Nursing Gerontological Nursing Interventions Research Center, Research Translation and Dissemination Core; 2004
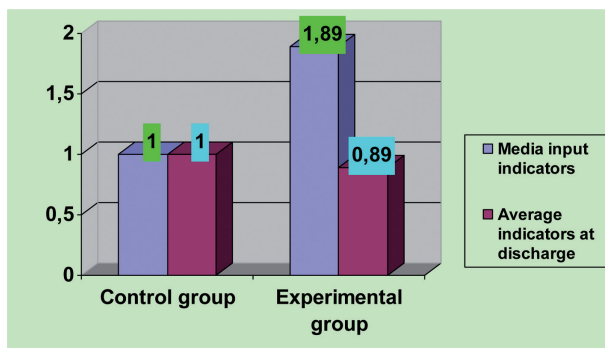
Figure 3. Media indicators of dehydration in the control group and experimental OU complex Geriatric Clinic of the University Hospital of Parma, at admittance and at discharge
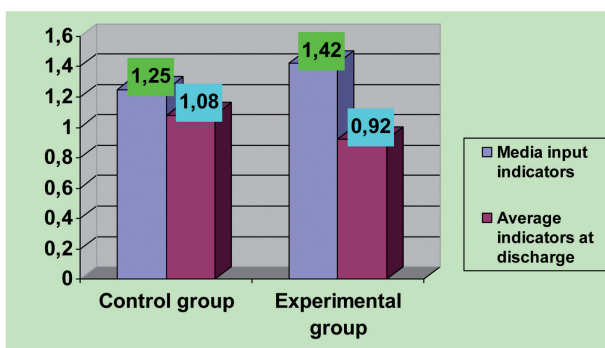

Figure 4. Media indicators of dehydration in the control group and experimental OU Geriatrics and long-term care unit of the Azienda USL Piacenza, at the entrance and at discharge

Conclusions

The literature review enabled the retrieval of a guideline in the National Guideline Clearinghouse database found to be very specific to the topic of research. This document refers to a tool for assessing the risk of dehydration of the elderly called "Dehydration Risk Appraisal Checklist", which is considered useful in the assessment and prevention of the risk of dehydration in the elderly.

To confirm or refute this hypothesis, it was decided to experiment with this instrument with the objective of demonstrating that the checklist increases the sensitivity to the problem of dehydration in the elderly population, leading to earlier recognition of the problem and enabling it to be tackled and managed more effectively.

Table 2. Indicators of the presence of dehydration at admittance and at discharge within the two groups at The OU complex Geriatric Clinic of the University Hospital of Parma (Mann Whitney test)

Parma				
group	**t0**	**t1**	**delta**	
	9	9	9	*N°*
control	1	1	0	average
	1	1	0	*median*
	9	9	9	*N°*
experimentation	1,89	0,89	-1	average
	2	1	-1	*median*

Table 3. Indicators of the presence of dehydration at admittance and at discharge within the two groups at the OU Geriatrics and long-term care unit of the Azienda USL Piacenza (Mann Whitney test)

Piacenza				
group	**t0**	**t1**	**Delta**	
	12	12	12	*N°*
control	1,25	1,083333	-0,166667	average
	1	1	0	*median*
	12	12	12	*N°*
experimentation	1,42	0,92	-0,5	average
	1	1	-0,5	*median*

The checklist was tested in two groups, one experimental and one control, consisting of patients of both sexes, all over the age of 65, hospitalized at the OU Geriatrics and long-term care unit of the Azienda USL Piacenza and at the OU complex Geriatric Clinic of the University Hospital of Parma.

Although the results deriving from the statistical tests carried out show that the relative difference in the presence of number of indicators of dehydration at admittance and at discharge was not statistically significant, it can still be noted that the analysis did not show any worsening of the patients in either group; in fact, the score attributed to the indicators of dehydration at the time of discharge was always equal to or less than that calculated at admittance.

For this reason, and because the assessment of the state of hydration/dehydration of the elderly person is not so simple since some of the signs and symptoms

may be nonspecific and are also found in healthy elderly people, or they may be secondary to a variety of other diseases or conditions, it can be concluded that the use of the "Dehydration risk appraisal checklist" can be considered an especially useful assessment tool in cases where it is possible to use multiple sources of information and there is cooperation from the patient or from the caregiver. Its systematic use may also increase the sensitivity of healthcare professionals and caregivers with regard to this problem that is so prevalent in the elderly population.

References

1. Senin U. Disidratazione ed altri disturbi idro-elettrolitici in: Senin U. Paziente anziano. Paziente geriatrico. Medicina di complessità. II edizione. Napoli: EdiSES; 2006: p. 381.

2. Hodgkinson B, Evans D, Wood J. Maintaining oral hydration in older people. The Joanna Briggs Institute for Evidence Based Nursing and Midwifery; 2001 Sistematic Review No. 12

3. The Geriatric Depression Scale (GDS). Sherry A, Greenberg, PhD (c) , MSN, GNP-BC, New York, University College of Nursing; Try This: Best pratcie in Nursing Care to oder Adults; Issue Number 4; revised 2012.

4. Barthel Index. Mahoney FI, Barthel DW: Mar St Med J 1965; 14: 61-65.

5. Indice di dipendenza nelle attività della vita quotidiana (scala ADL). Katz TF. A.D.L. Activities of Daily Living. Jama 1963; 185: 914.

6. Carpenito-Moyet LJ. Manuale delle diagnosi infermieristiche in: Carpenito-Moyet L. J. Diagnosi infermieristiche. Applicazione alla Pratica Clinica. 5° Edizione, Rozzano (MI): Casa Editrice Ambrosiana; 2010: p. 422-423

7. Nutrition Day. Questionnaires: nutritionDay_files_for_hospitals_Italian_2013. Visitato il 13 Luglio 2013 http:// www.nutritionday.org/index.php?id=1813_ND_explanations_italian_2013.pdf.

8. Mentes J. Oral hydration in older adults: greater awareness is needed in preventing, recognizing, and treating dehydration. Am J Nurs 2006 Jun; 106 (6): 40-9.

9. Ferry M. Strategies for Ensuring Good Hydration in the Elderly. Nutrition Reviews 2005; 63, (6): 22-29.

10. Marin M. La gestione della disidratazione nel paziente anziano fragile. M.D. Medicinae Doctor 2009 21 gennaio; Anno XVI numero 1:44-5

11. Shimizu M, Kinoshita K, Hattori K, Ota Y, Kanai T, Kobayashi H, Tokuda Y. Physical signs of dehydration in the elderly. Intern Med 2012; 51(10): 1207-10

12. Kinoshita K, Hattori K, Ota Y, Kanai T, Shimizu M, Kobayashi H, Tokuda Y. The measurement of axillary moisture for the assessment of dehydration among older patients: a pilot study. Exp Gerontol 2013 Feb; 48 (2): 255-8.

13. Hodgkinson B, Evans D, Wood J. Maintaining oral hydration in older people. The Joanna Briggs Institute for Evidence Based Nursing and Midwifery; 2001 Sistematic Review No. 12

14. Molaschi M, Ponzetto M, Massaia M, Villa L. Hypernatremic dehydration in the elderly on admission to hospital. J Nutr Health Aging 1997; 1(3): 156-60.

15. Maughan RJ. Hydration, morbidity, and mortality in vulnerable populations. Nutrition Reviews 2012 Nov; 70 Suppl 2: 152-5.

16. Manz F., Wentz A. The Importance of Good Hydration for the Prevention of Chronic Diseases. Nutrition Reviews 2005; 63, No 6: 2-5.

17. Bossingham MJ, Carnell NS, Campbell WW. Water balance, hydration status, and fat-free mass hydration in younger and older adults. Am J Clin Nutr 2005; 81 (6): 1342-50.