*J Nutr Health Aging*
*Volume 19, Number 7, 2015*

# KNOWLEDGE AND ATTITUDES OF NURSING STAFF TOWARDS MALNUTRITION CARE IN NURSING HOMES: A MULTICENTRE CROSS-SECTIONAL STUDY

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**Abstract:** *Introduction: Background:* The international literature shows that there are considerable deficits in nutritional care provision in nursing homes. Limited knowledge and negative attitudes can contribute to these deficits but international studies on knowledge and attitudes among nursing staff are rare. *Objective:* The study aimed to assess the knowledge and attitudes of registered nurses and nurse aides towards malnutrition care in nursing homes. *Design:* This study followed a multicentre, cross sectional design. *Setting and Participants:* The study was performed in 66 Austrian nursing homes with 1152 participants. *Measurements:* The validated Knowledge of Malnutrition-Geriatric (KoM-G) questionnaire and the Staff Attitudes to Nutritional Nursing Care Geriatric (SANN-G) scale were used for data collection. *Results:* On average, 60.6% of the respondents answered the questions correctly, whereas registered nurses knew significantly more (65.6%) than nurse aides (57.3%). The question that was answered correctly by most dealt with the factors that positively affect oral nutritional intake (87.2%) while the question which was incorrectly answered by most was on the professions involved in malnutrition treatment (26.1%). 39.2% of respondents had positive attitudes towards nutritional care. Registered nurses displayed more positive attitudes (48.1%) than nurse aides (33.6%). The most positive attitudes were shown in the 'Intervention' subscale while the least positive attitudes were indicated in the 'Norms' subscale. A medium positive correlation between knowledge and attitudes was found (r=.423, p<0.000). *Conclusion:* This study identified specific knowledge deficits and areas of negative attitudes in registered nurses and nurse aides, which will enable tailored training programmes to be developed.

**Key words:** Knowledge, attitudes, nursing staff, malnutrition, nursing homes.

## Introduction

Malnutrition has a significant influence on patient health outcomes (1, 2) and was found in a recent review to occur in up to 71% of nursing home residents (3). Halfens et al. (4) reported a prevalence rate of 23% in Austrian nursing homes and 14% in Dutch nursing homes. International clinical practice guidelines (CPGs) provide recommendations on how to screen nutritional status and prevent and treat malnutrition (5-7). Nevertheless, several international studies have reported a lack in the use of validated nutritional screening tools (8-10) leading to poor recognition of malnutrition and its risk factors in residents (11, 12). Furthermore the literature identifies deficits in nutritional interventions, like the provision of energy-enriched diets to malnourished residents or those at risk (8-10).

One important precondition of adherence to CPG recommendations is the presence of adequate and sufficient knowledge of and positive attitudes towards malnutrition care in health care professionals (13-15). According to Donabedian's model, structures (e.g. knowledge and attitudes of the staff) can influence processes (e.g. routine screening and subsequent interventions), which in turn impact the outcomes of residents or patients (e.g. prevalence or incidence of a problem) in an institution (16).

In 2009, the Council of Europe claimed that health care professionals in care homes need to be better educated on malnutrition (17), because insufficient knowledge, limited interest and negative attitudes toward nutrition are perceived as the most common barriers to adequate nutritional practice (14, 18). Among health care professionals, nursing staff is in the best position to provide adequate nutrition (17, 19), therefore their knowledge and attitudes with regard to malnutrition play a fundamental role in the provision of nutritional care in nursing homes (13-15).

Studies on the knowledge and attitudes of nursing staff in nursing homes are rare, however. Stanek, Powell & Betts (20), Crogan, Shultz & Massey (21) and Beattie et al. (22) examined this knowledge using small sample sizes between 24 and 44 registered nurses and licensed practical nurses, respectively. The greatest knowledge deficits were found in nutritional status screening (21) and nutrient and food requirements in older residents (21, 22). Only Crogan, Shultz & Massey (21) analysed differences between registered nurses and licensed practical nurses and found that licensed practical nurses had significantly less knowledge than registered nurses. Bachrach-Lindström et al. (23) and Bonetti et al. (24) investigated attitudes towards nutritional care in 252 registered nurses and nurse aides respectively 33 registered nurses with the Staff Attitudes to Nutritional Nursing Care Geriatric (SANN-G) scale. Bachrach-Lindström et al. (23) found that 33% of the 252 respondents displayed positive attitudes. Both found that respondents had the most positive attitudes in the 'Intervention'

*Received May 6, 2014*
*Accepted for publication June 5, 2014*

subscale and the lowest positive attitudes in the 'Norms' subscale (23, 24). Furthermore Bachrach-Lindström et al. (23) found that registered nurses had better attitudes towards nutritional care than did nurse aides.

To conclude, it is known from previous studies that there are considerable deficits in nutritional practice in nursing homes (9, 10, 12) but information on nursing staff knowledge and attitudes, which play a fundamental role in providing adequate nutritional practice (11, 25), is only limited. Most of the studies conducted were based on small sample sizes and did not use systematically developed and psychometrically evaluated questionnaires. In addition, a large part of the studies conducted only concentrated on registered nurses or combined the results of nurses with other staff, e.g. facility directors or kitchen staff (20, 22). Most did not include nurse aides, despite the fact that they are the main care givers in nursing homes (26, 27). Registered nurses are not always aware of the residents' daily problems, meaning that the nurse aides must function as the "eyes and ears of nurses" and thus have to be trained accordingly (27, 28). Having more detailed information on knowledge and attitudes would enable the planning of targeted training programmes to improve knowledge and attitudes of registered nurses and nurse aides as well as long-term malnutrition care. Consequently, the aims of this study were to assess the knowledge and attitudes of registered nurses and nurse aides towards malnutrition care in nursing homes, as well as to look at differences in knowledge and attitudes with regard to general characteristics like gender, age and years of working experience.

## Methods

### *Design*

This study followed a multicentre, cross-sectional design.

### *Setting and sample*

All Austrian nursing homes with more than 50 beds (n=470) were invited by e-mail and letter to participate in the study. The average number of beds in these nursing homes is 99 (29). A total sample of 66 Austrian nursing homes, with an average number of 95 beds, agreed to participate. All registered nurses and nurse aides (subsequently referred to as nursing staff) who were available during the 4-week data collection period in these nursing homes were asked to participate. In Austria, registered nurses attend a 3-year program with 30 lessons in nutrition and diets in their first year and nurse aides attend a 1-year program with 25 lessons in nutrition and diets. Registered nurses are primary educated in schools in which they are awarded a diploma upon graduation. In recent years some universities and universities of applied science have begun to offer bachelor-level programs where graduates are awarded a diploma and a Bachelor of Nursing Science (BSc) (30, 31). To date, registered nurses in Austria with Bachelor's certificates are few.

### *Data collection*

Data were collected between November 2012 and February 2013. The nursing and ward directors were personally informed about the study and its procedures by the primary investigator. They were provided with the questionnaires including the informed consent forms and boxes for data collection as well as with instructions on how to distribute the questionnaires. The ward directors distributed the questionnaires to nursing staff, informed them about the study and emphasized the importance of filling in the questionnaire without the assistance of other resources (like Internet or help from others). The questionnaires were delivered securely and anonymously in sealed data collection boxes. The nursing directors returned the completed questionnaires to the Institute of Nursing Science of the Medical University of Graz by mail four weeks after receiving them.

### *Instruments*

The knowledge was measured with the Knowledge of Malnutrition-Geriatric (KoM-G) questionnaire. The KoM-G was developed by the authors using a Delphi technique with input from eight international malnutrition experts and afterwards was psychometrically evaluated. The KoM-G is a 19-item multiple-choice questionnaire where each question has six answer options including 'I don't know'. Questions wherein five of the six answer options were correctly answered were scored as correct, while all other variants were scored as not correct. Hence, these scores range between 19 and 114, with higher scores reflecting higher knowledge. The psychometric evaluation revealed a Scale-Content Validity Index Average (S-CVI/Ave) of 0.91. Furthermore, the KoM-G had an item difficulty of 60.6% and a discrimination index of 0.38. The analysis of previously defined known groups revealed significant differences with regard to nursing degree, additional training in malnutrition as well as attitudes towards nutritional care. The result of the Kuder-Richardson-20 for the whole questionnaire was 0.69 (32).

The attitudes of nursing staff were assessed using the SANN-G scale developed by Christensson & Bachrach-Lindström (25). The permission to translate and use the SANN-G was obtained from the developers. For the purpose of this study, the SANN-G was translated by a professional translator from English to German and back from German to English by another professional translator. The primary English version and the translated English version were then compared by the primary author and only minor differences in language were found with no impact on meaning. The SANN-G scale consists of 18 items representing five subscales: 'Norms' (e.g. It is best that the staff serves food on plates without help from the residents); 'Habits' (e.g. One prepared warm meal/day is enough for people aged 70 or more); 'Assessment' (e.g. It is meaningless to assess body weight of all residents); 'Intervention' (e.g. No special knowledge or experience is needed when helping a resident to eat) and 'Individualization'

(e.g. Mealtimes do not need to be individually adjusted). All items are negatively worded statements. Answers are given on a Likert-scale where 1 represented 'completely agree' and 5 'completely disagree'. The scores range between 18 and 90 where a score below 54 reflect a negative attitude and a score of 72 or higher represent a positive attitude. The original and the German version of the SANN-G revealed a Cronbachs Alpha of 0.83 (25).

Furthermore, general characteristics like gender, age, nursing degree, years of working experience and additional training in malnutrition were gathered. Additional training in malnutrition was defined as advanced and lasting at least two hours with no further details on content.

### *Ethical considerations*

The ethical approval from the ethics committee of the Medical University of Graz and written informed consent from the participating nursing staff was obtained.

### *Data analysis*

The statistical analyses were performed with IBM SPSS, version 20.0 (IBM, Armonk, NY, USA). Data were coded and prepared for analysis by checking for discrepancies, logical inconsistencies and missing responses. The knowledge of nursing staff was assessed according to the percentage of correct answers and median values. The attitudes of nursing staff were assessed as percentage of positive attitudes and median values. The analysis between groups was performed using Mann-Whitney U and chi-square tests. The Spearman rank order correlation between knowledge and attitudes was analysed. Correlation coefficients between .30 and .49 were considered medium correlations and between .50 and 1.0 were judged as large correlations (33). P-values were based on two-sided tests, and values lower than 0.05 were considered statistically significant. Only complete questionnaires on knowledge respectively attitudes were used for comparisons between groups.

## Results

### *General characteristics*

The response rate of the nursing staff from the 66 participating nursing homes was 59.5% meaning that 1152 participants gave informed consent and filled in the questionnaire. 458 registered nurses and 619 nurse aides participated, while 75 participants did not indicate their level of education. Most of the respondents were female and the mean age was 41.4 years (table 1). Registered nurses, as opposed to nurse aides, had significantly more years of working experience and also confirmed significantly more often having attended additional training in malnutrition.

### *Knowledge of nursing staff*

Of the 1008 registered nurses and nurse aides who filled in the KoM-G completely, an average of 60.6% questions were answered correctly (table 2). 87.2% of the whole sample knew which factors positively affect oral nutritional intake. Furthermore, more than 80% of the respondents knew possible consequences and signs of malnutrition, factors that negatively affect oral nutritional intake and possible interventions in residents with dysphagia at risk of malnutrition. The question with the lowest percentage of correct answers related to the involvement of different professions in malnutrition treatment, which was known by 26.1% of the respondents. In addition, the question about the 'normal' and healthy Body Mass Index (BMI) in older residents was known by 31.6%. Registered nurses knew significantly more (65.6%) than nurse aides (57.3%). The items on risk factors for and consequences of malnutrition, signs of dehydration, BMI, weight loss, almost all items on planning nutritional interventions and factors that negatively affect oral nutritional intake were known significantly more often by registered nurses than nurse aides. The percentage of correct answers and median values did not differ significantly with regard to gender, age and years of working experience (table 3). Additional training in malnutrition made a significant difference by showing that those with training in malnutrition knew more than those without training in malnutrition.

**Table 1**
Characteristics of respondents (in %)

| | Total | Registered nurses | Nurse aides | p-value |
|---|---|---|---|---|
| Gender | n=1104 | n=458 | n=619 | |
| Female | 87.5 | 89.5 | 85.9 | 0.080 |
| Age | n=1020 | n=429 | n=578 | |
| ≤ 30 years | 18.6 | 14.0 | 22.0 | |
| 31-40 years | 23.8 | 27.7 | 20.8 | |
| 41-50 years | 39.1 | 40.8 | 37.9 | |
| ≥ 51 years | 18.6 | 17.5 | 19.4 | |
| Mean age in years (SD) | 41.4 (10.1) | 42.0 (9.3) | 41.0 (10.5) | 0.246 |
| Years of working experience | n=907 | n=400 | n=501 | |
| ≥ 6 years | 75.1 | 81.8 | 69.7 | |
| Mean years of working experience (SD) | 13.9 (10.1) | 17.8 (11.2) | 10.8 (7.9) | <0.000 |
| Additional training in malnutrition | n=1092 | n=451 | n=619 | |
| Yes | 20.6 | 29.7 | 13.7 | <0.000 |

### *Attitudes of nursing staff*

39.2% of the respondents had positive attitudes, 51.7% displayed neutral attitudes and 9.1% showed negative attitudes towards nutritional care. 71.7% of the respondents displayed positive attitudes in the 'Intervention' subscale whereas 35.6% displayed positive attitudes in the 'Norms' subscale (table 4). 48.1% of the registered nurses and 33.6% of the nurse aides had positive attitudes towards nutritional care. Registered nurses and nurse aides differed significantly in

**Table 2**
Correct answers per item on the Knowledge of Malnutrition-Geriatric (KoM-G) questionnaire (in %)

| Dimension | Item | Total (n=1008) | Registered nurses (n=420) | Nurse aides (n=547) | p-value |
|---|---|---|---|---|---|
| Etiology and consequences of malnutrition | What are possible risk factors for malnutrition? | 66.9 | 80.6 | 64.7 | 0.003 |
| | What are possible consequences of malnutrition? | 80.7 | 88.1 | 79.0 | <0.000 |
| | What are possible signs of malnutrition? | 65.3 | 70.2 | 64.9 | 0.080 |
| | What are possible signs of dehydration? | 80.8 | 86.9 | 76.2 | <0.000 |
| Screening and assessment of nutritional status | What indicators should be assessed in nutritional screening? | 68.2 | 71.4 | 69.3 | 0.470 |
| | When should residents be nutritionally screened? | 63.3 | 65.0 | 61.6 | 0.279 |
| | What is a 'normal' and healthy BMI (Body Mass Index) of older residents (over 65 years old)? | 31.6 | 36.2 | 28.7 | 0.013 |
| | What % of unintentional weight loss in the past 3 months is a possible sign of malnutrition? | 50.0 | 55.7 | 45.7 | 0.002 |
| Planning interventions | Which professions should be involved when necessary in treating malnourished residents? | 26.1 | 33.1 | 22.1 | <0.000 |
| | A resident lost 3kg in the last month. What steps can be initiated? | 56.8 | 62.6 | 54.7 | 0.013 |
| | To what extent do the energy and nutrient requirements change for older residents (over 65 years old)? | 39.4 | 46.0 | 35.6 | 0.001 |
| | The daily fluid requirements of a person are…? | 47.2 | 58.3 | 41.1 | <0.000 |
| | What factors can lead to higher energy and protein requirements? | 52.9 | 67.9 | 45.2 | <0.000 |
| | What specific nutrient requirements do residents with pressure ulcers have? | 73.8 | 83.6 | 66.0 | <0.000 |
| | Why should nurses keep a food and fluid log? | 41.2 | 42.4 | 41.7 | 0.827 |
| Possible interventions for improving nutritional intake | What factors can positively affect oral nutritional intake? | 87.2 | 90.5 | 86.8 | 0.080 |
| | What factors can negatively affect oral nutritional intake? | 82.1 | 88.3 | 80.4 | 0.001 |
| Enteral and parenteral nutrition | What interventions should be ideally done for a resident with mild dysphagia at risk of malnutrition? | 85.5 | 88.6 | 86.1 | 0.256 |
| | For which residents is tube feeding appropriate? | 38.6 | 38.3 | 38.4 | 0.985 |
| Total | Total percentage of correct answers | 60.6 | 65.6 | 57.3 | <0.000 |

**Table 3**
Knowledge (Knowledge of Malnutrition-Geriatric (KoM-G) questionnaire) and attitudes (Staff Attitudes to Nutritional Nursing Care Geriatric (SANN-G) scale) presented as percentage of correct answers/percentage of positive attitudes and median values per sample characteristics

| | Knowledge | | | Attitudes | | |
|---|---|---|---|---|---|---|
| | % | Median | p-value | % | Median | p-value |
| Gender | | | | | | |
| Female | 61.0 | 93.0 | 0.617 | 40.1 | 69.0 | 0.349 |
| Male | 60.4 | 93.0 | | 35.8 | 68.0 | |
| Age | | | | | | |
| ≤ 30 years | 61.8 | 93.0 | 0.648 | 38.2 | 69.0 | 0.940 |
| 31-40 years | 59.8 | 93.0 | | 39.4 | 68.0 | |
| 41-50 years | 61.9 | 94.0 | | 40.8 | 69.0 | |
| ≥ 51 years | 60.9 | 94.0 | | 39.9 | 69.0 | |
| Years of working experience | | | | | | |
| ≥ 6 years | 61.4 | 94.0 | 0.314 | 39.5 | 69.0 | 0.086 |
| ≤ 5 years | 63.8 | 94.0 | | 46.5 | 71.0 | |
| Additional training in malnutrition | | | | | | |
| Yes | 65.2 | 95.0 | <0.000 | 45.6 | 70.0 | 0.089 |
| No | 59.6 | 93.0 | | 38.3 | 69.0 | |

**Table 4**
Attitudes per subscale of Staff Attitudes to Nutritional Nursing Care Geriatric (SANN-G) scale presented as percentage of positive attitudes and median values (Q1, Q3)

| | | Total (n=1005) | | | Registered nurses (n=414) | | | Nurse aides (n=548) | | | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Break point for positive | % positive attitudes | Median | Q1-Q3 | % positive attitudes | Median | Q1-Q3 | % positive attitudes | Median | Q1-Q3 | |
| Norms (5-25) | 20 | 35.6 | 18.0 | 15.0-21.0 | 42.0 | 19.0 | 16.0-21.0 | 31.6 | 18.0 | 15.0-20.0 | <0.000 |
| Habits (4-20) | 16 | 41.0 | 15.0 | 12.0-17.0 | 47.1 | 15.0 | 13.0-18.0 | 37.2 | 14.0 | 12.0-16.0 | <0.000 |
| Assessment (4-20) | 16 | 60.2 | 16.0 | 14.0-18.0 | 67.4 | 17.0 | 15.0-18.0 | 54.9 | 16.0 | 14.0-18.0 | <0.000 |
| Intervention (3-15) | 12 | 71.7 | 13.0 | 11.0-14.0 | 79.2 | 13.0 | 12.0-14.0 | 66.6 | 12.0 | 11.0-14.0 | <0.000 |
| Individualization (2-10) | 8 | 55.7 | 8.0 | 6.0-9.0 | 60.1 | 8.0 | 6.0-10.0 | 53.5 | 8.0 | 6.0-9.0 | 0.036 |
| Total (18-90) | 72 | 39.2 | 69.0 | 61.0-76.0 | 48.1 | 71.0 | 64.0-78.0 | 33.6 | 67.0 | 60.0-74.0 | <0.000 |

their attitudes in the total score as well as in all subscales. The general characteristics of the respondents (gender, age, years of working experience and additional training in malnutrition) were not significantly related to their attitudes (table 3).

A medium positive correlation between knowledge and attitudes was found for the whole sample (r=.423, p<0.000) as well as for registered nurses (r=.411, p<0.000) and nurse aides (r=.441, p<0.000) individually.

## Discussion

Internationally, this study was one of the first to measure knowledge and attitudes towards malnutrition care on the parts of registered nurses and nurse aides in nursing homes. Previously conducted studies on knowledge and attitudes were mostly based on low sample sizes and concentrated only on registered nurses or mixed samples. The results of this study indicated that registered nurses had better knowledge and more positive attitudes than nurse aides. The main knowledge deficits were found to be in involving professionals in nutritional care as well as screening and assessment of nutritional status. Furthermore, most negative attitudes were found in the 'Norms' subscale, which deals with the organisation of mealtimes and involving residents in mealtime preparation.

On average, 60.6% of the respondents answered the questions in the KoM-G correctly, which is in line with Stanek, Powell & Betts (20) who reported a mean of 60% correct answers. In addition to this, the study revealed a significant difference in knowledge between registered nurses and nurse aides, which can be explained by their different education and the amount of nutritional training received. Similar results were shown by Crogan, Shultz & Massey (21) with a mean of 65% correct answers, while licensed practical nurses scored significantly lower (56%) than registered nurses (68%). Furthermore, additional training in malnutrition was related to increased knowledge, whereas gender, age and years of working experience were not related to knowledge. Stanek, Powell & Betts (20) also found that years of working experience did not influence knowledge significantly. In contrast, Crogan & Evans (34) found that nurses with fewer years of working experience had more knowledge than more experienced nurses in nursing homes. Although not significant, our study also showed that nurses with fewer years of working experience had more knowledge and also more positive attitudes than nursing staff with more years of working experience. This may partly be explained by their more recent basic education and therefore more accessible and current knowledge. Crogan & Evans (34) noted that these results may lead to problems, as experienced nurses may function as role models for nurse aides and have more responsibilities because of their experience, e.g. performing nutritional assessment, even though their knowledge level might be worse compared to their less experienced colleagues.

The question with the lowest percentage of correct answers dealt with the professions potentially involved in treating malnourished residents. This supports findings from the literature which showed that responsibilities in the nutritional process are badly defined and that there is a lack of awareness of their own and the others' role in nutrition within the team. This constitutes one of the main barriers to adequate nutritional care (18, 35). Since screening and assessment are essential for enabling good nutritional practice (6), relevant indicators for nutritional status should be well known. The question on the 'normal' BMI of older residents was only correctly answered by 31.6% of the respondents. Crogan, Shultz & Massey (21) also found deficits regarding knowledge on nutritional screening and assessment. Knowledge on etiology and consequences of malnutrition as well as factors influencing oral nutritional intake and possible interventions in residents at risk of malnutrition was high, both for registered nurses and nurse aides. Beattie et al. (22) also found high knowledge scores e.g. on questions regarding feeding strategies for dementia residents, which emphasized that knowledge on practical aspects of nutritional interventions among nursing staff, for example, was generally high. Interestingly, the items which were known or not known by most of the nursing staff were similar between registered nurses and nurse aides.

In the present study, 39.2% displayed positive attitudes towards nutritional care, which is a little higher than the result reported by Bachrach-Lindström et al. (23) where 33%

displayed positive attitudes. This study revealed significant differences in attitudes between registered nurses and nurse aides whereas no significant differences with regard to gender, age, years of working experience and additional training were found.

Nursing staff displayed the most positive attitudes toward the 'Intervention' subscale, while the most negative attitudes were found in the 'Norms' subscale, which is both in line with Bachrach-Lindstrom et al. (23) and Bonetti et al. (24). This was true for the entire nursing staff as well as for registered nurses and nurse aides individually. The low percentage of positive attitudes in the 'Norms' subscale showed that nursing staff, especially nurse aides, believe that the organisation of mealtimes should focus mainly on relieving staff's workload and that residents should not be involved in preparing or arranging mealtimes. During mealtimes, the perspectives and needs of two different actors, the nursing staff and the resident, come together. The primary interest of the nursing staff is to manage their workload during mealtimes, which is difficult due to limited time and nursing staff (22, 35). On the other hand, mealtimes are a sign of normality and personal identity for the residents and function as a compass during the day in nursing homes. Since mealtimes also offer opportunities to foster the independence and wellbeing of residents (36-38), the implementation of extra staff during mealtimes or soliciting the help of relatives is recommended. Even such slight changes in mealtime organisation can potentially improve the situation of residents, which may also lead to a slight relief in the workload of nursing staff during mealtimes (37, 38). As already indicated with regard to nursing staff knowledge, the subscales with high values of positive attitudes and negative attitudes were similar between registered nurses and nurse aides. This leads to the conclusion that, although registered nurses still knew significantly more and had significantly more positive attitudes than nurse aides, the areas of knowledge/knowledge deficits and positive/negative attitudes were similar.

The results of this study revealed a medium positive correlation between knowledge and attitudes. This was also underlined by the relationship between the results on the subscales of the SANN-G and the results on the individual items of the KoM-G. For example, it was shown that knowledge regarding nutritional interventions was high among the nursing staff and that attitudes of nursing staff were quite positive in the 'Intervention' subscale.

This study also had several limitations. The nursing directors decided whether an institution should participate or not, which entails a potential bias in that those who participated may have already had an interest in nutritional care. Furthermore, the nursing directors may have also influenced to whom the questionnaire was given and how it was filled in. Factor analysis has not yet been conducted, but is recommended for further studies. Additionally, not all questionnaires were complete, leading to missing data.

However, this study provided detailed information on knowledge and attitudes of registered nurses and nurse aides. It was based on a large sample of nursing staff from nursing homes of different sizes covering every Austrian state. There is no available data on non-respondents and subsequently on representativeness, which is common in these types of studies. Nevertheless the mean number of beds at the participating nursing homes compared to all nursing homes in Austria was found to be similar, which enhances generalizability. Furthermore, the response rate was quite high, compared to the studies by Beattie et al. (22) (33%) or Stanek, Powell & Betts (20) (38%).

For the purposes of nursing research, the authors recommend modifying the KoM-G used here for other settings, like hospitals and home care. Since the demand for knowledge about malnutrition differs between settings, the items on the KoM-G should be evaluated with regard to content and relevance. It would also be of interest to compare knowledge and attitudes between different settings in order to establish whether areas of knowledge deficits are similar. It would also be important to not only look at knowledge and attitudes in other settings, but rather to also compare them with daily nursing care, because there is already a discussion about the discrepancy between what is known and what is actually practiced in daily nursing care, which should be pursued further (21, 22). In addition, forthcoming studies should focus on team composition and skill mix, because not only the knowledge of individual nurses, but also their combination and the composition of teams are important when aiming to improve nutritional care.

This study demonstrated the differences between registered nurses and nurse aides with regard to knowledge and attitudes. Since nurse aides perform most of the direct care in nursing homes, nurse aide training is a cornerstone of good quality care provision (27, 28). The information from this study will enable the development of tailored training programmes for registered nurses and nurse aides, potentially helping to improve nutritional care in the long term. Multidisciplinary nutritional care as well as screening and assessment of nutritional status are among the topics definitively deserving coverage, because these were the topics that lacked knowledge among nursing staff. However, malnutrition should also be more heavily emphasized in basic and further education for both registered nurses and nurse aides.

*Ethical standards:* All measures comply with the current laws of Austria.

*Declaration of interest:* The authors declare that there are no conflicts of interest in relation to the current study.

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