

Research article

Development of a microlearning intervention regarding nursing nutritional care for older adults: A multi-methods study

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ABSTRACT

Background: Nutritional care for older adults provided by hospital and home care nurses and nursing assistants is suboptimal. This is due to several factors including professionals' lack of knowledge and low prioritisation. Affecting these factors may promote nurses' and nursing assistants' behavioral change and eventually improve nutritional care. To increase the likelihood of successfully targeting these factors, an evidence-based educational intervention is needed.

Objectives: To develop an educational intervention for hospital and home care nurses and nursing assistants to promote behaviour change by affecting factors that influence current behaviour in nutritional care for older adults. In this paper, we describe the intervention development process.

Design: A multi-methods approach using literature and expert input.

Settings: Hospital and home care.

Participants: Older adults, nurses, nursing assistants, experts, and other professionals involved in nutritional care.

Methods: The educational intervention was based on five principles: 1) interaction between intervention and users, 2) targeting users on both individual and team level, 3) supporting direct and easy transfer to the workplace, and continuous learning, 4) facilitating learning within an appropriate period, and 5) fitting with the context. Consistent with these principles, the research team focussed on developing a microlearning intervention and they established consensus on seven features of the intervention: content, provider, mode of delivery, setting, recipient, intensity, and duration.

Results: The intervention consisted of 30 statements about nursing nutritional care for older adults, which nurses and nursing assistants were asked to confirm or reject, followed by corresponding explanations. These can be presented in a snack-sized way, this means one statement per day, five times a week over a period of six weeks through an online platform.

Conclusions: Based on a well-founded and comprehensive procedure, the microlearning intervention was developed. This intervention has the potential to contribute to nursing nutritional care for older adults.

1. Introduction

Nutrition and nursing activities regarding nutritional care for older

adults in the hospital and home care setting are part of essential nursing care (Kitson et al., 2013; Volkert et al., 2022). Hospital and home care nurses and nursing assistants have the ideal position to maintain

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continuity and coordination of nutritional care in their everyday practice (Cederholm et al., 2017; Volkert et al., 2022). This enables them to promote health and well-being, prevent deterioration of nutritional status by early recognition and risk assessment, and identify and treat potential malnutrition (Schuurmans, 2012; Volkert et al., 2022; World Health Organization, 2012; Zwakhalen et al., 2018).

The provision of good quality care and continuity of nursing nutritional care in daily hospital practice is however moderate (Bonetti et al., 2013; Dahl Eide et al., 2015). Previous studies have demonstrated that numerous factors influencing hospital nurses' and nursing assistants' current behaviour are at issue. Several examples of factors are lack of knowledge, moderate awareness of the importance, low prioritisation and partial absence of sense of responsibility (Bachrach-Lindström et al., 2007; Boaz et al., 2013; Bonetti et al., 2013; Dahl Eide et al., 2015; Lassen et al., 2008; Robison et al., 2015; Ross et al., 2011; Söderhamn and Söderhamn, 2009). Here, behaviour is defined as "any observable or measurable movement or activity of an individual. Behaviour can be verbal or nonverbal, overt or covert. Covert responses are private or unobservable events that can be cognitive, emotional, or physiological" (Sundel and Sundel, 2018).

To successfully impact factors influencing hospital and home care nurses' and nursing assistants' current behaviour in nutritional care for older adults and hence their behaviour, an optimal fit with a suitable intervention in a specific context is essential (Bleijenberg et al., 2018; Craig et al., 2008; Michie et al., 2014; Skivington et al., 2021). Therefore, we did a comprehensive analysis in the context of Dutch hospital and home care. In a Delphi study, we conducted six preparatory studies (ten Cate et al., 2021a, b, c), where we identified nine factors that influence nurses' and nursing assistants' current behaviour in nutritional care for older adults. Subsequently, these nine factors were presented to an expert panel in two Delphi rounds. Experts rated eight out of nine factors that influence current behaviour as relevant, modifiable and feasible to influence (ten Cate et al., 2021c). These eight factors are presented in Table 1.

A solid and supportive way to target these eight factors and eventually promote behaviour change is through education (Michie et al., 2011; Michie et al., 2014). There are studies that describe educational interventions for nurses providing nutritional care for older adults in hospital (Bell et al., 2014; Keller et al., 2017; Laur and Keller, 2015; Silver et al., 2018). However, these interventions do not fit with aforementioned eight factors (Table 1), which can then potentially lead to ineffectiveness of the intervention (Craig et al., 2008; Michie et al., 2014; Skivington et al., 2021). Therefore, we developed a new educational intervention targeting all these eight factors simultaneously (Michie et al., 2014). In this paper, we describe the development process of this educational intervention for hospital and home care nurses and nursing assistants to promote behaviour change by affecting factors that influence current behaviour in nutritional care for older adults.

2. Methods

For the development of our educational intervention, we followed a

Table 1

Eight factors that influence current behaviour of hospital and home care nurses and nursing assistants in nutritional care for older adults.

1. Lack of sufficient knowledge about topics regarding nutrition and malnutrition
2. Mainly neutral attitude towards nutritional care
3. Low prioritisation of nutritional care
4. Ambiguous motivation to routinely use guidelines on and screening tools for malnutrition
5. Moderate awareness about risk factors of malnutrition
6. Lack of sense of involving informal caregivers in nutritional care
7. Ambiguous motivation to follow education about and training on nutrition and malnutrition
8. Strong focus on medical nutrition as opposed to normal nutrition

comprehensive and systematic approach (Michie et al., 2014) and used a multi-methods approach utilising literature and expert input (Hesse-Biber and Johnson, 2015). The Template for Intervention Description and Replication (TIDieR) checklist and guide was followed for reporting (Hoffmann et al., 2014) (Supplementary material 1).

2.1. Key principles of the educational intervention

We based our intervention on five key principles regarding active learning and learning support, which are set out in relevant literature. The research team (DtC, JD, RE, MS) agreed on these five key principles to optimise the impact of the intervention on behaviour change by affecting factors that influence nurses' and nursing assistants' current behaviour in nutritional care for older adults.

First, emphasis was put on the interaction between the intervention and nurses and nursing assistants. Second, in line with Michie et al. (2014), we sought to reach a large group of nurses and nursing assistants, who could be targeted individually and through their nursing team. Third, we aimed that the transfer of education in the workplace would be direct and easy. This in order to support continuous learning and motivation to follow education over an extended period. An extended period increases the chance of affecting factors that influence current behaviour and behaviour change (Bates, 2004; Chiaburu and Tekleab, 2005; Holton and Baldwin, 2003). Fourth, we intended to facilitate learning within an appropriate period. Appropriate meaning not too long neither too short to enhance successful learning and enable successful change of factors influencing current behaviour but to avoid negative influences on learning motivation (Anderson and Krathwohl, 2001; Tze et al., 2016). Fifth, we considered it important to ensure a maximum fit between the intervention and nurses' and nursing assistants' everyday work in the Dutch hospital and home care setting. Here, we kept in mind that nurses and nursing assistants must deal daily with a high workload and little time (Aiken et al., 2013; Hegney et al., 2019).

2.2. Features of the educational intervention

Consistent with the abovementioned five principles, the research team decided to focus on a microlearning intervention. Microlearning refers to "short forms of learning and consists of short, fine-grained, inter-connected and loosely-coupled learning activities with micro-content" (Buchem and Hamelmann, 2010). Furthermore, the research team established consensus regarding seven features of the intervention to enhance the quality of the development of our intervention and select the most appropriate intervention features (Michie et al., 2014). These features are: 1) content, 2) provider, 3) mode of delivery, 4) setting, 5) recipient, 6) intensity, and 7) duration (Davidson et al., 2003; Hoffmann et al., 2014; Michie et al., 2014).

2.3. Design of the intervention content

For the microlearning intervention, we developed statements and corresponding explanations about nutritional care for older adults provided by nurses and nursing assistants in the hospital and home care setting. In this process, we used elements of the Consensus-based Standards for the selection of health Measurement INstruments (COSMIN) Study Design checklist for Patient-reported outcome measurement instruments (Terwee et al., 2018; de Vet et al., 2011). This comprised development by 1) generating themes, 2) generating statements and 3) assessing content validity of the statements by measuring relevance and comprehensiveness, and assessing clear language. In addition, we 4) formulated explanations corresponding to statements and 5) established readability and face validity of both statements and explanations (Fig. 1). Additional information regarding the steps is given in Supplementary material 2.

2.3.1. Step 1: generating themes

Within this step, the goal was to generate themes about nutrition and nursing nutritional care for older adults (Terwee et al., 2018; de Vet et al., 2011). First, these themes were identified in relevant literature published between 2000 and 2018.

Second, an overview of these themes was presented to experts with work experience regarding nutrition and nutritional care for older adults in hospital and home care. They were asked to answer four questions regarding the overview of themes about 1) completeness, 2) missing themes and 3) ranking of the themes. In addition, the experts were requested to 4) formulate themes relating to nursing, and behaviour and professional attitude of nurses and nursing assistants towards nutrition and nutritional care. The four questions can be found in Supplementary material 2.

Third, in a consensus meeting, three researchers with a substantial background within nursing practice, education and (nutritional) research (DtC, JD, LvV), discussed and reached agreement about theme suggestions by the experts. They also verified the nursing themes with associated frameworks and theories used in the nursing domain. After this consensus meeting, an updated list of themes was derived. Finally, the experts were asked to approve this list by email. This resulted in a definitive overview of themes about nursing nutritional care for older adults in the hospital and home care setting.

2.3.2. Step 2: generating statements

The objective was to select and formulate statements based on the overview from step 1 (Terwee et al., 2018; de Vet et al., 2011). Three researchers (DtC, JD, LvV) generated these statements from the literature used in step 1 and examples of cases provided by the experts and the research team.

In addition, to stimulate active learning, we used the revised Bloom's Taxonomy Model to incorporate different levels of learning for statement development (Anderson and Krathwohl, 2001). This model categorises four knowledge dimensions and six categories of the cognitive process dimension, which are important aspects for learning. Statements were constructed in such a way that they emphasised the more abstract levels of knowledge, i.e. conceptual and procedural knowledge, and those cognitive processes that enhance transfer of knowledge, i.e. understanding, applying, analysing, evaluating and creating. With this, an

attempt was made to maximally promote transfer of knowledge to new situations, and meaningful learning, thinking and problem solving (Anderson and Krathwohl, 2001). In this way, factors that influence nurses' and nursing assistants' current behaviour were positively affected and consequently behaviour change was stimulated. The researchers agreed to dichotomise the response option to a single statement (de Vet et al., 2011) as true or false (de Gruijter, 2008). All answers were based on literature and therefore formulated as absolutely true or false. Because the literature was not always consistent with situations in daily nursing practice, one could argue that some answers were not always absolutely true or false. By formulating answers as absolute, we aimed to stimulate discussion and self-reflection (Anderson and Krathwohl, 2001).

The researchers formulated statements and these were discussed until consensus was reached on content and objective. The outcome was a full set of statements, which was a depiction of the list of themes about nursing nutritional care for older adults.

2.3.3. Step 3: content validity and language

The aim of this step was to assess content validity and language of the statements and come to reduction of statements in two Delphi rounds. The outcome was a final selection of statements, which adequately represents nursing nutritional care (Terwee et al., 2018; de Vet et al., 2011). In the first round, experts were contacted for participation. These were older adults and professionals working in clinical practice, research or education and with expertise regarding nutrition and nutritional care for older adults in hospital and home care. The experts were independently asked to rate relevance and comprehensiveness of the statements (Lynn, 1986; Polit et al., 2007) by email. The experts appraised the relevance on a 4-point Likert scale (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant). They evaluated comprehensiveness by assessing whether the statements comprised the assumed construct (yes/no) (de Vet et al., 2011). In addition, experts were requested to assess clarity of language (yes/no) (Fowler, 2013). The Item-level Content Validity Index (I-CVI) was computed for each statement to assess the proportion in agreement about relevance. A priori it was decided that statements with an I-CVI ≥ 0.78 were determined relevant (Polit et al., 2007) and included in the second round. Data were analysed using SPSS version 25.0 (IBM Corp.,

Development of statements and corresponding explanations

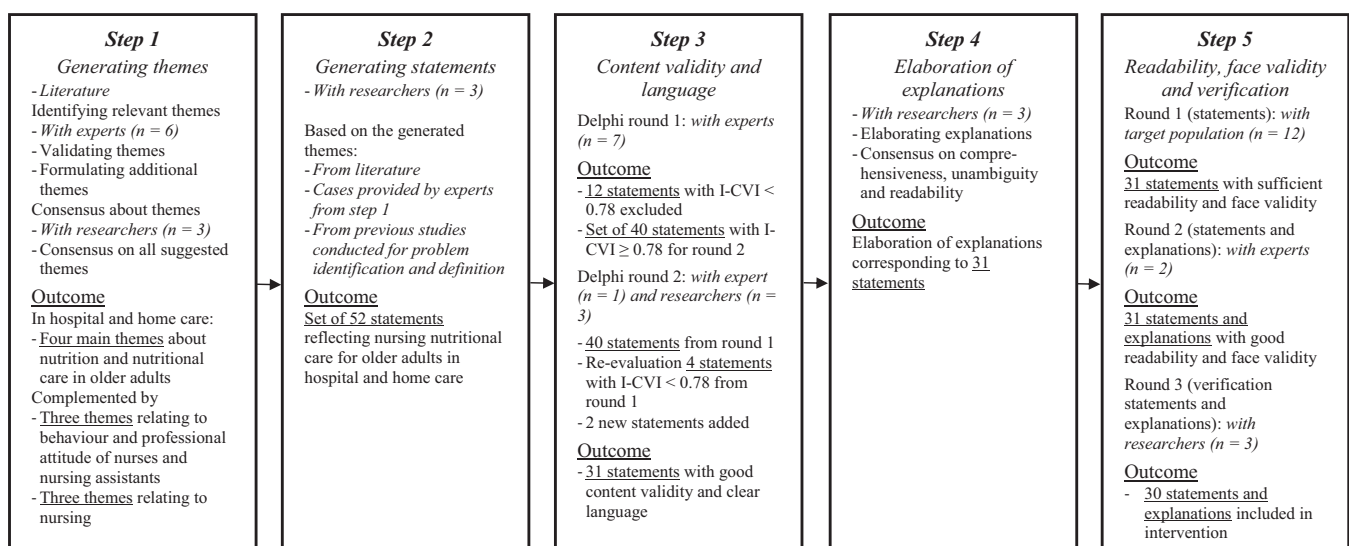


Fig. 1. Development of the statements and corresponding explanations for the educational intervention.

Armonk, NY). Statements were considered comprehensive and written in clear language when at least 70 % of the experts agreed with the assumed construct and that the statements were written in clear language respectively. Statements were not yet excluded when these were considered incomprehensive and not written in clear in language (<70 % agreement), but were re-evaluated in the next round. In addition, experts were able to add new statements.

In the second round, a face-to-face consensus meeting was organised with three researchers (DtC, JD, LvV) and all the experts from the first round (step 3) were invited to participate. The goal of this meeting was to (re-)evaluate all statements which were judged in the first round with an I-CVI ≥ 0.78 on relevance, comprehensiveness, clear language, and potentially add new statements. Another goal was to confirm that the total number of statements proportionally represented the themes and sub-themes. All statements, including potentially new statements, were judged relevant when the statements had I-CVI values of 0.78 and higher. The statements were considered comprehensive and written in clear language when at least 70 % of the experts and researchers agreed. This resulted in a set of statements, which showed good content validity, clear wording (de Vet et al., 2011) and was based on the themes about nursing nutritional care for older adults from step 1.

2.3.4. Step 4: elaboration of explanations

The goal was to provide an explanation for each statement. Three researchers each formulated explanations related to a number of statements and underpinned the explanations by using leading guidelines, reference books and scientific articles. Consistent with microlearning, the essence of each explanation should be presented in a maximum of eight sentences, so that it could be read in approximately 3 min. Every explanation was subsequently reviewed by the two other researchers. Next, the three researchers discussed all explanations and consensus was reached on comprehensiveness (yes/no), unambiguity (yes/no) and readability (yes/no) (Fowler, 2013; de Vet et al., 2011).

2.3.5. Step 5: readability, face validity and verification

The purpose of this step was to assess readability and face validity of the statements and explanations and to verify these to establish a final set (Fowler, 2013; de Vet et al., 2011). First, nurses and nursing assistants working with older adults were approached by email and asked to answer the statements using SurveyMonkey (SurveyMonkey Inc., San Mateo, California, USA). Furthermore, they were asked if the statements were readable (yes/no) and if all the statements covered nursing nutritional care for older adults (10-point Likert scale; 1 = totally unsuitable and 10 = totally suitable). Coverage was assessed to be acceptable when the score was ≥ 5.5 (Dikken et al., 2015). Second, two experts with work experience in healthcare, research and education, were asked if the statements and explanations were comprehensive (yes/no), unambiguous (yes/no) and readable (yes/no) (Fowler, 2013; de Vet et al., 2011).

Third, three researchers (DtC, JD, LvV) verified the statements and corresponding explanations, which resulted in a final set of statements and explanations. To determine the relevance of the whole set of statements, the Scale Content Validity Index (S-CVI/Ave), was evaluated by one researcher (DtC). The S-CVI/Ave was calculated by averaging I-CVI across statements derived in step 3. We considered the whole set of statements as having excellent content validity, when each statement had an I-CVI of ≥ 0.78 and the whole set a S-CVI/Ave of ≥ 0.90 (Polit et al., 2007). Based on the proportion well-answered statements by the nurses and nursing assistants, the statements were divided into easy (proportion ≥ 0.83), moderate (proportion between 0.5 and 0.83) and difficult (proportion ≤ 0.5).

This study was approved by the Medical Research Ethics Committee of the University Medical Center Utrecht, the Netherlands (18-236/C). In all phases of the study, the experts gave implied consent by sending their input to the researchers after being informed completely (Fowler, 2013).

3. Results

3.1. Features of the educational intervention

The content of the microlearning intervention consisted of 30 statements and corresponding explanations about nursing nutritional care for older adults in hospital and home care. The intervention was delivered by a company providing an online platform to certify healthcare professionals (Redgrasp B.V., Utrecht, the Netherlands) (provider, mode of delivery). Teams of hospital and home care nurses and nursing assistants participated in the intervention (setting, recipient). Each participant individually received one statement per day by email from the online platform and was then redirected to the platform to receive the right answer and corresponding explanation along with positive rewards expressed in points. The intervention was delivered in a snack-sized way, this means one statement per day, five times a week in a time frame of six weeks (intensity, duration). A detailed overview of the seven features of our intervention is presented in Table 2.

3.2. Design of the intervention content

3.2.1. Step 1: generating themes

First, themes about nutrition and nursing nutritional care were extracted from six guidelines, three reference books and fourteen scientific articles. The references of this literature can be found in Supplementary material 2. This led to the formulation of four main themes: 1) normal nutrition; 2) nutrition and disease; 3) food preferences and eating behaviour; and 4) cultural and social influences, and including sub-themes.

Second, six experts participated, i.e. a nurse specialist in clinical geriatrics, a clinical geriatrician/professor in clinical geriatrics, three researchers/lecturers with either a nursing background in hospital or home care, or background in nutrition science and a representative of the local Network Care for Older Adults. The experts suggested adding nine new sub-themes to the themes and sub-themes. The experts ranked the theme ‘nutrition and disease’ and particularly the sub-theme ‘malnutrition’ the highest. They suggested three general themes in nursing and three themes relating to behaviour and professional attitude of nurses and nursing assistants regarding nutritional care for older

Table 2
Overview of the features of the microlearning intervention.

Intervention feature	Information
Content	<i>Material:</i> 30 statements and corresponding explanations about nursing nutritional care for older adults in hospital and home care <i>Procedure:</i> A statement was sent by email (Today's question). Each participant read the statement and answered if the statement was true or false by clicking on the appropriate button. Then, the participant was redirected to the online platform where the right answer and corresponding explanation was given. In addition, a link to background literature about the topic was given. Also, a participant received information about the average response of all participants on the statement and an individual total response score for all statements answered until that time point. If desired, a participant could contribute to the discussion forum
Provider	Redgrasp company
Mode of delivery	Digitally by email and subsequently redirection to the online platform (individual)
Setting	Hospital and home care
Recipients	Established teams of hospital and home care nurses and nursing assistants in the Netherlands
Intensity	Snack sized: five times a week, one statement on each weekday. For each statement, the total time investment of reading and answering the statement and reading the corresponding explanation was approximately 3 min
Duration	Total time frame of six weeks

adults.

Third, the researchers included the experts' suggestions in the overview of themes. They reformulated or added some words and agreed with the ranking of the themes as suggested by the experts. Also, they verified the nursing themes with nursing frameworks and theories (International Council of Nurses, 2008; Orlando, 1990; Schuurmans, 2012; Sherman and Pross, 2010; World Health Organization, 2002). The experts approved with the updated list of themes. This resulted in a final overview of themes reflecting nursing nutritional care for older adults in hospital and home care (Fig. 2).

3.2.2. Step 2: generating statements

In total, 52 statements were generated (see Table II in Supplementary material 2). The original statements were written in the Dutch language. Themes were weighted (de Vet et al., 2011) based on ranking of the themes as indicated by the experts in step 1 (Fig. 3).

3.2.3. Step 3: content validity and language

In the first round, seven experts participated. They judged 40 out of 52 statements as relevant ($I-CVI \geq 0.78$), which were included in the second round and they did not add new statements (Fig. 3 and see Table II in Supplementary material 2). In the second round, the expert who is a researcher and lecturer with a background in nutrition science and three researchers assessed 40 statements from round 1, re-evaluated four statements and added two new statements (total of 46 statements). They excluded 15 statements and reached consensus for 31 statements on relevance, comprehensiveness and clear language. They considered that the themes and sub-themes about nursing nutritional care were reflected solidly in the statements (Fig. 3 and see Table III in Supplementary material 2).

3.2.4. Step 4: elaboration of explanations

The three researchers formulated explanations relating to 31 statements, which were written in Dutch. Next, they reached consensus on comprehensiveness, unambiguity and readability for all explanations.

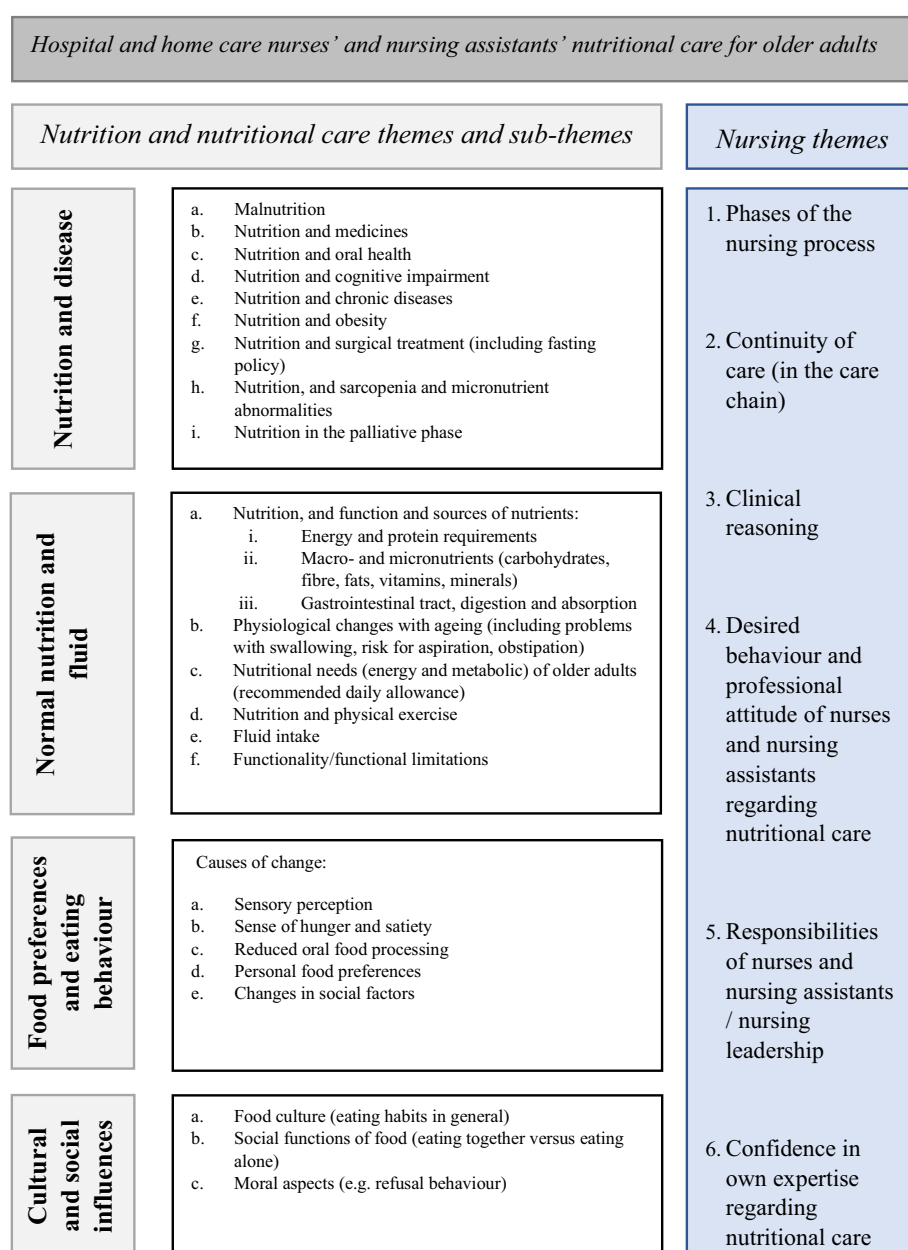


Fig. 2. Overview of the themes and sub-themes about hospital and home care nurses' and nursing assistants' nutritional care for older adults (step 1).

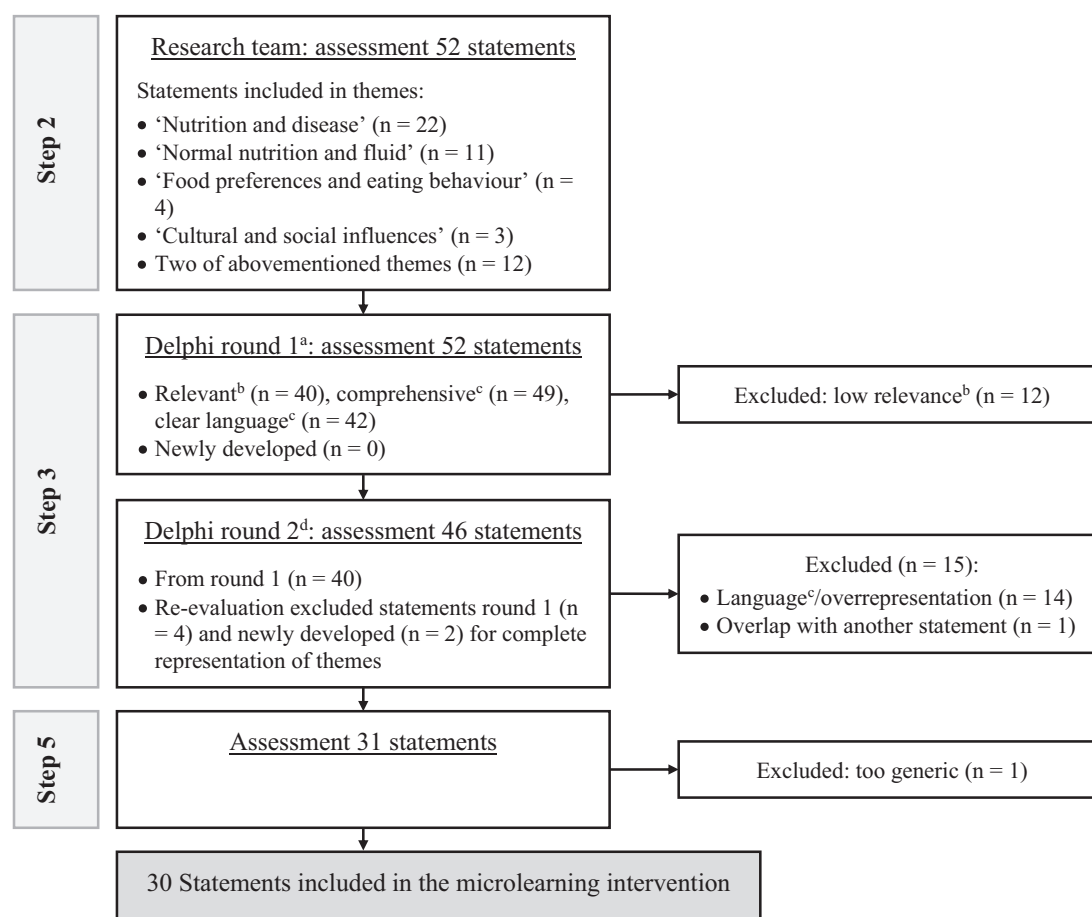


Fig. 3. Flow diagram of the process of including and excluding statements of the microlearning intervention (steps 2, 3 and 5).

^aSeven experts (of whom four also participated in step 1) participated: a nurse specialist in clinical geriatrics, a clinical geriatrician/professor in clinical geriatrics, two researchers/lecturers with either a nursing background in the home care setting or background in nutrition science, one nurse specialist in geriatrics working in primary care and two older adults.

^bStatements with I-CVI ≥ 0.78 were determined relevant (I-CVI = Item-level Content Validity Index: the proportion in agreement about relevance (Polit et al., 2007)).

^cStatements were comprehensive and written in clear language when at least 70 % of the experts agreed.

^dOne expert (who also participated in step 1 and step 2, round 1) who is a researcher/lecturer with a background in nutrition science and three researchers participated.

An example is displayed in Table 3.

3.2.5. Step 5: readability, face validity and verification

First, twelve nurses and nursing assistants filled in the 31 statements and the mean score of right answers was 20.5 (range 15–27). They considered the statements readable and acceptable with a mean score of 6.8 (range 1–10). Second, the two experts, who were a researcher/

Table 3

Example of a statement with corresponding explanation^a (step 4).

Statement	Explanation
It is the task of the nurse to facilitate dietary preferences (e.g. halal, kosher, vegan)	The nursing profession aims at promoting well-being and health of the care recipient. This takes into account personal factors, wishes and needs. Food preferences have a significant impact on food choice, which in turn determines dietary intake. If an older care recipient has a specific diet (e.g. halal, kosher, vegan) and this diet is not available, it is likely that an older care recipient will have insufficient dietary intake. To read more about food preferences, read here.

^a The original statement and explanation are written in the Dutch language.

lecturer with a background in nursing and a medical doctor with teaching experience, assessed that the statements and explanations were comprehensive, unambiguous and readable. This validation of the nurses, nursing assistants and experts did not lead to changes in the statements and explanations.

Third, the researchers deleted one statement, which they considered too generic and wide in scope. A total of 30 statements and corresponding explanations were included in our intervention. The relevance of the total set of 30 statements was established as excellent with S-CVI/Ave of 0.97. Based on the proportion well-answered statements by the twelve nurses and nursing assistants, eleven statements were regarded as easy, twelve statements as moderate and seven statements as difficult. In sequencing the statements, we built up complexity from easy to moderate to difficult twice for statements 1 till 15 (1 till 5: easy, 6 till 10: moderate, 11 till 15: difficult) and statements 16 till 30 (16 till 21: easy, 22 till 28: moderate, 29 and 30: difficult). The rationale was to stimulate continuous learning and support motivation over the period of six weeks (Bates, 2004; Chiaburu and Tekleab, 2005; Holton and Baldwin, 2003). The 30 statements can be found in Table 4.

4. Discussion

In this study, we described the evidence-based development of a

Table 4
Statements about nurses' and nursing assistants' nutritional care for older adults.

No.	Difficulty ^a	Statement in English language ^b
1.	Easy	For a nurse/nursing assistant, an important intervention is always to monitor what and how much a frail older care recipient has eaten (T)
2.	Easy	Screening for malnutrition is usually not necessary, because malnutrition is clearly visible based on the observation of the nurse/nursing assistant (F)
3.	Easy	It is the task of the nurse/nursing assistant to set up the environment in such a way that the older care recipient can eat well (T)
4.	Easy	At admission/intake, nurses/nursing assistants must provide information to older care recipients about the importance of protein intake through normal food (T)
5.	Easy	As a nurse/nursing assistant, you barely have influence on changing eating patterns resulting from a form of dementia (F)
6.	Moderate	During the anamnesis/intake, it is undesirable to ask supplementary questions about personal eating habits and food preferences, because it compromises the older care recipient's privacy (F)
7.	Moderate	The best way of screening for malnutrition is to keep checking with the older care recipient himself/herself if he/she has lost weight in the past month (F)
8.	Moderate	It is good to advise a malnourished older adult on a protein-enriched diet to exercise less to prevent weight loss (F)
9.	Moderate	When an obese older care recipient is depressed, it is important to treat the depression prior to discussing the eating pattern (F)
10.	Moderate	It is primarily the dietitian's job to prescribe interventions for malnutrition (F)
11.	Difficult	It is the task of the nurse to facilitate dietary preferences (e.g. halal, kosher, vegan) (T)
12.	Difficult	When it has been determined that an older adult is malnourished, the first priority is to start with energy- and protein-enriched drinks (F)
13.	Difficult	The older care recipient always carries prime responsibility for his/her nutrition (F)
14.	Difficult	Older people chew less well than younger people, causing them to feel saturation earlier (T)
15.	Difficult	It is important to let older care recipients take their medicines with a glass of water before meals (F)
16.	Easy	Physical recovery following hospital treatment is more important than sufficient dietary intake (F)
17.	Easy	An older care recipient eats less when a nurse/nursing assistant is present at the scene, because this disturbs the older care recipient in his/her eating ritual (F)
18.	Easy	In older care recipients of, for example, Turkish or Moroccan descent, providing information about medication is more important than about nutrition, because they are by nature susceptible to type 2 diabetes mellitus (F)
19.	Easy	Only when there is weight loss can we speak of malnutrition (F)
20.	Easy	It is the task of the nurse/nursing assistant to stimulate a single older care recipient to eat together, for example, with family, friends or at an association (T)
21.	Easy	In the hospital, the food is always balanced and healthy, which makes the risk for malnutrition smaller than in the home situation (F)
22.	Moderate	When an older care recipient is malnourished, it is important to recommend sweet snacks, as desired, so that they at least consume something (F)
23.	Moderate	Measuring the albumin blood level is the most reliable method to identify malnutrition (F)
24.	Moderate	It is conducive to the general health of an older adult with a BMI > 25 kg/m ² that he/she loses 5 kg of weight in a short period of time due to disease (F)
25.	Moderate	The main cause of malnutrition is poor oral health (F)
26.	Moderate	Also in the palliative phase it is important for older care recipients to maintain current dietary restrictions to ensure that this situation will not be worsened (F)
27.	Moderate	It is important always to follow the protocol to keep older care recipients fasting before surgery (F)
28.	Moderate	It is desirable for the older care recipient to eat a full meal three times a day to prevent insufficient dietary intake (F)
29.	Difficult	Because the sense of smell and taste diminishes in older adults, they can enjoy food less (F)
30.	Difficult	Older people should drink more than younger people, among other things, because it reduces the risk of constipation (T)

T = true; F = false.

^a Difficulty of statements was set at: easy (proportion well-answered statements ≥ 0.83), moderate (proportion well-answered statements between 0.5 and 0.83) and difficult (proportion well-answered statements ≤ 0.5).

^b The original statements are written in the Dutch language. The statements were translated into English according to the back-translation procedure (Brislin, 1970; Manesriwongul and Dixon, 2004).

microlearning intervention for hospital and home care nurses and nursing assistants to promote behaviour change by affecting factors that influence their current behaviour in nutritional care for older adults. The intervention includes a total of 30 statements and corresponding explanations about nursing nutritional care for older adults in the hospital and home care setting. These statements can be presented to hospital and home care nurses and nursing assistants in a snack-sized way, this means one statement daily, five times a week for a total duration of six weeks through an online platform.

We considered a number of key principles to facilitate learning and learning support important to provide a well-founded basis for our microlearning intervention (Bates, 2004; Chiaburu and Tekleab, 2005; Holton and Baldwin, 2003). One of the most important of these was incorporation of different levels of learning for statement development to stimulate active learning and deep understanding (Anderson and Krathwohl, 2001). The foundation of these levels of learning was also covered in other educational interventions for nurses about nutritional care for older adults with different didactic approaches (Arroyo et al., 2008; Berggren et al., 2016; Silver et al., 2018). Mainly, we put strong emphasis on strengthening of self-reflection by formulating answers as absolute (Anderson and Krathwohl, 2001). Reflection is a key ingredient of effective learning, but not always integrated in learning material leading to failure in learning (Edwards et al., 2013). Also, with the statements, we had a particular focus on targeting conceptual and procedural knowledge and cognitive processes that enhance transfer of knowledge (Anderson and Krathwohl, 2001). To our knowledge, generating statements based on this principle to encourage learning instead of using for example for assessment to test knowledge is a relatively new approach.

In our intervention, we focussed on impacting nurses' and nursing assistants' behaviour. From previous studies, it was evident that behaviour change was essential (Bassola et al., 2020; ten Cate et al., 2021a, b; Ziyilan et al., 2015). Targeting behaviour change through education was also integrated in multicomponent interventions, which were developed to improve multiple outcomes in multidisciplinary nutritional care (Bell et al., 2014; Keller et al., 2017; Laur and Keller, 2015). These are complex interventions that clearly reflect how challenging the provision of good nutritional care to older adults on a daily basis is. However, although these interventions are well developed, the downside is that with these interventions too many aspects may be tackled simultaneously, potentially leading to lack of impact (Craig et al., 2008; Michie et al., 2014). In our decision-making process, we made the choice to only address behavioral aspects, which in itself is already complex (Michie et al., 2011; Michie et al., 2014) and particularly, because we selected multiple factors that influence behaviour. Although education is a sufficient way to target behaviour, other interventions, such as involving role models and receiving audit and feedback on nutritional care practices are important as well (Laur et al., 2015; Michie et al., 2014). Also, despite the fact that nutritional care provided to older adults mainly requires a multidisciplinary approach (Volkert et al., 2022), we only targeted nursing professionals. For an optimal approach, changing nurses' and nursing assistants' behaviour by affecting factors that influence their current behaviour in nutritional care for older adults was a prerequisite (Michie et al., 2014) before dealing with additional significant issues to optimise nutritional care.

In an extensive process, we developed our microlearning intervention systematically and replicable, taking into account its users, i.e. nurses and nursing assistants, and the context of the hospital and home care setting. Furthermore, we incorporated constant discussion loops

with important stakeholders ensuring validation and transparently reported the development process. In addition, essential nursing care and in particular nursing nutritional care is still mainly characterised by sparsity of evidence and devaluation of this care (Richards et al., 2018; Zwakhalen et al., 2018). With our intervention, we may contribute to better appreciation and subsequently enhancement and sustainability of this significant and key part of nursing.

4.1. Strengths and limitations

This study has several strengths. To thoroughly study intervention development from different perspectives and to maximise the chance of a good fit between the intervention with its users, we involved various stakeholders including experts and most importantly the end users (Bleijenberg et al., 2018; Craig et al., 2008). Also, the intervention was based on a multi-methods approach using literature and expert input providing data triangulation and ensuring a solid evidence base for the intervention (Craig et al., 2008; Hesse-Biber and Johnson, 2015; Polit and Beck, 2017). Another strength is that we took the hospital and home care context of the intervention into account. This may increase the likelihood of successful implementation in the daily workplace of hospital and home care nurses and nursing assistants where they provide complex care to several care recipients concurrently (Aiken et al., 2013; Bleijenberg et al., 2018; Michie et al., 2014).

There are also some limitations to discuss. First, although we aimed to constantly involve hospital and home care nurses in the intervention development process, we did not achieve this for all steps. Although we assume that we have received sufficient input from nurses and nursing assistants, this may have led to some missing information. Second, we used a convenience sample for including nurses, nursing assistants, older adults, experts and other healthcare professionals involved in nutritional care in the development process. This may be a limiting factor due to probability of including participants who were unrepresentative of the population (Polit and Beck, 2017). However, inclusion of our participants was based on accurate judgement of several members of the research team.

4.2. Future research

Future research should include a feasibility study (Craig et al., 2008) to assess the feasibility of our educational intervention in the daily work practice of its users, i.e. hospital and home care nurses and nursing assistants. In a subsequent phase of the development and evaluation process, it should be considered if the intervention development needs refinement or if the pilot, evaluation and/or implementation phase can be initiated (Craig et al., 2008; Skivington et al., 2021).

4.3. Implications for researchers and intervention developers

The results of our study can be used by researchers and intervention developers in two ways. First, the actual content may be of interest for educational development projects. Researchers and intervention developers should be aware on which theory and evidence our intervention is based, who the end users are and in which context the intervention was built. It should be considered that a mismatch on one or more of these elements may reduce the likelihood of success (Bleijenberg et al., 2018; Craig et al., 2008). Second, the systematic approach and complete description of the process of our intervention development enhancing replication may constitute an example for building well-founded educational interventions. Besides, it may illustrate how to contribute to increasing quality of evidence in the complex area of behaviour change within essential nursing care (Bleijenberg et al., 2018; Craig et al., 2008; Richards and Borglin, 2011). In the development of future educational interventions, it is important to make appropriate methodological choices, including anticipation of subsequent phases, such as piloting, evaluation and implementation, and estimate what is

specifically needed to improve the intervention (Craig et al., 2008; Skivington et al., 2021).

5. Conclusions

In this study, we extensively and transparently presented the robust development of a microlearning intervention for hospital and home care nurses and nursing assistants. The intervention is provided by an online platform, over time and integrated in their workplace. The intervention includes a total of 30 statements, which nurses and nursing assistants are asked to confirm or reject, followed by corresponding explanations about nursing nutritional care for older adults. The intervention can be provided in a snack-sized way, where one statement is presented every day for five times a week over a total period of six weeks. The intervention development is an important first step to eventually make an essential contribution to improve nursing nutritional care to enhance well-being, health and adequate dietary intake of older adults.

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CRediT authorship contribution statement

Debbie ten Cate: Conceptualization, Funding acquisition, Data curation, Investigation, Methodology, Project administration, Resources, Writing – original draft. **Jeroen Dikken:** Conceptualization, Funding acquisition, Investigation, Methodology, Resources, Supervision, Validation, Writing – review & editing. **Roelof G.A. Ettema:** Methodology, Supervision, Validation, Writing – review & editing. **Lisette Schoonhoven:** Methodology, Supervision, Validation, Writing – review & editing. **Marieke J. Schuurmans:** Conceptualization, Funding acquisition, Methodology, Supervision, Validation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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