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## Original Article

# Dietitians' experiences of nutrition assessment via TeleNutrition: “Video-calls are better than phone-calls, but it's probably difficult for patients to show their ankles on the screen”

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## SUMMARY

**Background & Aims:** Nutrition assessment is integral to dietetic practice. TeleNutrition enabled dietitians to continue nutrition care provision during the COVID-19 pandemic but created challenges with undertaking nutrition assessment. The aim of the present study was to describe how dietitians in three Nordic countries perceived their nutrition assessment practice when physically distant from patients.

**Methods:** The present study is a sub-analysis from one research project undertaken by the Global TeleNutrition Consortium, GTNC. Data was generated from a digital survey of a convenience sample of dietitians in Denmark, Norway, and Sweden who had a minimum of one adult patient interaction per week, distributed through the dietetic professional and/or regulatory bodies of each country, as well as closed social networks. Data from free-text questions were assessed using thematic analysis where the construction of final themes were guided by the Technology Acceptance Model (TAM).

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<sup>#</sup> Global TeleNutrition Consortium (GTNC), <https://globaltelenutrition.org/>.

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**Results:** In total, 146 dietitians participated in the study (Denmark 16%, Norway 34%, and Sweden 50%). The qualitative analysis of answers from 24 free-text questions resulted in four themes (key constructs) related to dietitians' experience of performing nutrition assessment using TeleNutrition: *Perceived usefulness*, *Perceived ease of use*, *Perceived barriers*, and *Perceived facilitators*. Each theme was divided into two to three sub-themes (explanatory dimensions).

**Conclusions:** To best support dietitians in the new era of healthcare digitalisation, internationally accepted standards or protocols for performing nutrition assessment using TeleNutrition ought to be established. This is especially critical for nutrition assessment measures that require physical examination.

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## 1. Introduction

Digitalisation and the use of information and communication technology (ICT) in healthcare is an area of steady evolution with the main aim to improve patient experience and care [1]. The COVID-19 pandemic forced the use of digital solutions to the extreme as healthcare professionals were required to deliver care in a manner that limited virus-spread and, therefore, kept patients safe. Healthcare shifted from in-person interactions to meeting patients using digital solutions. This enforced use of Telemedicine enhanced user confidence and satisfaction, and led to an increased preference of both healthcare professionals and patients for the ongoing use of Telemedicine [2]. With continued use of digitalisation and ICT within healthcare, there is an urgent need to share perspectives and lessons learned from experiences with Telemedicine after the COVID-19 pandemic to enhance its utility and effectiveness.

The Nutrition Care Process (NCP) is an internationally recognized, systemised framework that dietitians use to provide nutrition care. The first step, nutrition assessment and reassessment, requires the dietitian to gather and assess information from a range of different sources e.g., the patient, medical record, and other healthcare professionals [3]. Anthropometric measures such as body weight and height are central to the nutrition assessment step. In many countries, the dietitian also performs physical examination of body composition, where the dietitian looks for nutrition-related physical signs and symptoms of deficiency by a head-to-toe examination [4]. This typically includes assessment of muscle mass and quality, subcutaneous fat stores, and oedema or ascites [4] and is a core component of malnutrition assessment and diagnosis tools such as the Subjective Global Assessment (SGA), patient generated SGA (PG-SGA), and the Global Leadership Initiative on Malnutrition (GLIM) [5–7].

Based on the World Health Organization (WHO) definition of Telemedicine [8], TeleNutrition can be defined as: “*the use of different modes of communication to deliver nutrition care service at a distance*”. At the onset of the COVID-19 pandemic, dietitians use of digital solutions for nutrition assessment and intervention increased considerably [9,10]. Hence, many dietitians transferred all or part of their practice to a TeleNutrition setting. Consequently, nutrition assessment had to be adapted accordingly, and anecdotally constituted a barrier for many dietitians [9,11,12]. Even though practice tips and guidelines for TeleNutrition have now been suggested [13–15], there are no internationally accepted standards or protocols for performing nutrition assessment when the patient and dietitian are not in the same room. As a response to the sudden change in dietetic practice and recognising the need to evolve and develop TeleNutrition practices, the Global TeleNutrition Consortium (GTNC) was established. GTNC represents different countries around the world and has initiated two international projects that focus on remote nutrition screening and assessment practices. In the present sub-study of

data from the GTNC, the aim was to describe how dietitians in three Nordic countries perceived their nutrition assessment practice when physically distant from their patients.

## 2. Materials and methods

### 2.1. Setting

This study was conducted in Denmark, Norway, and Sweden between August 2021 and November 2021. At the time of the study, the COVID-19 pandemic had required altered healthcare provision in each country with a greater focus on delivering care from a distance, e.g., with the use of TeleNutrition.

All three countries have adequate infrastructure for digitalisation. Recent data from the statistical office of the European Union, Eurostat, showed that more than 94% of households in these countries had internet access, with the majority having broadband access (>90%) and access to a computer (>92%) [16].

### 2.2. Study design and recruitment

This study adopted a qualitative study design approach on a subset of data from a larger international survey, developed by a subgroup of GTNC members. The final survey was established through consensus, considering differences in terminology and concepts between countries and tested for comprehension and timing with experienced dietitians in each country. The digital survey was hosted on Nettskjema, an online survey platform designed by the University Information Technology Center (USIT) at the University of Oslo, Norway (<https://nettskjema.no/>). National language surveys were distributed through the dietetic professional and/or regulatory bodies of each country (Table 1). In addition, social media networks specific to dietitians were used to ensure that non-member practising dietitians had the opportunity to participate, that is, non-members of these associations, but dietitians that meet country-specific requirements to practice. The aim was to reach as many practicing dietitians as possible in each country.

### 2.3. Participants

Participants of the present study consisted of a convenience sample of dietitians in Denmark, Norway, and Sweden who had a minimum of one adult patient interaction per week. Dietitians within diverse clinical practice facilities were included i.e., hospitals, clinics, assisted living, long-term care, community, home visits, and residential care, as well as all care settings i.e., inpatient, outpatient, ambulatory, and private.

**Table 1**

Survey distribution and number of possible survey recipients in each country (Denmark, Norway, and Sweden) during the fall of 2021.

Denmark	
The Danish Society of Clinical Dietitians closed Facebook group	appr. 1.000 members
Norway	
The Norwegian Association of Clinical Dietitians affiliated with The Norwegian Association of Researchers e-mail list and closed Facebook group	appr. 500 members
Sweden (the three sources have overlapping members)	
The Swedish Association of Clinical Dietitians	appr. 1.300 members
Closed Facebook group for dietitians	appr. 1.100 dietitians
E-mail list dietitians within community	appr. 100 dietitians

## 2.4. Data collection

The survey was divided into three sections: (i) Nutrition assessment when dietitians are not in the same room as their patient; (ii) Demographic information of participants; and (iii) Information regarding the participants professional practice setting. The survey included questions of the following styles: yes/no, select all that apply, and free-text boxes.

The present study focused on the free-text answers from section (i), with data from sections (ii) and (iii) used to provide participants' background information. Most of the free-text questions followed the same principle: asking what had or had not worked in practice when using TeleNutrition for various components of nutrition assessment (anthropometry, nutritional intake, nutrition impact symptoms, muscle mass, fat stores, fluid status, nutritional deficiency indicators, performance/functional capacity, metabolic demands, other parameters) and why. General free-text questions on experiences of using TeleNutrition in performing nutrition assessment were also asked.

## 2.5. Theoretical model

As dietitians adapted their practice and methods simultaneously with the progression of the pandemic, there are lessons to be learned from these end-users that can inform digitalisation and ICT in healthcare. To understand reasons for accepting or rejecting ICT use and to describe end-users' behaviour toward ICT, the Technology Acceptance Model (TAM) has previously been applied [17]. First developed by Davis *et al.* in the 1980's [18,19], the model has since been modified and utilized in a diverse number of settings. It has also proved useful to understand ICT use in healthcare [20]. In TAM, two main key constructs are present: *perceived ease of use* and *perceived usefulness*, that in themselves determine the *attitude* towards using ICT [18,19]. Attitude influences the *intention* to use ICT which is said to predict *actual* use. The relationship between these constructs is not streamlined but instead intertwined. For instance, *perceived usefulness* is said to have a direct impact on *intention* to use ICT without taking the route via *attitude* towards using ICT. Understanding the key constructs of *perceived ease of use* and *perceived usefulness* of TeleNutrition for nutrition assessment is a critical step towards learning how dietitians can best be supported to deliver high-quality nutrition care from a distance.

## 2.6. Qualitative analysis

The free-text questions from the surveys were analysed with a qualitative approach using thematic analysis [21]. As the data were retrieved from three countries, one author started the analysis using country specific language data. The data were read repeatedly to get an overview and to ensure familiarisation. Data of analytic interest to the study aim were then labelled with a word or a sentence (in English) describing the core essence (code). Codes describing a similar phenomenon were combined (sub-themes). This process was then repeated for the other two countries. Finally, the full transcript was analysed for compatibility. This was possible due to the similarities in languages between the three countries.

The sub-themes were reviewed and refined in a back-and-forth process between the different steps of the analysis allowing for between country similarities and differences. In a final step, the sub-themes were organised into groups (themes) guided by the key constructs described by TAM [18,19]. When generating the schematic model of the themes (key constructs) and their relation to each other, the sub-themes were seen as explanatory dimensions of the key constructs. Examples of the analysis process are shown in [Table 2](#).

## 2.7. Statistical considerations

Descriptive statistics were performed using IBM SPSS statistics version 28 (IBM, Armonk, NY, USA) and were used to present participant background information.

**Table 2**

Overview of the qualitative analysis process of survey data from free-text answers using thematic analysis. Sub-analysis of data from a survey answered by dietitians in Denmark, Norway, and Sweden conducted by the Global TeleNutrition Consortium (GTNC), during the fall of 2021.

Free text answer	Code	Sub-theme	Theme
I experience cognitive problems as the biggest obstacle. If I am to get a complete picture of the patient's (physical, mental, and nutritional) status during a distant meeting, the meeting will be very long.	Struggle – cognitive issues	Challenge for some patients when doing TeleNutrition assessments	Perceived barriers
Most are 80+ years old and know nothing about digital tools. Most want phone calls or physical visits.	Struggle – older patient		
It does not work to ask the patient to state a weight via telephone or digital meeting... when, for example, they suffer from dementia.	Struggle – dementia		
If the patient has bad hearing, the quality of the conversation may deteriorate.	Struggle – hearing	TeleNutrition can create relational distance with the patient	
It can sometimes be experienced as more difficult to create a relationship with the patient over the phone than it is in reality.	Hinders in relation patient - dietitian		
Difficult to capture non-verbal communication and led conversations.	Lacking non-verbal communication		
The patient is not alone at home, children in the same room, for example.	Environmental challenges		

## 2.8. Ethical statement

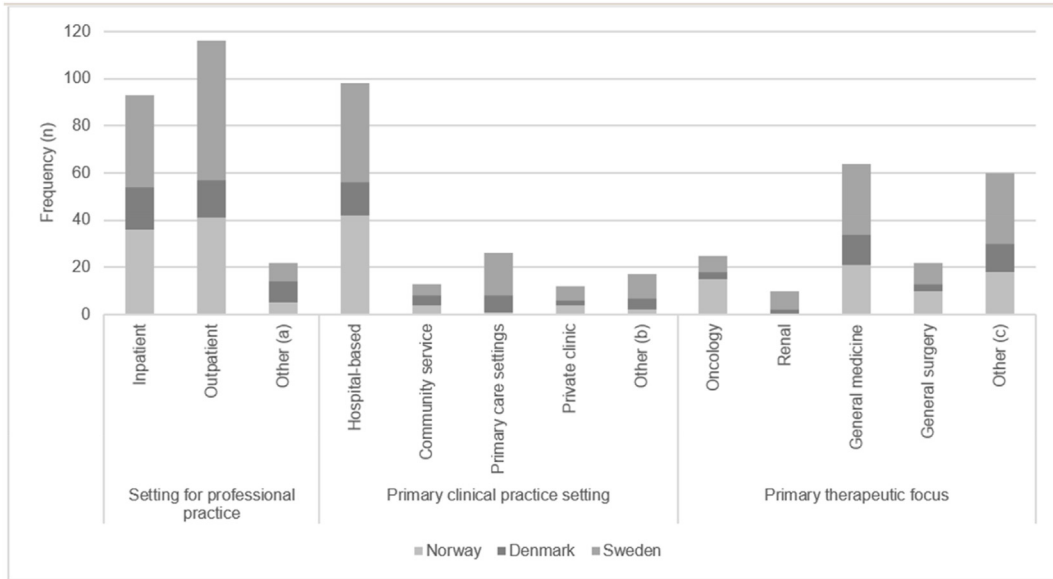
Completion of the survey was voluntary, and participation was anonymous. The participant could stop filling out the survey at any time. No identifying information was collected, and responses were unable to be linked back to any participant by their internet protocol (IP-) address. Consent to participate was provided as part of the online survey. The Ethical Review Authority in Norway and Sweden had no ethical objections to the research study (Norway Application number: 278790; Swedish Dnr 2021–02479). The Ethical Committee in Denmark confirmed that the project did not require an application (LBK nr. 1338 of 01/09/2020).

## 2.9. Research group and researchers' preconceptions

The GTNC is a voluntary, unfunded non-government organization of practising and academic dietitians and physicians from more than ten countries around the world established to facilitate the progression of TeleNutrition practices. The present sub-analysis of data from one GTNC research project was performed by researchers and GTNC members from three Nordic countries. These researchers are dietitians working in higher education and/or in clinical practice. They all have experience in nutrition assessment from research and/or clinical practice.

## 3. Results

In total, 146 dietitians participated in the study after excluding responders who worked in paediatrics ( $n = 6$ ) (Figure 1). Of these, 24 (16%) worked in Denmark, 49 (34%) in Norway, and 73 (50%) in Sweden. Clinical working experience was:  $< 2$  years  $n = 16$  (11%); 2–10 years  $n = 64$  (44%); and  $\geq 10$  years  $n = 65$  (45%).



<sup>a</sup>Other setting for professional practice e.g., home-assisted care

<sup>b</sup>Other primary clinical practice setting e.g., rehabilitation

<sup>c</sup>Other primary therapeutic focus e.g., neurology

**Figure 1.** Participant characteristics (n = 146). Data from a survey answered by dietitians in Denmark, Norway, and Sweden conducted by the Global TeleNutrition Consortium (GTNC), during the fall of 2021. It was possible for respondents to give multiple answers.

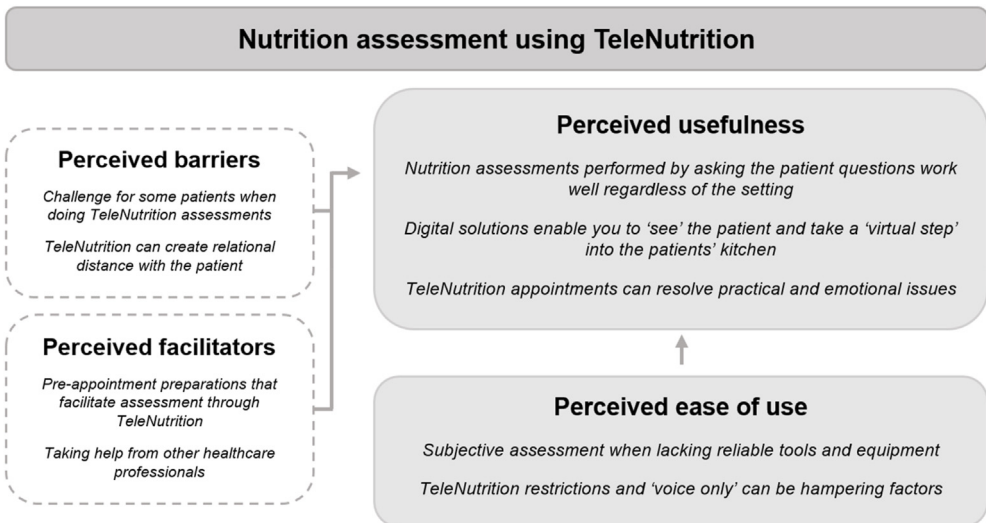
Answers from 24 free-text questions were included in the analysis. Not all dietitians answered all free-text questions in the survey. The number of free-text answers per question ranged from 46 to 6, with questions related to anthropometry and food-intake receiving the highest number of answers and questions related to ‘other parameters’ e.g., respiration, temperature, pulse, received the lowest number of answers. Other questions that were more biased by no-response were those related to muscle mass, fat stores, and nutritional deficiency indicators. Here, some dietitians answered that they did not conduct nutrition assessment of these parameters in their regular clinical practice and reasons stated were limited resources, lack of instruments, or no habitual clinical practice of assessing these parameters.

TeleNutrition practises for nutrition assessment during the COVID-19 pandemic could be described using four themes: *Perceived usefulness*; *Perceived ease of use*; *Perceived barriers*; and *Perceived facilitators*. These themes were further defined using two to three sub-themes each (Figure 2). All sub-themes were identified in responses from each country. Free-text answers illustrating each sub-theme are shown in Table 3.

### 3.1. Perceived usefulness

The dietitians described some benefits when performing parts of the nutrition assessment via TeleNutrition, especially when they were able to use video solutions. TeleNutrition was also highlighted as more practical for some patients. *Perceived usefulness* could be summarised in three sub-themes: *Nutrition assessments performed by asking the patient questions work well regardless of the setting*; *Digital solutions enable you to ‘see’ the patient and take a ‘virtual step’ into the patients’ kitchen*; and *TeleNutrition appointments can resolve practical and emotional issues*.

For most assessment parameters, dietitians stated that information could be gathered by simply asking the patient specific questions. Asking for nutrition impact symptoms and nutrition intake was described as something that was the same, irrespective of performing it distantly or in-person. Some dietitians stated that assessing nutrition intake distantly was something that worked “quick and easy”. For fluid status, dietitians identified that it was often possible to identify if the patient had a dry mouth



**Figure 2.** How dietitians perceived their clinical practice when performing nutrition assessment using TeleNutrition. The figure shows themes (key-constructs) and sub-themes (explanatory dimensions) from the thematic analysis and their relationships, with the use of the technology acceptance model (TAM) as a conceptual framework. Results from a qualitative sub-analysis of data from a survey answered by dietitians in Denmark, Norway, and Sweden conducted by the Global TeleNutrition Consortium (GTNC), during the fall of 2021.

**Table 3**

Free-text answers illustrating each sub-theme. Results from a qualitative sub-analysis of data from a survey answered by dietitians in Denmark, Norway, and Sweden conducted by the Global TeleNutrition Consortium (GTNC), during the fall of 2021.

Theme: Perceived usefulness	
Sub-theme	Free-text answers <sup>a</sup>
Nutrition assessments performed by asking the patient questions work well regardless of the setting	<p>"Roughly the same descriptions [Nutritional intake] from patients during physical and digital visits." (SWE)</p> <p>"You often get a good picture on what the food situation looks like at home if they have difficulty shopping and cooking." (SWE)</p> <p>"I think that eating-related symptoms can be assessed without being in the same room as the patient, as long as we have a good [internet] connection." (NOR)</p> <p>"Dry mouth and colour of urine. This works well because it is easy for the patient to follow." (NOR)</p> <p>"Works well for some, especially those who weigh themselves regularly before. Some have weighed themselves during the meeting." (NOR)</p> <p>"It has worked well, that patients can provide their own weight and weigh themselves in the morning before eating and after going to the toilet." (DNK)</p> <p>"It worked fine in terms of getting a feel for which foods are consumed and in which time periods." (DNK)</p>
Digital solutions enable you to 'see' the patient and take a 'virtual step' into the patients' kitchen	<p>"During a digital meeting, you always see the patient's face, which makes it easier to see the fat layers." (SWE)</p> <p>"On video it can be easier because you can see if the patient e.g., looks thin." (SWE)</p> <p>"It [Nutritional Intake] works as usual, sometimes better if the patient is at home and can read packages/show products." (SWE)</p> <p>"Video-calls are better than phone-calls, but it's probably difficult for patients to show their ankles on the screen." (NOR)</p> <p>"This [Nutritional intake] could possibly be done with a video call." (DNK)</p> <p>"Through video, you can be shown the exact protein drink and what, for example, is in the fridge at home." (DNK)</p>
TeleNutrition appointments can resolve practical and emotional issues	<p>"The patient has been more alert when he has been at home, and I feel that the patient coped with the telephone call better compared to when meeting in the office." (SWE)</p> <p>"Time saving when not having to travel, even if it is not a long distance, many patients have appreciated setting aside an hour via video/phone versus also taking time going to and from the hospital. Easier for them to set time aside, fewer cancellations." (SWE)</p> <p>"Some are so mentally ill that it takes too much of them to show up for the meeting." (NOR)</p> <p>"Patient more comfortable in their own home if intestinal problems" (DNK)</p>
Theme: Perceived ease of use	
Sub-theme	Free-text answers <sup>a</sup>
Subjective assessment when lacking reliable tools and equipment	<p>"The patient can say what weight they want, without it having to be correct. The patient's scale may not work very well." (SWE)</p> <p>"Is a subjective assessment [fluid status] and patients who are used to being swollen may not reflect on whether it is more or less from day to day." (SWE)</p> <p>"Questions about pressure ulcers get subjective answers from the patient which are not always reliable." (SWE)</p> <p>"To assess weight change when you are not in the same room as the patient, you must rely on what the patient states as weight and weight change. There may be a difference between the patient's [self-reported] weight and practice." (NOR)</p> <p>"I find that many patients have difficulty describing their fluid status. They may say they have swollen ankles, but the degree of swollen ankles is difficult to assess without seeing the ankles." (NOR)</p> <p>"However, there is also a risk that they do not provide the correct weight." (DNK)</p> <p>"There are sources of error in weighing if, for example, different scales are used." (DNK)</p>
TeleNutrition restrictions and 'voice only' can be hampering factors	<p>"Taking a food history is very challenging. The support from IT [information technology] at work does not provide the opportunity to share screens and digital tools." (SWE)</p> <p>"In general, not being able to see the patient is a problem, sometimes the weight can be similar, but you see a clear change in the face. Common with e.g., weight change due to fluid retention." (SWE)</p>



**Table 3** (continued)

Theme: Perceived ease of use	
Sub-theme	Free-text answers <sup>a</sup>
	<p>"Sometimes it can be difficult for the patient to explain portion sizes. Over the phone ... they cannot show with their hands how big the portions are, like they can during a physical visit." (SWE)</p> <p>"Missed being able to show products, examples of portion sizes sometimes." (NOR)</p> <p>"I find this difficult to map [Functional capacity] without seeing the patient. The changes can happen gradually and are difficult to understand for many." (NOR)</p> <p>"Muscle mass cannot be assessed when you are not in the same room as the patient. Not sure how to fix this ..." (DNK)</p> <p>"Without video, it is not possible to use a white board to note the food history on, which is used in physical meetings." (DNK)</p>
Theme: Perceived barriers	
Sub-theme	Free-text answers <sup>a</sup>
Challenge for some patients when doing TeleNutrition assessments	<p>"Most are 80+ years old and know nothing about digital tools. Most want phone calls or physical visits." (SWE)</p> <p>"It does not work to ask the patient to state a weight via telephone or digital meeting ... when, for example, they suffer from dementia." (SWE)</p> <p>"There are challenges if the patient has difficulty hearing, or if the patient does not speak Norwegian very well." (NOR)</p> <p>"Not everyone can set a weight correctly." (DNK)</p>
TeleNutrition can create relational distance with the patient	<p>"Phone calls do not allow for the extra time that a meeting in a room does. This means that you can miss things. Can tend to sound more like an interrogation than an interview/dialogue. Perhaps the patient is not as mentally prepared over the phone as during a physical visit." (SWE)</p> <p>"Sometimes it is not the same natural transition to do assessment of the physical body over the phone as during a physical visit." (SWE)</p> <p>"It can sometimes be more difficult to create a relationship with the patient over the phone than in reality." (SWE)</p> <p>"... a lot of noise from surroundings, [the patient] does not pick up the phone. The patients do other things such as pick up from nursery school/sit on the bus." (NOR)</p> <p>"Experience that the patient is 'not fully present' in the conversation or that I am disturbing." (NOR)</p> <p>"In addition, a different relationship is established by physical meeting with the patient versus telephone/video and this can contribute to that patients do not state exactly what they are consuming [food]." (NOR)</p> <p>"If the patients are concerned about something or have doubts, it is easier to ask questions or have a dialogue about it when they are physically present." (DNK)</p>
Theme: Perceived facilitators	
Sub-theme	Free-text answers <sup>a</sup>
Pre-appointment preparations that facilitate assessment through TeleNutrition	<p>"It would be good if more health centres had scales available close to the reception." (SWE)</p> <p>"The patient could take pictures of himself regularly and see differences between the pictures to evaluate fluid retention." (SWE)</p> <p>"Food record was sent prior to consultation, as it gave a better overview of food intake." (NOR)</p> <p>"3-day food records which is received [by patients] through email." (DNK)</p>
Taking help from other healthcare professionals	<p>"I have usually had a nurse physically on site with the patient who performed the anthropometry while I consulted remotely using audio or video." (SWE)</p> <p>"It is no need to meet the patient physically to examine these [Nutritional Deficiency Indicators], it is enough to look at the medical record and assessments done by the physician." (SWE)</p> <p>"At the hospital I work, we use a lot of weight change and BMI [body mass index], as weight history with several measurement points was available in an electronic curve. Very useful if you can't talk to the patient, or the patient is unable to answer questions about weight change." (NOR)</p> <p>"Conversation about intake, possibly blood samples that may show dehydration." (NOR)</p> <p>"I talk to the care provider [Nutritional Intake], and it is not always accurate." (DNK)</p>

<sup>a</sup> Translated to English from country specific language (Danish, Norwegian, or Swedish).

when they were talking, and they could ask patients about their observations of swelling or oedema. Functional ability was generally assessed by asking questions about activities of daily living with a specific focus on the ability to cook and do food shopping. Patients could answer questions about their body weight if they had a scale available at home.

Being able to ‘see’ the patients via video was described as superior to a phone call. Being able to see facial expressions and body language was perceived as useful. Many of the comments made by dietitians were related to specific physical assessments, for example, that video interaction enabled dietitians to do a visual assessment of fat, muscles, and fluid status. Although, as one dietitian stated, “*video-calls are better than phone-calls, but it’s probably difficult for patients to show their ankles on the screen*”. This illustrates that not all components in the physical assessment of body composition are practical via TeleNutrition. For the assessment of nutrition intake, the dietitians perceived it useful to talk with patients at home, as the dietitian was able to gain insight into the patient’s kitchen and pantry. Patients could easily show plates used for eating and specify nutrient content in food products.

*Perceived usefulness* was also described in relation to solving practical and emotional issues for the patient. The dietitians reported that some patients were better able to manage the meeting from home. For example, TeleNutrition helped patients with physical or psychological challenges such as gastrointestinal problems that required patients to be close to a toilet or psychological problems such as a social phobia. For older adults, the dietitians experienced patients being less fatigued when they did not need to manage practical and travel issues related to leaving their home. For younger patients, the dietitians described TeleNutrition as timesaving for the patient as it did not interfere with work to the same extent as in-person meetings. The dietitians themselves also experienced saving time with more effective meetings and fewer missed appointments.

### 3.2. Perceived ease of use

The dietitians described how nutrition assessment performed using TeleNutrition was often conducted using subjective methods, relying on verbal information from the patient and/or visual assessment by the dietitian. The experience was that not all components of the assessments could be done using phone only, and in some cases TeleNutrition restricted the possibility to do nutrition assessment. *Perceived ease of use* was illustrated using two sub-themes: *Subjective assessment when lacking reliable tools and equipment* as well as *TeleNutrition restrictions and ‘voice only’ can be hampering factors*. Both sub-themes described an increased effort when using digital solutions.

With TeleNutrition, the dietitian was fully reliant on the patient’s recall about what they could and wanted to convey. For instance, body weight taken at home was perceived as misleading due to the scale used (i.e., not calibrated, questionable quality/reliability), or if patients did not adhere to recommendations about when/how to weigh themselves. The challenge of the subjective aspect was especially expressed by the dietitians for assessments that normally need physical examinations (e.g., fluid, muscle, and fat stores), or equipment such as scales or a measuring tape. Dietitians felt these were potential sources of error when patients had to measure themselves.

Fluid status, muscle, and fat stores were described by the dietitians as “*difficult*” or “*impossible*” to assess on the phone due to the lack of a “*clinical eye*”. Here, dietitians expressed the need of incorporating video into TeleNutrition or meeting the patient in-person to be able to do the assessment effectively. Portion size of food eaten was expressed by dietitians as difficult to assess when they could not see the patient or when there was a lack of technical solutions that enabled screen sharing. Without observing the patients’ body language and lack of technical solutions, the dietitian perceived that it was more difficult to understand the amount of food eaten. Being able to show pictures of portion sizes was described as necessary as it is “*difficult to describe portion sizes with words only*”.

### 3.3. Perceived barriers

Dietitians expressed how TeleNutrition could hinder dialogue and connection to the patient. *Perceived barriers* were illustrated using two sub-themes: *Challenge for some patients when doing TeleNutrition assessments* as well as *TeleNutrition can create relational distance with the patient*.

The dietitians expressed barriers in doing distant assessment with particular groups of patients. They experienced that older adults sometimes had difficulty managing digital solutions and only wanted to use the phone or meet physically. The dietitians also experienced barriers when performing TeleNutrition assessments with patients who had language deficiencies, cognitive deteriorations, or patients with impaired hearing. Here, the dietitians highlighted the importance of body language to be able to understand and make oneself understood to the patient.

The dietitians described how the physical distance to the patient could also create a personal distance and challenges related to the interpersonal dialogue. Many mentioned that it was more difficult building a relationship with the patient, especially in the first meeting, and that the dialogue could sound more like an interrogation than a conversation. The dietitians felt a resistance towards asking more in-depth questions and receiving more in-depth answers. They also expressed barriers towards the physical assessment i.e., asking patients to take some of their clothing off in a video-setting.

In addition to the dialogue and relationship building, dietitians highlighted barriers related to the environment where the TeleNutrition meeting took place. For instance, some patients were doing other activities while talking to the dietitian. Other patients did not conduct the meeting in a calm and quiet environment, with e.g., kids in the background. In these situations, dietitians perceived that patients were not able to give the dietitian their full attention.

#### 3.4. Perceived facilitators

The dietitians had adapted their clinical practice to enable nutrition assessment despite barriers experienced with using TeleNutrition. They also expressed ways to evolve and develop TeleNutrition practices to better facilitate the nutrition assessment when physically distant from patients. *Perceived facilitators* could be summarised using two sub-themes: *Pre-appointment preparations that facilitate assessment through TeleNutrition* as well as *Taking help from other healthcare professionals*.

Dietitians had found ways to make patients better prepared for the TeleNutrition meetings. Strategies included sending out instructions, symptom diaries, and food records in advance for the patient to read/complete. Some were able to digitally send the food record to patients while others simply mailed it in a regular envelope. The dietitians also made comments that one solution for the future should be to enable patients to weigh themselves at their closest health centre by having, for example, a scale available at the patient reception area. One dietitian stated that it should be mandatory for health centres to weigh all patients over 65 years of age. Dietitians suggested that pictures could be used in the future to help adapt nutrition assessment for TeleNutrition, especially for indicators such as fluid status, nutritional deficiency indicators, and metabolic demands. For instance, pictures of pressure ulcers could be used to assess their change over time and thus their impact on metabolic demands.

The dietitians also highlighted the importance of close and good collaboration with other healthcare professionals to improve TeleNutrition assessment. When the dietitian could not meet patients physically, help from other healthcare professionals (e.g., nurses in clinics or during home visits could weigh patients) was seen as a successful solution. Some dietitians, however, did express that the accuracy of measured values such as muscle mass or food intake were reliant on the skills of the other healthcare professional. The medical records were also seen as a valuable source of information by many dietitians. E.g., for test results and information on medications taken.

## 4. Discussion

This study addresses the perspectives of dietitians as end-users of TeleNutrition during the COVID-19 pandemic and the results emphasise important aspects that need to be considered with the steadily increasing adoption of ICT and digitalisation in healthcare. As proposed by earlier researchers who used TAM in the context of healthcare [20,22], the present study suggests adding key constructs of *perceived barriers* and *perceived facilitators* in addition to *perceived ease of use* and *perceived usefulness*, and we highlight explanatory dimensions of importance to help understand these key constructs. Importantly, we use the salient knowledge and beliefs of dietitians that needed to transfer all or part of their practice into using TeleNutrition as a result of the COVID-19 pandemic. Aside from the pandemic-situation,

many areas of the representative countries are remote from healthcare services by a dietitian, so the need remains to understand the importance of these key constructs.

During the first step of the NCP framework, the nutrition assessment and reassessment, dietitians gather information to enable a patients' nutrition-related problems and their causes to be identified [3]. Nutrition assessment is a crucial step in deciding individualised and targeted nutrition interventions. As identified by the dietitians in the present study, information gathered by patient interviews, for instance nutrition intake, worked well regardless of meeting the patient in-person or by TeleNutrition. Conversely, assessments that needed equipment or physical examination of body composition (e.g., fluid status, muscle mass, and fat reserves) were described by the dietitians as “*subjective*”, more demanding, or even “*impossible*” when performed using TeleNutrition. These findings are supported by previous surveys of dietetic practice from the United States and Italy [9,10]. Validation of malnutrition assessment and diagnosis tools is based on the assessment of body composition being an integral component [5–7]. With the GLIM diagnostic criteria for malnutrition, assessment of the phenotypic criteria weight loss, body mass index, and muscle mass needs body weight, weight history, height, and a validated measurement method of muscle mass to solve calculations [7]. The dietitians expressed concerns regarding the trustworthiness of self-assessed body weight due to scales not being calibrated or having questionable reliability. In general, earlier studies have shown significant differences between measured and self-reported body weight and height with overreporting for height and under-reporting for body weight, for both healthy [23] and obese [24] individuals, and in disease-related malnutrition [25]. It is important, therefore, that dietitians are aware of these limitations when patients self-assess, and, wherever possible accurately measured values should be used. Hence, from the result of the present study, there are aspects that need further development in order for the dietitian to be able to conduct a high-quality nutrition assessment using TeleNutrition, were the anthropometric measures and the physical examination of body composition is of particular concern.

The dietitians in the present study expressed ways to evolve and develop TeleNutrition practices to better facilitate the nutrition assessment. They identified that other healthcare professionals could be utilised for anthropometric measurements and were considered a valuable resource for information relevant to the nutrition assessment (e.g., medical records). One important step towards more reliable anthropometric data would be well-established routines for continuous measures of body weight and height, in both the in- and out-patient setting. Also, photographs were highlighted as a method that could be used to assess metabolic demands and their change over time. The dietitians also stressed the importance of video calls instead of voice only contact. There are limited research where new methods have been tested for nutrition assessment using TeleNutrition. Miller *et al.* examined whether photographs taken by trained dietitians could be used to complete the scored PG-SGA [26]. They concluded that photographs used for the assessment of muscle and fat status had a moderate agreement compared to in-person examinations. The main reason for lack of agreement was the inability to palpate, making it harder to assess deficits in muscle and fat stores. In a follow-up study, the agreement between in-person vs remote completion of the PG-SGA physical examination improved when dietitians assessed photographs taken by allied health assistants [27]. The authors argued that this improvement was probably due to the extensive training program delivered to the allied health assistants before study involvement. In summary, the research group suggested that additional research to determine how other healthcare providers or family members can be trained to support dietitians in remote nutrition assessment is warranted [26,27]. A recent study by Lawless *et al.* [28] showed how live physical examination by a dietitian through video call achieved sufficient levels of agreement when compared to in-person examination. Other studies in fields outside of nutrition and dietetics have shown promising results in using video calls for e.g., physiotherapy knee assessments [29] or specialised palliative care [30]. However, more evidence is needed about how video conferencing *can* and *should* be used for a valid physical examination of nutrition-related deficiency as part of the nutrition assessment.

In the era of healthcare digitalisation and person-centred care, it is also important to consider how patients experience the use of TeleNutrition. In the present study, dietitians expressed how the ‘subjectiveness’ of the information received from the patient was highly reliant on the patient's ability to reproduce information. The dietitians experienced that older adults could have difficulties in using

digital solutions and that issues related to cognitive deteriorations and impaired hearing were barriers related to TeleNutrition. These experiences are supported by earlier research [11,31]. However, this may not apply for all, since many older adults shows interest in and wants to adapt to new technological solutions [31,32]. In addition, the dietitians also expressed how TeleNutrition resolved practical issues for the patient, for example, the dietitians experienced older adults more alert when not needing to leave their home for consultations. Similar findings were observed in a survey study of dietitians by Brunton *et al.* [11]. Positive patient experiences of TeleNutrition related to not needing to travel, take time off from work, or miss other appointments were highlighted. Offering TeleNutrition as a routine alternative to in-person appointments could also increase continuity of care, as attendance to follow-up visits has been identified as a concern for patients with disease-related malnutrition [33]. The results from the present study can therefore support the dietitian on how to decipher on what patients that will benefit the most from using TeleNutrition solutions.

This study has both strengths and limitations. Strengths are the multi-national exploration, enabling the phenomena to be investigated in a broader context with similar settings in each country. E.g., working situation for dietitians during the COVID-19 pandemic as well as use of healthcare technology. However, it is important to acknowledge the study context when interpreting the results and its transferability. The countries represent developed countries with well-functioning structures for digitalisation, both in the healthcare setting and at a house-hold level. Dietitians in countries with less developed digitalisation structures may face a higher load of technological barriers related to internet connections or device accessibility for patients. Access to technology for older adults or patients with low income are issues particularly highlighted as a barrier for TeleNutrition [11]. Another study context to be acknowledged is that most dietitians did not conduct nutrition assessment of muscle mass, fat stores, nor nutritional deficiency indicators. It is therefore possible that dietitians in countries with a more established clinical practice of assessing these nutritional parameters would have perceived conducting nutrition assessment via TeleNutrition differently. A limitation of the study is the rather low response rate, with 146 dietitians answering the survey inducing a potential risk of bias towards not fully being able to capture relevant constructs of the phenomenon under study. Also, the dietitians most prone of using TeleNutrition might be the ones answering the survey. The free-text questions from the surveys varied in length, but generated a rich data material that could be analysed with a qualitative approach. However, individual or focus-groups interviews would have enabled a more in-depth investigation of the phenomenon and permitted follow-up questions. Half of the respondents were Swedish dietitians which should also be acknowledged when interpreting the results. The analysis and results were built through continuous triangulation between all researchers, deepening the analysis with each researchers' perspective and competence. This approach also enabled a stringent analysis when involving country specific language data from three countries, ensuring trustworthiness through the whole process.

The use of ICT within healthcare is rapidly emerging and in parallel, so is the use of TeleNutrition. However, there is a need for internationally accepted standards or protocols for performing nutrition assessment using TeleNutrition. Future research should focus on how to conduct high quality nutrition assessment using Telenutrition solutions, especially how to reliably assess anthropometrics and body composition. Also, the present study focused mainly on the nutrition assessment, and we also need to know more about the use of TeleNutrition within the other steps of the NCP framework. In addition to this, studies that address patient opinions regarding TeleNutrition practices would be highly valuable.

To conclude, the present study shows results from a qualitative analysis on free-text question from a survey and address the salient knowledge and beliefs of dietitians that needed to transfer all or part of their practice into using TeleNutrition as a result of the COVID-19 pandemic. The dietitians highlighted a variety of explanatory dimensions of importance to understand the key constructs of *perceived ease of use* and *perceived usefulness* when using TeleNutrition for nutrition assessment. The study results can be used as a guide on how to improve *attitude*, and by that, the *intention* to use TeleNutrition to deliver high-quality care when physically distant from patients. *Perceived barriers* for TeleNutrition use need to be removed or minimised while emphasising *perceived facilitators*. To best support dietitians in the new era of healthcare digitalisation and identify the best path forward, internationally accepted standards or protocols for performing nutrition assessment using TeleNutrition ought to be established. This is especially critical for nutrition assessment measures that require physical examination.

## Credit author statement

**Sandra Einarsson:** Conceptualization, Methodology, Investigation, Formal analysis, Writing - Original Draft, Visualization. **Lene Thoresen:** Conceptualization, Methodology, Investigation, Formal analysis, Writing - Review & Editing. **Randi Tobberup:** Conceptualization, Methodology, Investigation, Formal analysis, Writing - Review & Editing. **GTNC:** Conceptualization, Methodology, Writing - Review & Editing (completed by the following GTNC members: Angela Vivanti, Sue MacDonell, Lyn Lloyd, David St-Jules, and Terese Scollard). **Ingvild Paur:** Conceptualization, Methodology, Investigation, Formal analysis, Writing - Review & Editing.

## Declaration of competing interest

The authors declares that there is no conflict of interest.

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## Data availability statement

The datasets are available from the corresponding author upon reasonable request.

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