

Accurately measuring patients' dietary intake using the visual estimation method

Introduction

Malnutrition in hospital patients is a global problem and is associated with increasing medical costs and worsening clinical outcomes, such as mortality. Therefore, clinical staff need to improve the nutritional condition of their patients through appropriate nutritional care. The hospital meal is the foundation of nutritional care for patients consuming food orally. Patient dietary intake of hospital meals can be evaluated using the visual estimation method. In this method, raters directly view a plate of food and evaluate plate waste to measure the patients' meal intake. Despite the clinical need, identifying reliable and valid evaluation practices using the visual estimation method is difficult, and a detailed description of the process of this method has not been outlined in previous studies. Moreover, little is known about the reliability and validity of measuring patients' dietary intake using the visual estimation method for various meals in hospitals. Only a few studies have focused on the effects of visual estimation training for raters to improve the reliability and validity of the method. Therefore, this study aimed to describe the practice of the visual estimation method, and the barriers and factors that influence both the reliability and validity of this evaluation method, and to propose a process to accurately measure patients' dietary intake.

Study 1. A qualitative research study of clinical staff practice and the barriers to accurately measuring patients' dietary intake in hospitals, using the visual estimation method

We performed qualitative research with nurses and dietitians to assess practices and barriers to accurately measure patients' dietary intake in hospitals using the visual estimation method. We conducted individual interviews with 10 dietitians and 10

clinical nurses in Tokyo, Japan. Nurses, dietitians, nursing assistants, and care workers check plate waste as part of their routine work. Some practices, such as the frequency and process of evaluation using the visual estimation method, differed according to job category. Our study describing patients' dietary intake data evaluated using the visual estimation method, provides important information for hospital staff not only in terms of nutritional care but also for medical treatment from admission-to-discharge. Furthermore, five main categories, which indicate barriers to accurately measuring patients' dietary intake in hospitals using the visual estimation method emerged: hospitals, meals, colleagues, raters, and patients.

Study 2. Reliability and validity of the visual estimation method for determining patients' meal intake in hospitals

We described practices and barriers that affect accurate measurement of patients' dietary intake in hospitals using the visual estimation method in study 1. However, little is known as to whether these practices and barriers influence the reliability and validity of the visual estimation method. The aim of study 2 was to examine the reliability and validity of the visual estimation method based on the results of Study 1.

Study 2-1. Examination of the reliability and validity of the visual estimation method in relation to targeted standard meals

We aimed to describe the inter-rater reliability within different job categories, to compare the difference in the validity of the visual estimation method according to tray divisions and to demonstrate associations between meal characteristics and the validity of the visual estimation method in a standard clinical setting in a community hospital. We collected patients' dietary intake data in standard clinical settings for each of 450 standard meal trays in 3 ways: visual estimation by nursing assistants, visual estimation by dietitians, and weighing by researchers (reference method). We then compared the weights and visual estimation data to evaluate validity of the visual estimation method. Spearman's correlations for both methods were very high for dietitians (whole tray division: energy $\rho=0.94$, protein $\rho=0.89$, food items division: energy $\rho=0.98$, protein

$\rho=0.96$, $p<0.01$) and nursing assistants (energy: $\rho=0.91$, protein: $\rho=0.88$, $p<0.01$), respectively. Mean differences between both methods, as calculated using absolute values, were significantly different according to tray divisions and were as follows: whole trays, 41.4 ± 56.8 kcal/tray and 2.1 ± 2.8 g/tray (nursing assistants), and 36.4 ± 53.3 kcal/tray and 2.0 ± 2.7 g/tray (dietitians); and food items, 23.0 ± 30.7 kcal/tray and 1.0 ± 1.7 g/tray (dietitians). A high grain intake rate was significantly associated with decreased odds of a difference between the two methods (nursing assistants: odds ratio [OR] 0.84, 95% confidence interval [CI] 0.76-0.92; dietitians' whole tray division: OR 0.79, 95% CI: 0.71-0.87; and dietitians' food items division: OR 0.69, 95% CI: 0.61-0.78).

Study 2-2 Examination of the validity of the visual estimation method in relation to targeted standard and therapeutic meals

The aim of this study was to examine differences in the validity of the visual estimation method for determining patients' meal intake between various meal types and supplied food items in hospitals. These two aspects were both visually assessed from 335 meal trays by the attending nursing staff and through weighing conducted by researchers. Visual assessment results were tested for their validity through a comparison with the corresponding results of weighing. There were high correlations between the visual estimation method and the weighing method in measuring patients' dietary intake for various meal types and textures (energy: $\rho=0.95$, protein: $\rho=0.84$, $p<0.01$), except for meals with added supplied food items (OR: 3.84, 95% CI: 1.07-13.85).

Study 3. Differences in characteristics of raters who use the visual estimation method in hospitals based on their training experiences

Based on Study 2 results, we concluded there was a need for visual estimation training for raters. However, few studies have focused on training aspects in this regard. This study aimed to describe the differences in the characteristics of raters who evaluated patients' dietary intake in hospitals using the visual estimation method based on their training experiences. The participants comprised 199 nursing staff members (151 nurses and 48 nursing assistants), who completed a questionnaire. The results of

this study showed that trained participants had better required knowledge (OR: 2.78, 95% CI: 1.05-7.35) and that they used visual estimation tips (OR: 1.85, 95% CI: 1.26-2.73) more frequently than participants who had not been trained in the visual estimation method.

Conclusion

We identified practices and barriers to accurately measure patients' dietary intake in hospitals using the visual estimation method. In addition, we compared the differences in the validity of the visual estimation method between meal characteristics and inter-rater reliability according to different job categories and demonstrated differences in rater characteristics in using the visual estimation method in hospitals, based on training experiences. Dietary intake data evaluated using the visual estimation method provides important information that clinical staff utilize in their work. Therefore, accurately measuring patients' dietary intake is essential. We recommend that future studies focus on factors influencing the reliability and validity of the visual estimation method, and clinical staff members be trained to use the visual estimation method.