

Original Article

A survey of the Nutrition Care Process in Japanese acute care hospitals using a nationwide web-based questionnaire

Keisuke Maeda PhD, MD^{1,2,3}, Fumie Egashira AS⁴, Junko Ueshima PhD^{2,3,5}, Yuri Horikoshi MS⁶, Satoru Kamoshita BA⁶, Japanese Working Group on Integrated Nutrition for Dysphagic People (JWIND)

¹Nutrition Therapy Support Center, Aichi Medical University, Aichi, Japan

²Department of Geriatric Medicine, Hospital, National Center for Geriatrics and Gerontology, Aichi, Japan

³Department of Palliative and Supportive Medicine, Graduate School of Medicine, Aichi Medical University, Aichi, Japan

⁴PEACH Atsugi, Community Nutritional Care Center, Atsugi, Japan

⁵Department of Nutritional Service, NTT Medical Center Tokyo, Tokyo, Japan

⁶Medical Affairs Department, Research and Development Center, Otsuka Pharmaceutical Factory, Inc., Tokyo, Japan

Background and Objectives: Study aim was to determine the levels and barriers of the Nutrition Care Process (NCP), a practical method of individualized nutrition support. **Methods and Study Design:** Delegate of registered dietitians (RDs) from acute-care hospitals answered our nationwide web-based questionnaire (April-June, 2023) to determine the implementation status of screening, assessment, intervention (including planning), and monitoring (components of the NCP). **Results:** Of 5,378 institutions contacted, 905 (16.8%) responded. For *Screening*, 80.0% screened all inpatients: primary personnel in charge were RDs (57.6%); the most used screening tool was Subjective Global Assessment (SGA) (49.2%). For *Assessment*, 66.1% assessed all inpatients: food intake (93.3%) was most evaluated whereas muscle mass and strength (13.0%, 8.8%) were least evaluated. For *Intervention*, 43.9% did so within 48h of hospital admission: oral nutritional supplement (92.9%) was the most common RDs intervention and parenteral nutrition (29.9%) was used less. For *Monitoring*, 18.5% of institutions had monitoring frequency of ≥ 3 times/week whilst 23.0% had monitoring less than once a week for severely malnourished patients. Energy and protein intake (93.7%, 84.3%) were most monitored and lipid intake (30.1%) was less monitored. **Conclusions:** Barriers of NCP included inefficient staffing systems and unsuitable tools in *Screening*, inaccurate patient targeting and lack of important evaluation items in *Assessment*, delayed timing and incomplete contents in *Intervention*, and inadequate frequency and lack of important evaluation items in *Monitoring*. An increase in RDs staffing in acute-care general wards, widespread NCP instruction manuals, and education about the tools and evaluation items utilized in nutritional management are possible solutions.

Key Words: acute care hospital, nationwide survey, Nutrition Care Process, nutritional management, web-based questionnaire

INTRODUCTION

Many hospitalized patients are reported to be malnourished.^{1,2} At the same time, throughout the world, many hospitalized patients do not receive enough nutritional support to meet their nutritional requirements.^{3,4} The nutritional status of patients hospitalized for acute care is negatively influenced by higher severity of illness, greater degrees of inflammation, lower physical activity levels, and prolonged bed rest or immobility.^{5,6} Therefore, individualized nutritional management is important for patients admitted to acute care hospitals. Indeed, individualized nutritional support has been demonstrated to result in increased nutrition intake, improved nutritional status, and enhanced clinical outcomes in hospitalized patients.^{7,8} In 2003, the Academy of Nutrition and Dietetics recom-

mended the Nutrition Care Process (NCP) as a practical method of providing individualized nutritional management to patients.⁹ The NCP is a systematic framework that is to be used by nutrition professionals to provide high-quality nutrition care, and it consists of four steps: *Nutrition Screening, Assessment, Planning and Interv-*

Corresponding Author: Dr Keisuke Maeda, Nutrition Therapy Support Center, Aichi Medical University, Nagakute, Aichi, Japan 480-1195

Tel: +81561-62-3311; Fax: +81561-63-3208

Email: kskmaeda1701@gmail.com; kskmaeda@ncgg.go.jp

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tion, and Monitoring. At the International Congress of Nutrition and Dietetics in 2008, the participants agreed to promote it in their countries. As a result of this agreement, the Japan Dietetic Association recommended that the NCP be part of lifetime education for registered and general dietitians, and it is devoted to providing guidance and encouraging the use of the NCP in practice. Fifteen years have passed since the international agreement, but a nationwide NCP implementation survey has never been conducted in Japan.

A large-scale study of NCP-based nutrition management in hospitalized patients in Japan is needed to determine the levels of implementation of the NCP and to identify barriers for nutrition professionals in applying the NCP. The objectives of this web-based survey of nutrition professionals caring for hospitalized patients in acute-care hospitals in Japan were to determine the levels, timing and frequency, tools and items, and systems of each of the four components of NCP, as well as identify the reasons for suboptimal NCP implementation.

METHODS

Survey

We created a questionnaire; the construction of the web-based questionnaire system, implementation of the survey, and curation of the survey data were outsourced to an independent third party (Macromill Carenet, Inc., Tokyo, Japan). Macromill, Inc. which develops and provides the questionnaire data obtaining service has ISO/IEC27001 and JIS Q27001 issued by the Japan Quality Assurance Organization and implements organizational control, people control, physical control, and technological control, based on Information Security Management System. Also, measures to prevent log tampering by recording the log for usage status and system operation were taken.

The questionnaire was prepared by the author group. Four registered dietitians, other than the authors, confirmed the expressions, format, length, consistency, and easy-to-answer, and corrected it if necessary. The questionnaire construction was created based on NCP⁹; the Integrated Nutrition Pathway for Acute Care (INPAC)^{10,11} which is Canadian nutritional care program and the methods in the previous randomized clinical trial on individualized nutritional support were used as reference.⁷ NCP,⁹ ESPEN guideline on hospital nutrition,¹² and ESPEN guideline on clinical nutrition and hydration in geriatrics¹³ were used as reference for terminology.

The questionnaire focused on the measures taken in NCP implementation, including *Screening*, *Assessment*, *Intervention* (which we divided into *Planning* and *Intervention*), and *Monitoring* for hospitalized patients (Supplementary Table 1). *Screening* involved the identification of patients with malnutrition or suspected malnutrition. *Assessment* included the detailed evaluation of the nutritional status of patients by nutrition experts. *Planning* involved designing nutritional management and nutritional interventions for patients. *Intervention* was performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. Finally, *Monitoring* involved assessing the nutritional status of patients to determine

whether the goals of nutritional management were reached.

Frequency and proportions (%) were calculated for all categorical questions. Median, first quartile (Q1), and third quartile (Q3) were calculated for questions generating results that were continuous variables.

Study institutions

In April 2023 and June of 2023, a survey request letter which contained a summary of the questionnaire, the web address for the online questionnaire, and an independent identification number assigned to each institution was sent to a delegate of the registered dietitians (RDs) of 5,378 nationwide acute care hospitals (with acute-care general wards) in Japan. We left it to the nutrition management department of each institution to select the responding personnel. They would access the website, enter the independent identification number, record their email address, and respond to the questionnaire (Supplementary Table 1). Responses were accepted from April 2023 till June 2023.

Ethical statements

The study was approved by the Ethics and Conflict of Interest Committee of the National Center for Geriatrics and Gerontology (Approval number, 1673). The personal information obtained in this study (the email address of the respondent and the name and mailing address of the delegates) was managed by Macromill Carenet, Inc. according to the Personal Information Protection Law. The personal information treatment policy was made available for viewing on the questionnaire website, and consent was obtained from every respondent before they began the questionnaire.

RESULTS

Study institution characteristics

Of the 5,378 institutions to which we sent the survey request letter, 905 (16.8%) responded. The responses were obtained from institutions of every prefecture in Japan (47 prefectures). The characteristics of the hospitals of the respondents were shown in Table 1. For the hospitals, the median (Q1, Q3) of the number of beds was 156 (90, 292) and that of the number of RDs was 4 (2, 7). The median of the mean lengths of hospital stay for the institutions during the period from April 2022 through March 2023 was 14 (11, 20) days.

NCP instruction manual accessibility

The frequencies and proportions of 905 study institutions having accessible instruction manuals available for each of the NCP components were as follows: 696 (76.9%) for *Screening*; 699 (77.2%) for *Assessment*; 456 (50.4%) for *Planning*; 274 (30.3%) for *Intervention*; and 402 (44.4%) for *Monitoring* (Figure 1). The instruction manuals would most often make them available to all personnel (63.9-73.7%) and a small proportion (14.5-28.4%) would have the manuals be available to only RDs (Supplementary Figure 1).

Table 1. Characteristics of the 905 study institutions responding to the Nutrition Care Process (NCP) questionnaire during April 2023 and June 2023

Institution categories and characteristics	n	(%)
Functional type [†]		
General hospital type 1 [‡]	468	(51.7)
General hospital type 2 [§]	258	(28.5)
General hospital type 3 [¶]	42	(4.6)
Other	134	(14.8)
Unknown	3	(0.3)
DPC/PDPS ^{††} reimbursement		
Yes	440	(48.6)
Nutrition Support Team (NST)		
Yes	532	(58.8)
	median	(Q1, Q3)
Length of hospital stay, days		
Mean stay at each hospital ^{**}	14	(11, 20)
Beds		
Total	156	(90, 292)
Acute-care general ward	55	(20, 167)
Registered dietitians		
Total at hospital	4	(2, 7)
Outsourced	1	(0, 2)
In charge of nutritional management ^{§§}	3	(1, 5)
Assigned to acute-care general ward	1	(0, 3)
NST activity ^{¶¶}		
Patients seen per team per week	5	(2, 10)
Total patients seen per year ^{†††}	150	(0, 450)

Q1, first quartile; Q3, third quartile

[†]Based on hospital accreditation by the Japan Council for Quality Health Care.

[‡]Small-to-medium sized hospitals providing community healthcare in comparatively small regions.

[§]Core hospitals providing community healthcare focused on acute-phase treatment in comparatively large regions.

[¶]Hospitals providing advanced medical care as well as medical research, development, evaluation, and training (e.g., Special functioning and University hospitals).

^{††}The DPC (Diagnosis Procedure Combination)-based Per-Diem Payment System (DPC/PDPS) is the main medical service reimbursement system for acute inpatient care in Japan.

^{**}Mean length of stay of patients hospitalized from April 2022 through March 2023, excluding those hospitalized to undergo medical examinations, to receive palliative care, or in the ICU.

^{§§}Nutritional management was individualized and performed at the bedside, and it included hospital food service ordering and diet instruction.

^{¶¶}Activities of the Nutrition Support Teams (NST) from April 2022 to March 2023 of the 532 hospitals providing this service. The NST is typically a multidisciplinary team comprised of physicians, nurses, dietitians, pharmacists, dentists, social workers, and medical technologists.

^{†††}Based on NST claims data.

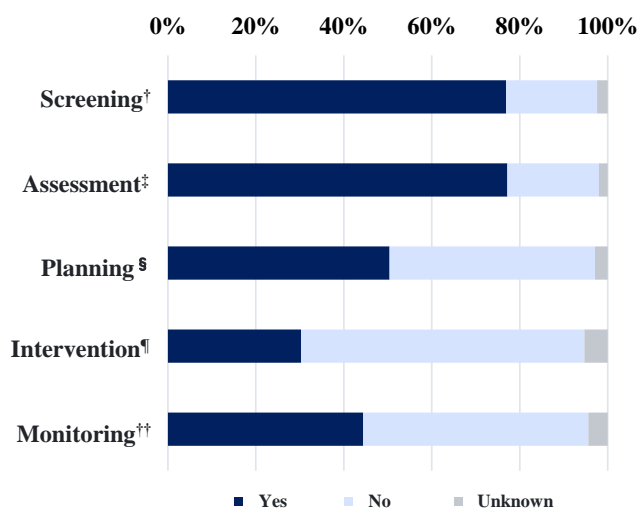


Figure 1. Accessible instruction manuals for each component of the Nutrition Care Process (NCP) in the 905 study institutions. Bar graph shows the proportions of hospitals having and not having accessible instruction manuals for each component of the NCP. [†]Identification of patients with malnutrition or suspected malnutrition. [‡]Detailed evaluation of nutritional status of patients done by nutrition experts. [§]Planning of nutritional management and of nutritional interventions for patients. [¶]Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. ^{††}Monitoring nutritional status of patients to determine whether goals of nutritional management are reached.

Patient targeting

Of the 905 study institutions, NCP components were implemented in all patients by 724 (80.0%) institutions for *Screening*, by 598 (66.1%) institutions for *Assessment*, 373 (41.2%) institutions for *Planning*, by 239 (26.4%) institutions for *Intervention*, and by 388 (42.9%) institutions for *Monitoring* (Figure 2). For the institutions implementing NCP components to only a portion (rather than all) of their patients, criteria used to select those patients who were targeted included risk-positive *Screening* results, dysphagia, physician's decision, and various degrees of nutritional disorders or disease severities (Supplementary Figure 2).

Timing and frequency of NCP implementation

In clinical practice for those institutions that implemented NCP components in all or a portion of patients, the timing of implementation of *Screening*, *Assessment*, *Planning*, and *Intervention* were shown in Figure 3A whereas the frequency of *Monitoring* was shown in Figure 3B. In the 850 institutions implementing *Screening*, 563 (66.2%) did so within 24 h. Of the 722 institutions implementing *Intervention*, 317 (43.9%) did so within 48 h of hospital admission. Of the 622 institutions implementing *Monitoring* in their severely malnourished patients, 115 (18.5%) did so 3 or more times per week, while 143 (23.0%) did so less than once a week. Using slightly different criteria, of the 412 institutions that implemented *Monitoring* in their severe disease patients, 87 (21.1%) did so 3 or more times per week, while 84 (20.4%) less than once a week. Timing or frequency of implementation of each component as directed by instruction manuals were shown in Supplementary Figure 3.

Personnel in charge of NCP implementation

Of the 850 institutions implementing *Screening*, the primary personnel in charge were RDs in 490 (57.6%) institutions and nurses in 325 (38.2%) institutions (Figure 4). For institutions implementing *Assessment*, *Planning*, *Intervention*, and *Monitoring*, the primary personnel in charge of implementation were RDs in more than 90% of the institutions. Other non-primary personnel involved in implementation were most often nurses (Supplementary Figure 4).

Reasons for inadequate NCP implementation

Some institutions did not implement any one of the NCP components, the most common reason given was "no instruction manual," followed by "human resource shortage," "lack of time," and "lack of awareness of nutritional management in medical staff" (Figure 5A). Other institutions reported delayed implementation of *Screening*, *Assessment*, *Planning*, and *Intervention*, or inadequate frequency of *Monitoring*. Common reasons given, in order, were "lack of time," "human resource shortage," and "lack of awareness of nutritional management in medical staff" (Figure 5B).

Tools and evaluation items used for Screening and Assessment

The tool used most often for *Screening* was the Subjective Global Assessment (SGA)¹⁴ by 418 (49.2%) institutions, followed by Mini Nutritional Assessment Short-Form (MNA-SF)¹⁵ by 190 (22.4%) institutions and Controlling Nutritional Status (CONUT)¹⁶ by 127 (14.9%) institutions (Figure 6).

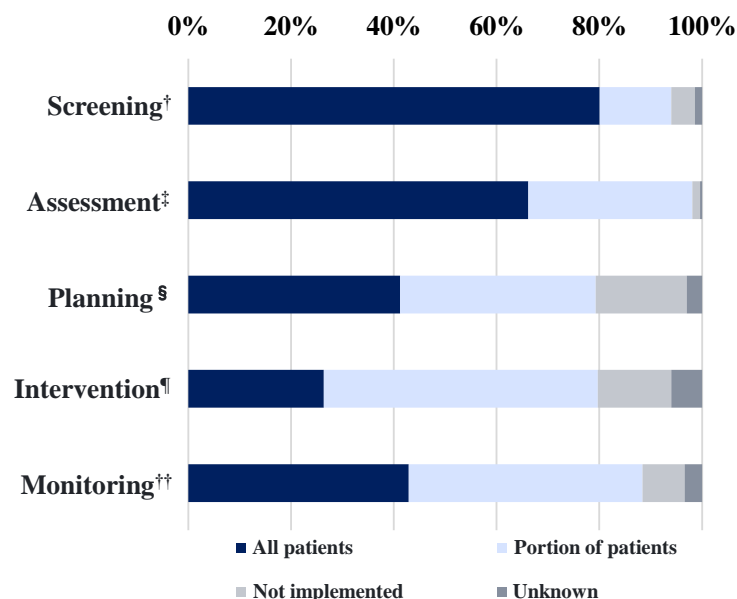


Figure 2. Implementation of each component of the Nutrition Care Process (NCP) in all, a portion, and none of the hospitalized patients of the 905 study institutions. Bar graph shows the proportions of hospitals implementing components of the NCP in all, a portion, and none of their patients. [†]Identification of patients with malnutrition or suspected malnutrition. [‡]Detailed evaluation of nutritional status of patients done by nutrition experts. [§]Planning of nutritional management and of nutritional interventions for patients. [¶]Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. ^{††}Monitoring nutritional status of patients to determine whether goals of nutritional management are reached.

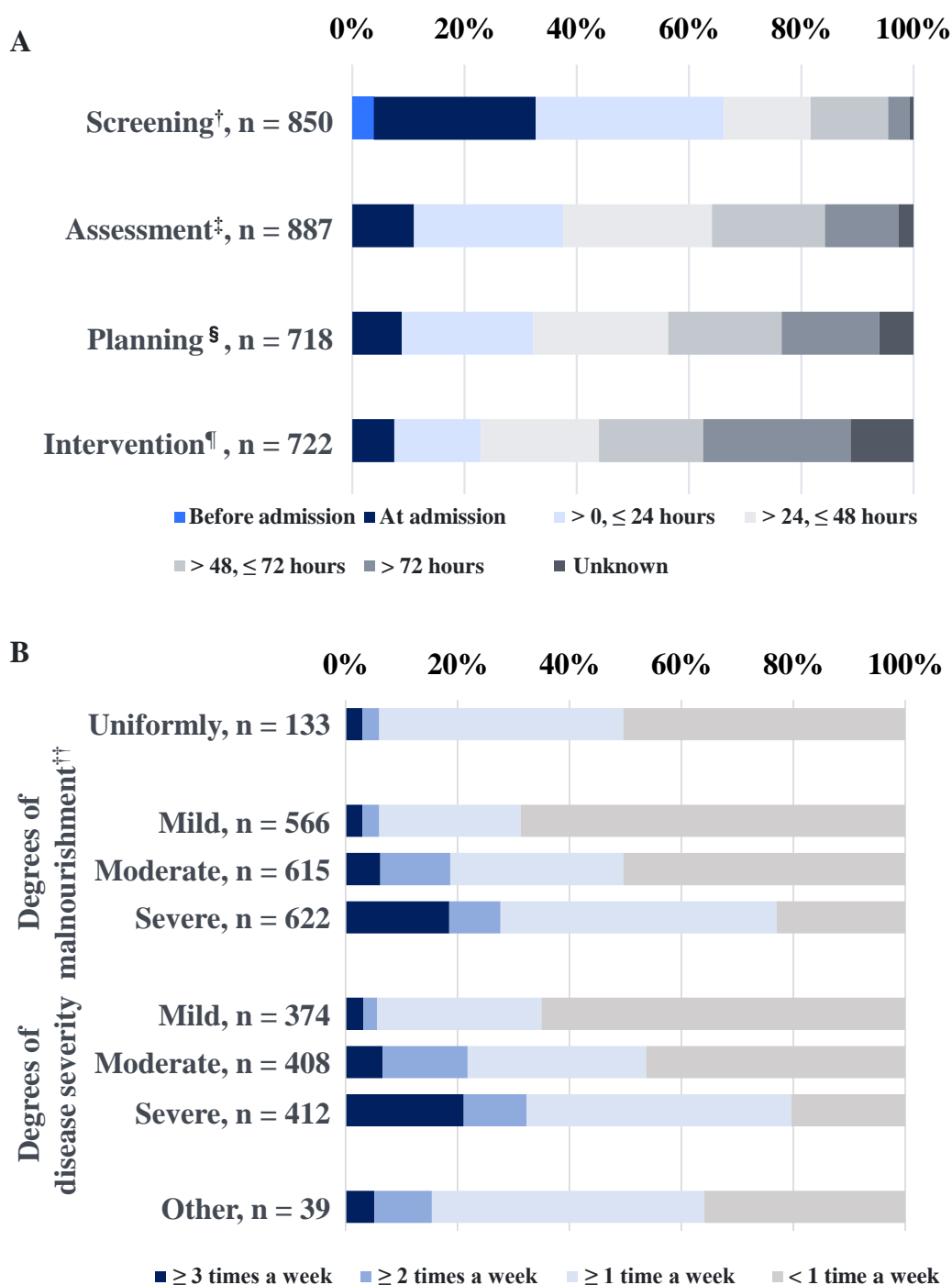


Figure 3. Timing or frequency of implementation of each component of the Nutrition Care Process (NCP), reported by the study institutions^{††} that performed implementations in some or all of their hospitalized patients. Each color bar represents the proportion of institutions performing implementation within each of the designated time or frequency periods (see legends below each graph). (A) Bar graph shows distributions of the most common timing of implementations in clinical practice of *Screening*[†], *Assessment*[‡], *Planning*[§], and *Intervention*[¶]. (B) Bar graph shows the distribution of the most common frequency of implementation in clinical practice of *Monitoring*^{§§}. Of the 800 study institutions implementing *Monitoring*^{§§} in some or all of their patients, 133 did so at a uniform frequency that is periodically *Monitoring*^{§§} implementation in all target patients, while 667 did so using differing frequencies for the various degrees. The total “n” for each degree of malnourishment, disease severity, and other degrees bar did not total 667, because some institutions provided multiple answers for some degrees of malnourishment, disease severity, and/or other degrees. [†]Identification of patients with malnutrition or suspected malnutrition. [‡]Detailed evaluation of nutritional status of patients done by nutrition experts. [§]Planning of nutritional management and of nutritional interventions for patients. [¶]Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. ^{††}Nutrient deficiency conditions due to problems with nutrient metabolism, absorption, and/or intake. ^{§§}For each NCP component, ‘n’ is the number of hospitals at which each NCP component was implemented in either all or a portion of patients. ^{§§§}Monitoring nutritional status of patients to determine whether goals of nutritional management are reached.

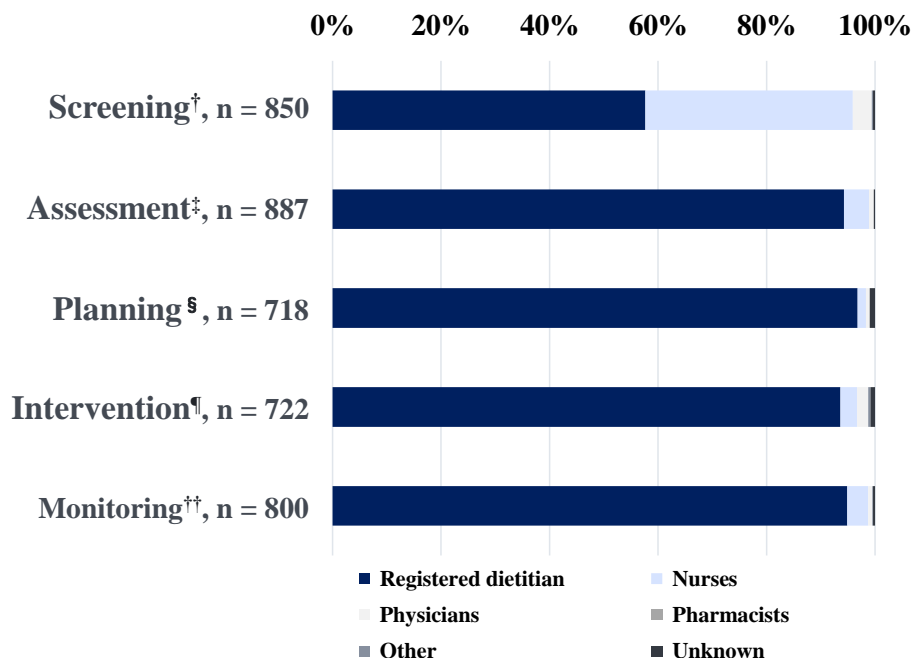


Figure 4. Personnel in charge of implementation of Nutrition Care Process (NCP) components at study institutions. Bar graphs show, for the institutions which implemented components of NCP, the proportions of the personnel most often in charge of the implementation for each of the five NCP components. [†]Identification of patients with malnutrition or suspected malnutrition. [‡]Detailed evaluation of nutritional status of patients done by nutrition experts. [§]Planning of nutritional management and of nutritional interventions for patients. [¶]Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. ^{††}Monitoring nutritional status of patients to determine whether goals of nutritional management are reached.

Similarly, the tool used most often for *Assessment* was also SGA¹⁴ by 356 (40.1%) institutions, followed by MNA-SF¹⁵ by 156 (17.6%) institutions and CONUT¹⁶ by 135 (15.2%) institutions. More than half of the institutions using SGA¹⁴ used the modified version rather than the original. In addition to the tools above, additional items assessed were food intake by 828 (93.3%) institutions, followed by Body Mass Index (BMI) by 798 (90.0%) institutions and serum albumin by 756 (85.2%) institutions (Figure 7B). However, muscle mass was assessed by only 115 (13.0%) institutions and muscle strength by only 78 (8.8%) institutions. Results of other questions about nutritional *Assessment* (and related questions about *Planning* and *Monitoring*) were summarized in Supplementary Table 2.

Registered dietitian Intervention and key Monitoring items

The *Intervention* most often implemented by RDs was providing oral nutritional supplements by 671 (92.9%) institutions, followed by identifying patient food-related preferences (e.g., appearance, volume, and smell of foods) by 661 (91.6%) institutions and food texture modification by 656 (90.9%) institutions (Figure 8A). On the other hand, RDs at 150 (20.8%) institutions intervened by improving meal-time atmosphere, RDs at 184 (25.5%) institutions intervened by identifying desirable conditions for food intake (i.e., allow patients to concentrate on eating), and RDs at only 216 (29.9%) institutions intervened by providing parenteral nutrition.

Energy intake and protein intake were considered to be essential for nutritional *Monitoring* by 750 (93.8%) and 674 (84.3%) institutions, respectively (Figure 8B). However, lipid intake as part of *Monitoring* was considered

essential by only 241 (30.1%) institutions. Items considered to be non-essential for *Monitoring* were summarized in Supplementary Figure 5.

DISCUSSION

Using a nationwide web-based questionnaire, the levels, timing and frequency, and tools or items and systems used for the implementation of NCP components (i.e., *Screening*, *Assessment*, *Intervention* [including *Planning*], and *Monitoring*) were surveyed. In addition, the reasons for and problems associated with suboptimal implementation were analyzed.

Previous studies on NPC implementation status^{17, 18} investigated the dietitian's personal thoughts and awareness. There were no studies which investigated NCP procedures in each institution. Also, previous studies¹⁷⁻¹⁹ were aimed to understand a rough implementation status for each NCP process and items assessed as well as the problems faced. On the other hand, our study was conducted to investigate the implementation of each NCP components in detailed including the instruction manuals preparation status, the personnel responsible, as well as the timing and frequency after hospital admission for each NCP component. As a result, the implementation level for each component and institution was shown in detailed, providing a clear understanding and enabling specific measures to be taken to improve NCP implementation in clinical settings in the future.

Screening

Problems found in *Screening* were the staffing system and tools. A total of 80.0% of the study institutions implemented *Screening* in all of their hospitalized pat-

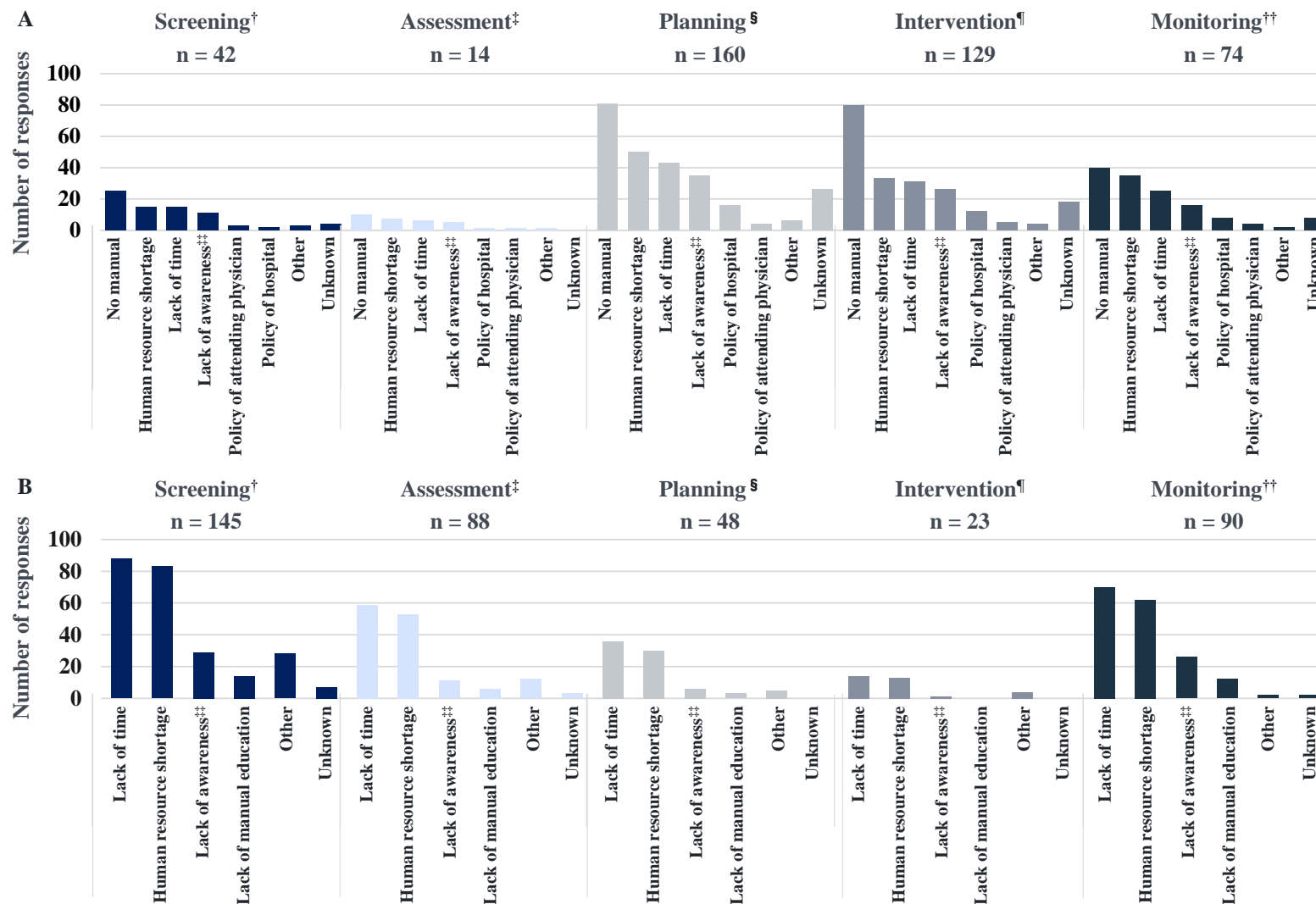


Figure 5. Reasons for lack of, delayed, and infrequent implementation of Nutrition Care Process (NCP) components in clinical practice relative to implementation directed by the instruction manuals for each component. (A) Bar graphs show frequencies of reasons reported by the 14 to 160 study institutions that NCP components were not implemented. (B) Bar graphs show frequencies of reasons reported by the 23 to 145 study institutions that had instruction manuals but nevertheless had delayed (*Screening*[†], *Assessment*[‡], *Planning*[§], and *Intervention*[¶]) or inadequate frequency of (*Monitoring*^{**}) implementation, as compared to the directions for timing and frequency provided by those instruction manuals. Multiple answers were allowed for all surveys. [†]Identification of patients with malnutrition or suspected malnutrition. [‡]Detailed evaluation of nutritional status of patients done by nutrition experts. [§]Planning of nutritional management and of nutritional interventions for patients. [¶]Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. ^{**}Monitoring nutritional status of patients to determine whether goals of nutritional management are reached. ^{**}Lack of awareness of nutritional management in medical staff.

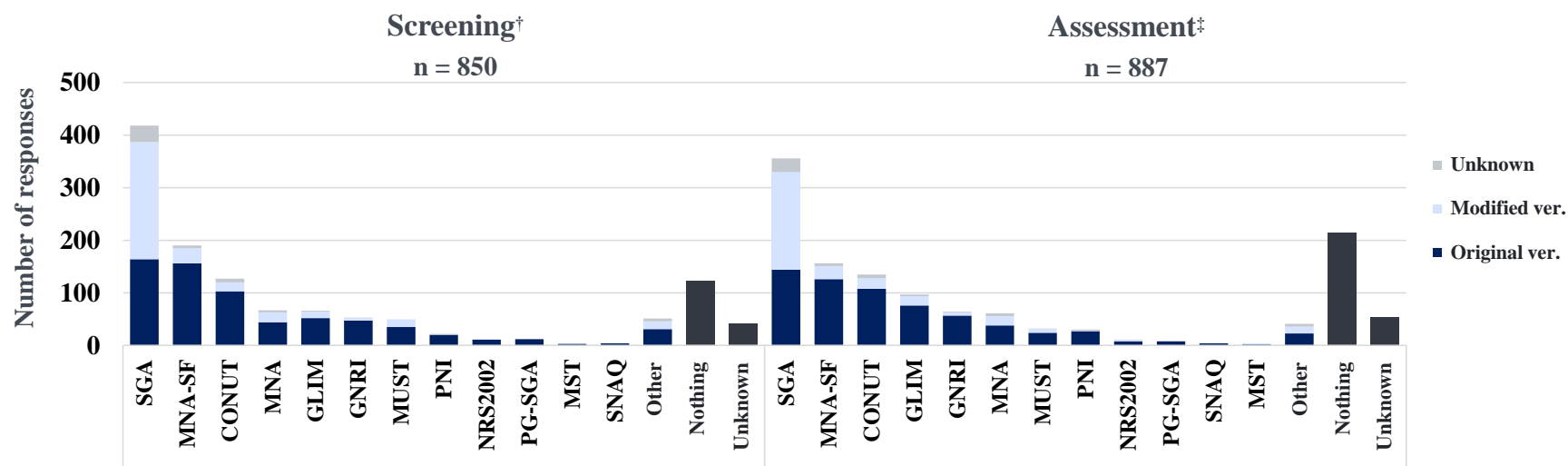


Figure 6. Tools used for the *Screening*[†] and *Assessment*[‡] components of the Nutrition Care Process (NCP) in the study institutions that implemented these components. Bar graphs show the frequencies of items reported as tools for *Screening*[†] for malnutrition at the 850 study institutions and for *Assessment*[‡] at the 887 study institutions. For each tool used, the version (i.e., original or customized) implemented was identified. Multiple answers were allowed for the survey of tools for both *Screening*[†] and *Assessment*[‡]. [†]Identification of patients with malnutrition or suspected malnutrition. [‡]Detailed evaluation of nutritional status of patients done by nutrition experts. SGA, Subjective Global Assessment;¹⁴ MNA-SF, Mini Nutritional Assessment Short-Form;¹⁵ CONUT, Controlling Nutritional Status;¹⁶ MNA, Mini Nutritional Assessment;²⁹ GLIM, Global Leadership Initiative on Malnutrition;⁵ GNRI, Geriatric Nutritional Risk Index;³⁰ MUST, Malnutrition Universal Screening Tool;³¹ PNI, Prognostic Nutritional Index;³² NRS2002, Nutritional Risk Screening 2002;³³ PG-SGA, Patient Generated Subjective Global Assessment;³⁴ MST, Malnutrition Screening Tool;³⁵ SNAQ, Short Nutritional Assessment Question³⁶

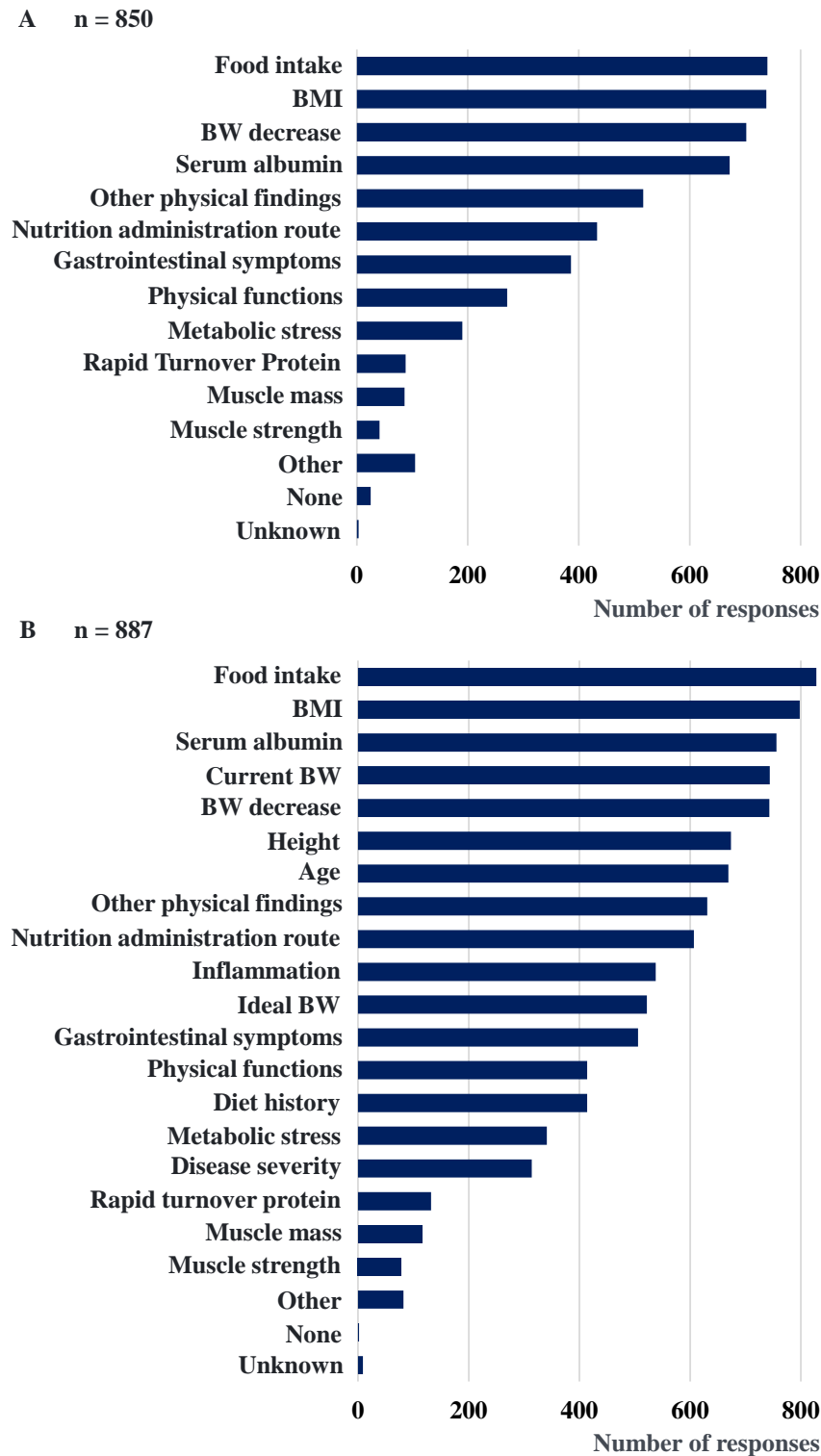


Figure 7. Evaluation items used for the *Screening*[†] and *Assessment*[‡] components of the Nutrition Care Process (NCP) in the study institutions that implemented these components. (A) Bar graph shows frequencies of items reported as evaluation items (other than tools) for *Screening*[†] for malnutrition at the 850 study institutions. (B) Bar graph shows frequencies of items reported as evaluation items (other than tools) for *Assessment*[‡] at the 887 study institutions. Multiple answers were allowed for the surveys of both *Screening*[†] and *Assessment*[‡] items. [†]Identification of patients with malnutrition or suspected malnutrition. [‡]Detailed evaluation of nutritional status of patients done by nutrition experts. BMI, body mass index; BW, body weight

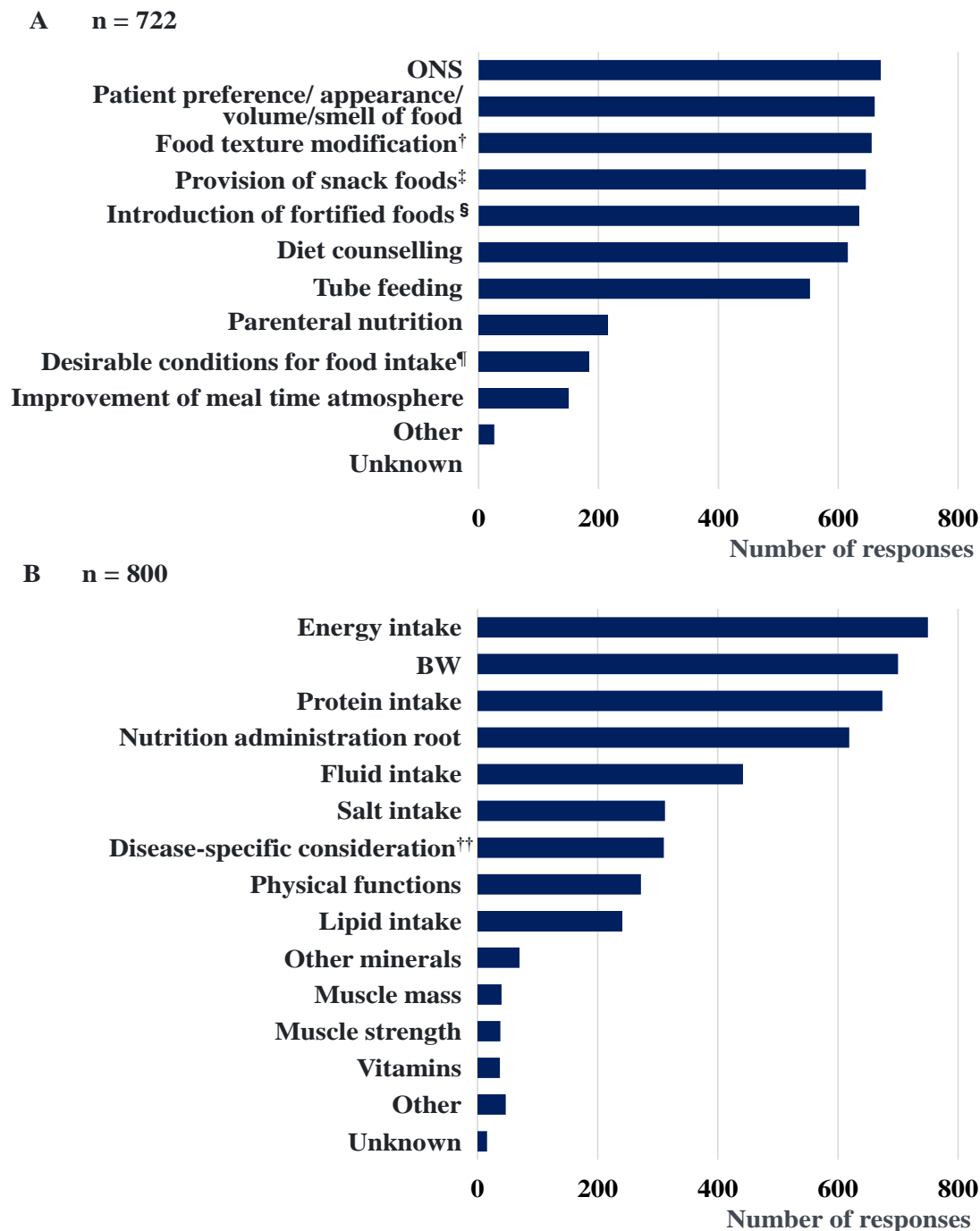


Figure 8. *Interventions*^{‡‡} by registered dietitians and *Monitoring*^{§§} considered to be essential at the institutions which implemented these components of the Nutrition Care Process (NCP). (A) Bar graph shows the frequencies of *Interventions*^{‡‡} implemented by registered dietitians at the 722 study institutions. (B) Bar graph shows frequencies of items reported as essential for nutritional *Monitoring*^{§§} at the 800 study institutions. Multiple answers were allowed for the surveys of both *Interventions*^{‡‡} and *Monitoring*^{§§} items. [†]Modifying food texture (e.g., Softening and mincing). [‡]Adding Snack foods (i.e., Between-meal snack to reach nutritional requirements). [§]Introducing fortified foods (e.g., Protein/oil-fortified foods). [¶]Identifying and providing desirable conditions for food intake (i.e., To allow patients to concentrate on eating). ^{††}Disease-specific consideration include monitoring doses of carbohydrate for diabetic patients, branched-chain amino acids (BCAA) for liver cirrhosis patients, dietary fiber for diarrhea patients, etc.. ^{‡‡}Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. ^{§§} Monitoring nutritional status of patients to determine whether goals of nutritional management are reached. BW, body weight

ients. The primary personnel in charge of *Screening* in the 850 study institutions which implemented *Screening* were RDs (57.6%) and nurses (38.2%). The number of RDs is limited,²⁰ and *Screening* can be successfully implemented by non-experts if they are provided with adequate tools.²¹ Furthermore, it has been argued that RDs should focus more on *Assessment* and *Intervention*, which require higher levels of professional knowledge. Optimally, *Screening* should be implemented immediately at hospital admission, and the results of our study suggested that it might be more efficient to have a staffing system in which RDs are replaced in this role by other medical staffs using adequate tool.

Another problem with *Screening* may be related to the tools being used. In this study, the tool used most often for *Screening* was the modified SGA. However, the SGA is actually an *Assessment* tool, rather than a *Screening* tool.^{14,22} When using the SGA, subjective judgement is needed, and the results rely on the proficiency of the personnel implementing it. Ideally, *Screening* tools should have both high sensitivity and high specificity to be useful.²¹ The modified SGA is not ideal for use as a *Screening* tool as its reliability and validity have not been verified for this application. Our findings suggest that, in addition to have the staffing systems modified, different tools should be used for *Screening* for malnutrition and additional education about those tools is warranted.

Assessment

Problems in *Assessment* were the target patients and evaluation items. In our study, 66.1% of institutions that implemented *Assessment* did so in all of their hospitalized patients. *Assessment* is implemented by nutrition experts, who performed a detailed evaluation of the nutritional status of patients who were considered to be at risk of malnutrition.⁹ Inaccurate patient targeting may result in nutrition experts being too busy to focus on those patients who really need assessment. Furthermore, many institutions in Japan may possibly confuse *Screening* with *Assessment*. This was indicated by the fact that the top 3 tools used (SGA,¹⁴ MNA-SF,¹⁵ and CONUT¹⁶) were the same during *Screening* and *Assessment*. Also, the proportion of institutions reporting that they had instruction manuals on *Screening* (76.9%) were almost identical to those with instruction manuals on *Assessment* (77.2%). These findings suggested that additional education about *Screening* and *Assessment* is warranted, and that *Assessment* should be implemented only in patients who are at risk of malnutrition.

Problems were also identified with some of the evaluation items used for *Assessment*. Among all items used to evaluate nutritional status, muscle mass and muscle strength are extremely important and should be evaluated at bedside.^{5,9} However, of the 887 institutions implementing *Assessment*, the proportion of institutions in our study where muscle mass and muscle strength were used during *Assessment* were 13.0% and 8.8%, respectively. Many RDs may not consider muscle mass and muscle strength to be important *Assessment* items, or alternatively they may not routinely perform *Assessment* at the bedside (where muscle mass and strength are evaluated). Since 2022, hospitals in Japan can claim reimbursement for

RDs working on patient wards, which reflects the expectation that they provide medical care at bedside.²³ Currently, such claims are allowed only for Special Functioning Hospitals (only 87 institutions in Japan). This type of reimbursement is expected to be paid for hospitals other than Special Functioning Hospitals because such change could encourage more bedside medical care by RDs. Also, the staffing system in which RDs have scheduling structured to perform *Assessment* at bedside is helpful, which may increase the likelihood of muscle strength and muscle mass to be a routine part of *Assessment*.

Intervention

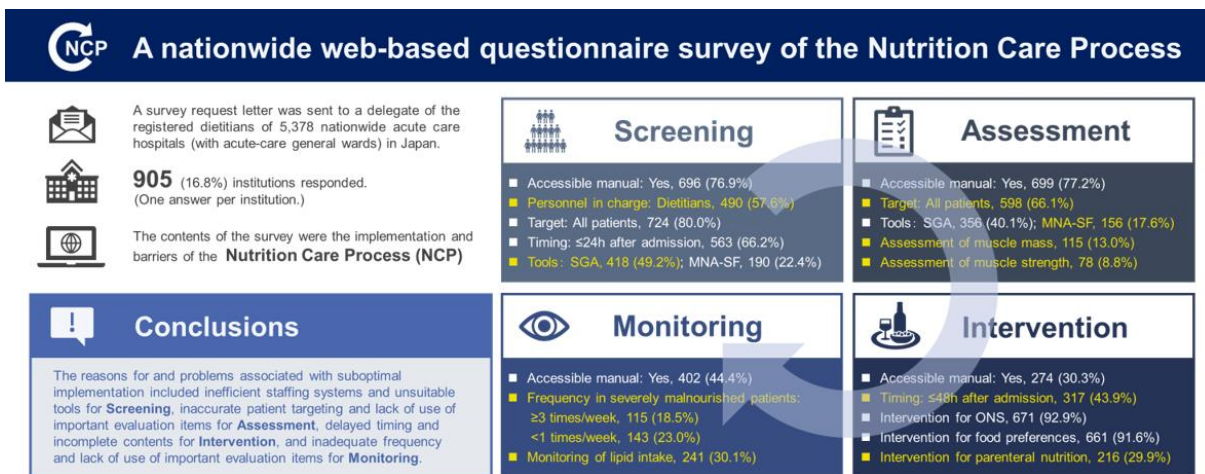
Problems for *Intervention* were the timing and contents of *Intervention* by RDs. Our study showed only 43.9% did so within 48h of hospital admission. The Academy of Nutrition and Dietetics and the American Society for Parenteral and Enteral Nutrition both recommend the implementation of *Intervention* (including *Planning*) within 48 h after patient hospital admission,²⁰ and the beneficial effects of this approach have been demonstrated in the large-scale, multicenter, randomized EFFORT trial.⁷ In our study, the primary reasons given for the delay of *Intervention* included “human resource shortage” and “lack of time,” and only 30.3% of all institutions reported having an instruction manual for *Intervention*.

Problems with implementing *Intervention* were not only related to delayed timing, but also to the contents of the *Intervention* performed by RDs. The most common interventions were those related to diet (i.e., oral nutritional supplements, food-related preferences, and food texture), whereas those related to environment for food intake (i.e., meal-time atmosphere and conditions for food intake) and parenteral nutrition were included much less often. Historically, Japanese dietitians have primarily been in charge of the hospital food service²⁴ and not involved in the management of parenteral nutrition. However, patients admitted to acute-care hospitals often require comprehensive nutritional intervention, which at times should include parenteral nutrition. For *Intervention*, more institutions need to have instruction manuals accessible, so that information about the timing and contents of *Intervention* are available to all. Also, education for RDs about parenteral nutrition, and structuring of staffing systems so that RDs can have more *Intervention* options, including parenteral nutrition, are warranted.

Monitoring

Problems for *Monitoring* were frequency and monitoring items. In our study, the proportions of institutions implementing *Monitoring* in moderately malnourished or moderately ill patients less than once a week were as high as about 50%. In addition, as high as 20% of institutions implement *Monitoring* in severely malnourished or severely ill patients less than once a week. The most common reasons for low-frequency *Monitoring* were “lack of time,” “human resource shortage,” and “lack of awareness of nutritional management in medical staff.” Also contributing may be the fact that less than 50% of the institutions had the instruction manual for *Monitoring*.

These results are concerning as frequent nutritional *Monitoring* is essential for acutely ill patients, particularly



Graphical Abstract

those who are malnourished. Furthermore, the nutritional status of hospitalized patients can change in a short period of time.²⁵ Beyond that, inadequate oral food intake during hospitalization is a known risk factor longer hospital stays and higher mortality rates.^{26, 27} The findings suggested that instruction manuals for *Monitoring* should be available at more hospitals in order to provide clear guidelines about the appropriate frequency of *Monitoring*, depending on the degrees of malnutrition and disease severity experienced by patients.

There were also issues in the items evaluated during *Monitoring*. Energy intake and protein intake were considered to be essential by 93.8% and 84.3%, respectively of institutions implementing *Monitoring*. However, lipid intake was considered essential by only 30.1% of these institutions. This is concerning as the frequency of use of lipid emulsion during parenteral nutrition has been shown to be extremely low in Japan.^{4, 28} Without adequate *Monitoring*, patients, especially those receiving parenteral nutrition, may be more prone to essential fatty acid deficiency. Our findings suggested that lipid intake should be added to energy intake and protein intake as essential items for nutritional *Monitoring*.

Possible solutions

Firstly, education on the meaning of *Screening* and screening tools should be reinforced; adequate staffing is also needed for higher quality screening. Secondly, it is necessary to promote the understanding of NCP by registered dietitians and to increase the number of ward registered dietitians for more adequate *Assessment*. Thirdly, preparation of instruction manuals and education on parenteral nutrition in registered dietitians for adequate *Intervention* and *Monitoring* is essential.

Study strengths and limitations

The strength of our study was that it was the first large-scale Japanese study to investigate the actual status of nutritional management in a detailed fashion using the NCP. To our knowledge, such studies have not been conducted in any other country. Our study, using the NCP framework, demonstrated a gap between an ideal and actual nutritional management in hospitalized patients in Japan.

A limitation of our study was the 16.8% response rate of the questionnaire. As such, it is not possible to rule out the possibility that many of the respondent institutions were those who were already more dedicated to improving nutritional management or using the NCP. Accordingly, the generalization of the study results might not be possible. Reasons of low response rate were as follows: the anticipated time required to answer (as stated in the request letter) was as long as 30 to 40 min; the importance and meaning of this survey might not be sufficiently conveyed via a document. Active promotions to explain the importance and meaning of this survey not only by paper documents but also by various tools such as video-sharing or the website showing project's instruction is needed to increase the response rate. In this study, the nutrition management department of each institution was free to select their own corresponding personnel without any selection criterion considering feasibility. Thus, it was unclear whether the corresponding personnel was qualified to answer the survey. However, it was believed that only the institutions that understood and agreed to the meaning of this survey responded because the participation was voluntary, and that such institution must select an adequate person from the nutrition management department. Nevertheless, these limitations should not be a distraction from the clear reason identified and associated with suboptimal implementation of nutritional *Screening*, *Assessment*, *Planning*, *Intervention*, and *Monitoring*. The NCP is a systematic approach that provides high quality nutrition care; awareness of the barriers to its optimal use may help promote and spread the world-wide implementation of the NCP.

Conclusion

In our investigation of Japanese acute-care hospitals that utilized NCP as a framework, we observed a gap between the ideal and actual nutritional management. Problems associated with suboptimal implementation included inefficient staffing systems and unsuitable tools for *Screening*, inaccurate patient targeting and lack of use of important evaluation items for *Assessment*, delayed timing and incomplete contents for *Intervention*, and inadequate frequency and lack of use of important evaluation items for *Monitoring*. Possible solutions include increased staff-

ing of acute-care general wards especially RDs, higher quality *Screening*, more widespread availability of NCP instruction manuals, and further education on NCP and the ideal use of tools and evaluation items in nutritional management.

SUPPLEMENTARY MATERIAL

Supplementary tables and figures mentioned in this manuscript is available upon request.

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