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

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ABSTRACT

Background and Objectives: Study aim was to determine the levels of and barriers of the Nutrition Care Process (NCP), a practical method of individualized nutrition support.

Methods and Study Design: The 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 the Screening, 80.0% screened all inpatients: the primary personnel in charge, RDs (57.6%); the most used screening tool, the Subjective Global Assessment (SGA) (49.2%). For the Assessment, 66.1% assessed all inpatients: most evaluated, food intake (93.3%); least evaluated, muscle mass and strength (13.0%, 8.8%). For the Intervention, 43.9% did so within 48 hours of hospital admission: the most often RDs' intervention, oral nutritional supplement (92.9%); less intervention, parenteral nutrition (29.9%). For the Monitoring, 18.5% of institutions had it ≥ 3 times/week and 23.0% had it less than once a week for severely malnourished patients: most monitored, energy and protein intake (93.7%, 84.3%); less monitored, lipid dose (30.1%). **Conclusions:** The barriers of NCP were 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 in nutritional management were the 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 more severe illness, greater degrees of inflammation, lower levels of physical activity, and more 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 recommended 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 Intervention, 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 recommends that the NCP be part of lifetime education for registered and general dietitians, and it is devoted to providing instruction about 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 of, timing and frequency of, tools and items, and systems of each of the four components of the NCP, and identify the reasons that implementation of the NCP may have been suboptimal.

MATERIALS AND METHODS

Survey

We created a questionnaire, and outsourced the construction of the web-based questionnaire system, implementation of the survey, and curation of the survey data 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 Japan Quality Assurance Organization and implements organizational control, people control, physical control, and technological control, based on Information Security Management System. Also, they take measures to prevent log tampering by recording the log for usage status and system operation.

The questionnaire was prepared by the author group. And 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 and

referring 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.⁷ For the terminology, NCP,⁹ ESPEN guideline on hospital nutrition,¹² and ESPEN guideline on clinical nutrition and hydration in geriatrics¹³ were referred.

The questionnaire focused on measures of NCP component 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 the all categorical questions. And, a 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 (Supplementary Table 1) 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 person. In order to respond, the delegate would access the website, enter the independent identification number, record their email address, and respond to the questionnaire. Responses were accepted from April 2023 through June 2023.

Ethical statements

The study was conducted after an approval 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 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 are 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). Institutions having accessible instruction manuals most often made them available to all personnel (range, 63.9% to 73.7%) and less often available to only RDs (range, 14.5% to 28.4%) (Supplementary Figure 1).

Patient targeting

Of the 905 study institutions, the NCP components were implemented in all patients for Screening by 724 (80.0%) institutions, for Assessment by 598 (66.1%) institutions, for Planning by 373 (41.2%) institutions, for Intervention by 239 (26.4%) institutions, and for Monitoring by 388 (42.9%) institutions (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, attending 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 distributions of the timing of implementation of Screening, Assessment,

Planning, and Intervention are shown in Figure 3A, and the distribution of the frequency of Monitoring is shown in Figure 3B. In the 850 institutions implementing Screening, 563 (66.2%) did so within 24 hours. Of the 722 institutions implementing Intervention, 317 (43.9%) did so within 48 hours 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 implementing Monitoring in their severe disease patients, 87 (21.1%) did so 3 or more times per week, while 84 (20.4%) did so less than once a week. Timing or frequency of implementation of each component as directed by instruction manuals are shown in Figure S3.

Personnel in charge of NCP implementation

For 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 the 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 components of NCP at all, and the most common reason 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 implementation of Monitoring. The most common reasons, 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 the Mini Nutritional Assessment Short-Form (MNA-SF)¹⁵ by 190 (22.4%) institutions and the Controlling Nutritional Status (CONUT)¹⁶ by 127 (14.9%) institutions (Figure 6). Similarly, the tool used most often for assessment was also the SGA¹⁴ by 356 (40.1%) institutions, followed by the MNA-SF¹⁵ by 156 (17.6%)

institutions and the CONUT¹⁶ by 135 (15.2%) institutions. Of the institutions using the SGA,¹⁴ more than half used the modified rather than the original version. In addition to tools, the evaluation items used for assessment included 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 used by only 115 (13.0%) institutions and muscle strength was used by only 78 (8.8%) institutions. Results of other questions about nutritional assessment (and related questions about planning and monitoring) are summarized in Supplementary Table 2.

Registered dietician intervention and essential monitoring items

The intervention most often implemented by RDs was providing oral nutritional supplements in 671 (92.9%) institutions, followed by identifying patient food-related preferences (e.g., appearance, volume, and smell of foods) in 661 (91.6%) institutions and food texture modification in 656 (90.9%) institutions (Figure 8A). On the other hand, RDs at only 150 (20.8%) institutions intervened by improving meal-time atmosphere, at only 184 (25.5%) institutions by identifying desirable conditions for food intake (i.e., to allow patients to concentrate on eating), and at only 216 (29.9%) institutions 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 are summarized in Supplementary Figure 5.

DISCUSSION

Using a nationwide web-based questionnaire, the levels of, timing and frequency of, and tools or items and systems used for implementation of the components of the NCP (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 dietician's personal thought and awareness. There are no studies which investigated NCP procedures in each institution. Also, previous studies¹⁷⁻¹⁹ were conducted to know a rough implementation status for each NCP process as well as the problems and assessment items. On the other hand, our study was conducted to investigate in detail the instruction manuals preparation status, the responsible personnel, the implementation timing and frequency after hospital admission for each NCP process. As a result, the implementation level for each process and for each

institution was shown in detail, which led to the clarification of specific improvement measures to be taken going forward.

Screening

Problems for screening were the staffing system and tools. A total of 80.0% of the study institutions implemented Screening in all of their hospitalized patients. The primary personnel in charge of Screening were RDs in 57.6% and nurses in 38.2% of the 850 study institutions implementing Screening. 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 suggest 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 tools.

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, because its reliability and validity have not been verified for this application. Our findings suggest that, in addition to staffing systems being modified, different tools should be used for the process of Screening for malnutrition and additional education about those tools is warranted.

Assessment

Problems for 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 perform a detailed evaluation of the nutritional status of patients who are 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 and Assessment. This is suggested by the fact that the top 3 tools used (SGA,¹⁴ MNA-SF,¹⁵ and CONUT¹⁶) were exactly the same for both Screening and Assessment. Also, the proportion of institutions reporting that they had instruction manuals was almost identical

for screening (76.9%) and assessment (77.2%). These findings suggest that additional education about screening and assessment is warranted, and that assessment should be implemented only in patients at risk of malnutrition.

Problems were also identified with some of the evaluation items used for assessment. Among items used to evaluate nutritional status, muscle mass and muscle strength are extremely important and should be evaluated at the 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 for 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 their medical care at the bedside.²³ Currently, such claims are allowed only for Special Functioning Hospitals (which comprised 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 promote more bedside medical care by RDs. Also helpful would be staffing systems in which RDs have scheduling structured to perform Assessment at the bedside, which may increase the likelihood that direct evaluation of items like muscle strength and muscle mass would 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 48 hours 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 hours 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 the instruction manual for Intervention.

Problems with implementing Intervention were related not only 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 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 make instruction manuals accessible, so that information about the timing and contents of Intervention are available. 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, the proportions implementing monitoring in severely malnourished or severely ill patients less than once a week were as high as 20%. 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, because frequent nutritional monitoring is essential for acutely ill patients, particularly 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 suggest that instruction manuals for Monitoring should be available at more hospitals, as these can provide clear guidelines about the appropriate frequency of Monitoring, depending on the degrees of malnutrition and disease severity experienced by patients.

Problems were also identified with some of the evaluation items used for monitoring. Of those institutions implementing monitoring, Energy intake and protein intake were considered to be essential for nutritional Monitoring by 93.8% and 84.3% of the study institutions, respectively. However, lipid intake was considered essential by only 30.1% of these institutions. This is concerning, because the frequency of use of lipid emulsion during parenteral nutrition has been shown to be extremely low in Japan.^{4, 28} Without adequate Monitoring essential fatty acid deficiency is more likely to develop, especially in patients

receiving parenteral nutrition. Our findings suggest that lipid intake should be added to energy intake and protein intake as essential items for nutritional monitoring.

Possible solutions

First, reinforcement of the education on the meaning of screening and screening tools and adequate staffing are needed for higher quality screening. Second, 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. Third, preparation of instruction manuals and education on parenteral nutrition in registered dietitians for the adequate intervention and monitoring.

Study strengths and limitations

The strength of our study is that it is 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 a study has not been conducted in any other countries. Our study, using the framework of the NCP, demonstrated that there appears to be a gap between ideal and actual nutritional management in hospitalized patients in Japan.

A limitation of our study is the 16.8% response rate for 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, there is a limitation of generalization of our study results. The reasons of low response rate are as follows: the anticipated time required to response written in the survey request letter was as long as 30 to 40 min; the importance and meaning of this survey might not be sufficiently understood only by the explanations in document. More active promotion with the explanation of the importance and meaning of this survey not only by document but also by various tools including a video-sharing or a project's instructive website is needed to increase the response rate. In this study, we left it to the nutrition management department of each institution to select the responding person without selection criterion considering feasibility. Thus, whether an adequate responding person was selected or not is unclear. However, we believe that only the institutions which understood and agreed to the meaning of the survey responded because the participation was voluntary, and that such institution must select an adequate responder from the nutrition management department based on their understanding. Nevertheless, these limitations should not distract from the clear identification of reasons for and problems associated with suboptimal implementation of nutritional

screening, assessment, planning, intervention, and monitoring. The NCP is a systematic approach to providing high quality nutrition care, and awareness of 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, using the NCP as a framework, we observed a gap between ideal and actual nutritional management. The reasons for and 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 staffing of acute-care general wards by RDs, higher quality Screening, more widespread availability of NCP instruction manuals, and enhanced education about the NCP and the ideal use of tools and evaluation items in nutritional management.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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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 [¶]	424	(46.9)
Other	134	(14.8)
Unknown	3	(0.3)
DPC/PDPS ^{††} reimbursement		
Yes	440	(48.6)
Nutrition Support Team (NST)		
Yes	532	(58.8)
	<i>median</i>	(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.

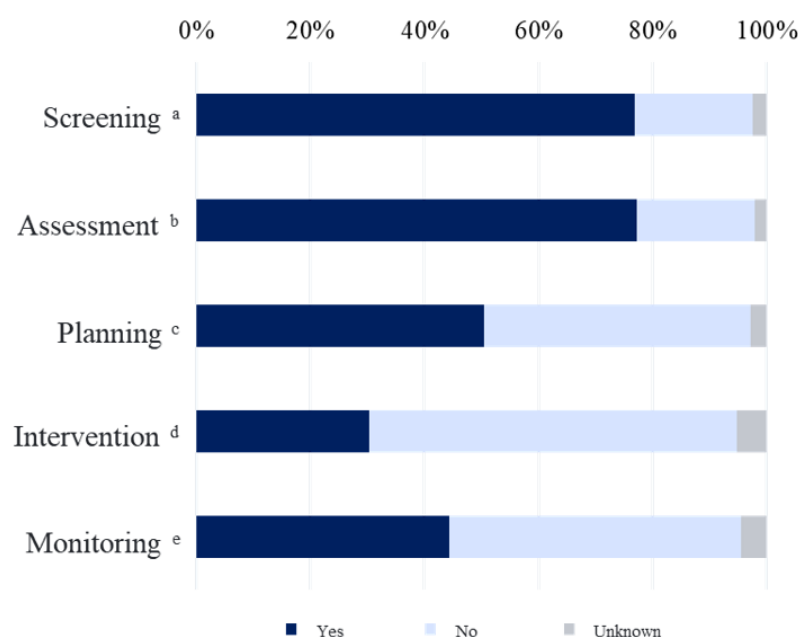


Figure 1. Accessible instruction manuals for each component of the Nutrition Care Process (NCP) in the 905 study institutions. Bar graph shows the proportions of hospitals having and not having accessible instruction manuals for each component of the NCP. a Identification of patients with malnutrition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

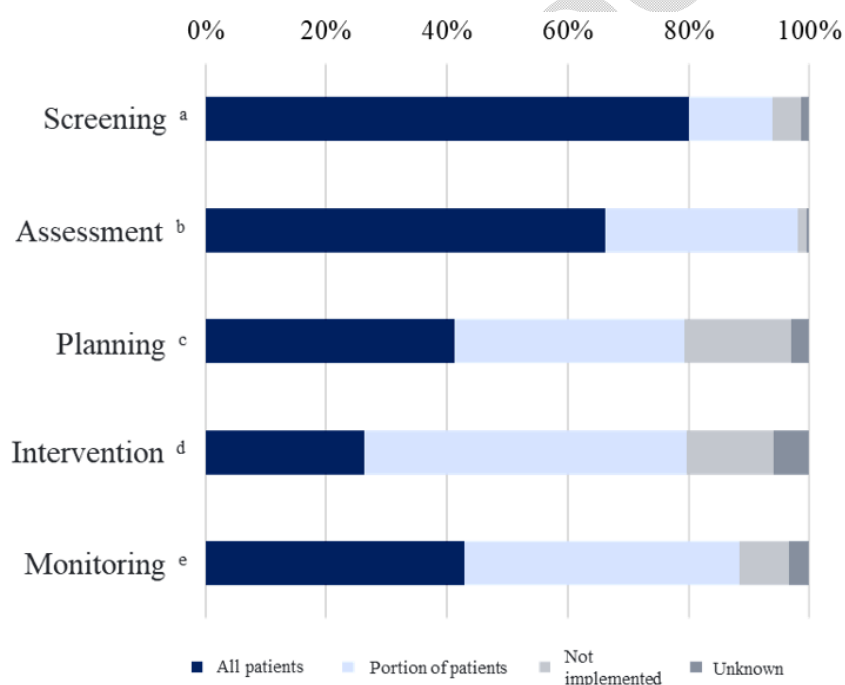


Figure 2. Implementation of each component of the Nutrition Care Process (NCP) in all, a portion, and none of the hospitalized patients of the 905 study institutions. Bar graph shows the proportions of hospitals implementing components of the NCP in all, a portion, and none of their patients. a Identification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

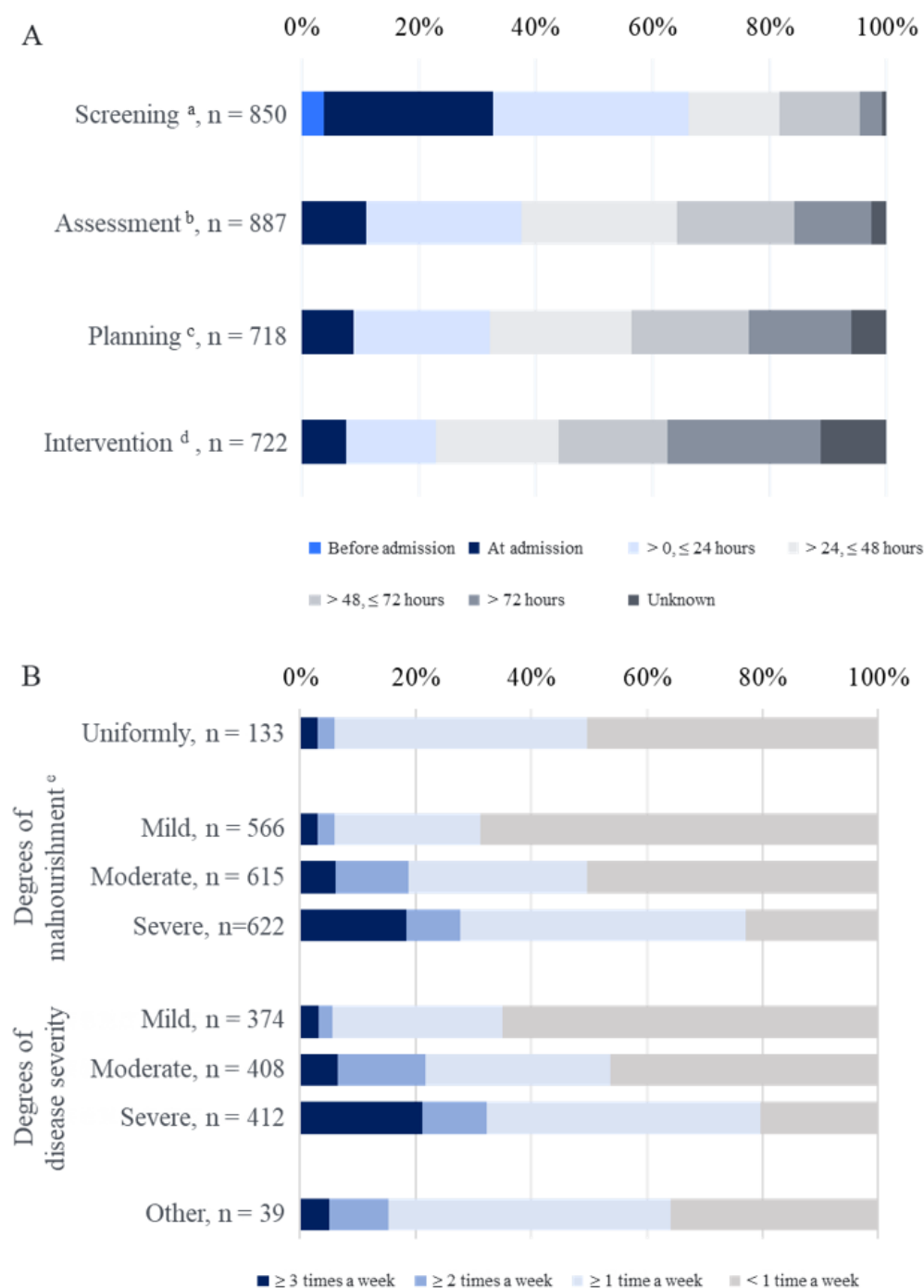


Figure 3. Timing or frequency of implementation of each component of the Nutrition Care Process (NCP), reported by the study institutions that performed implementations in some or all of their hospitalized patients. Each color bar represents the proportion of institutions performing implementation within 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^a, Assessment^b, Planning^c, and Intervention^d. (B) Bar graph shows the distribution of the most common frequency of implementation in clinical practice of Monitoring^e. Of the 800 study institutions implementing Monitoring^e in some or all of their patients, 133 did so at a uniform frequency that is periodically Monitoring^e implementation in all target patients, while 667 did so using differing frequencies for the various degrees. The total “n” for each of 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. a Identification of patients with malnutrition or suspected malnutrition. b Detailed evaluation of nutritional status of patients done by nutrition experts. c Planning of nutritional management and of nutritional interventions for patients. d Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. e Nutrient deficiency conditions due to problems with nutrient metabolism, absorption, and/or intake. f 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. g Monitoring nutritional status of patients to determine whether goals of nutritional management are reached

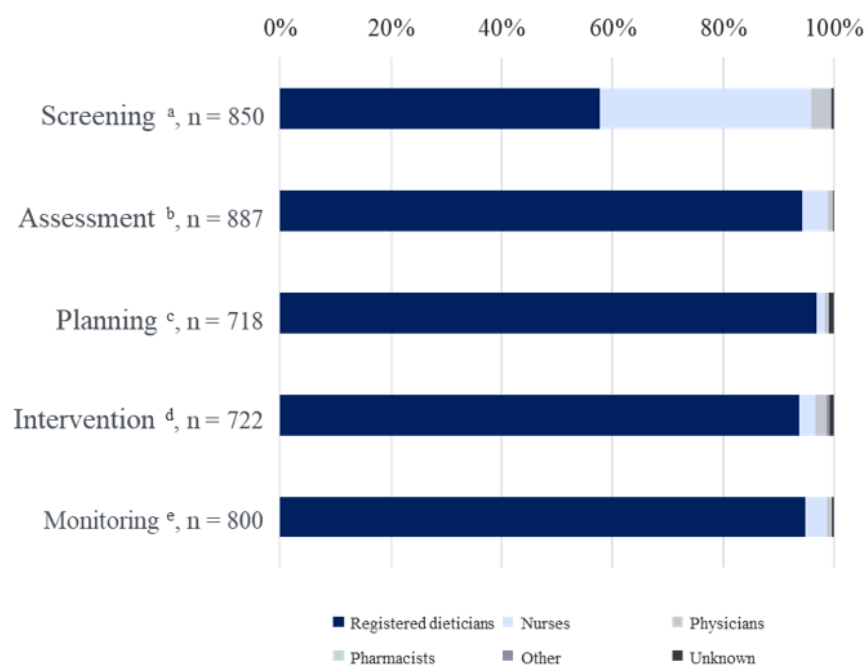


Figure 4. Personnel in charge of implementation of Nutrition Care Process (NCP) components at study institutions. Bar graphs show, for the institutions which implemented components of NCP, the proportions of the personnel most often in charge of the implementation for each of the five NCP components.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

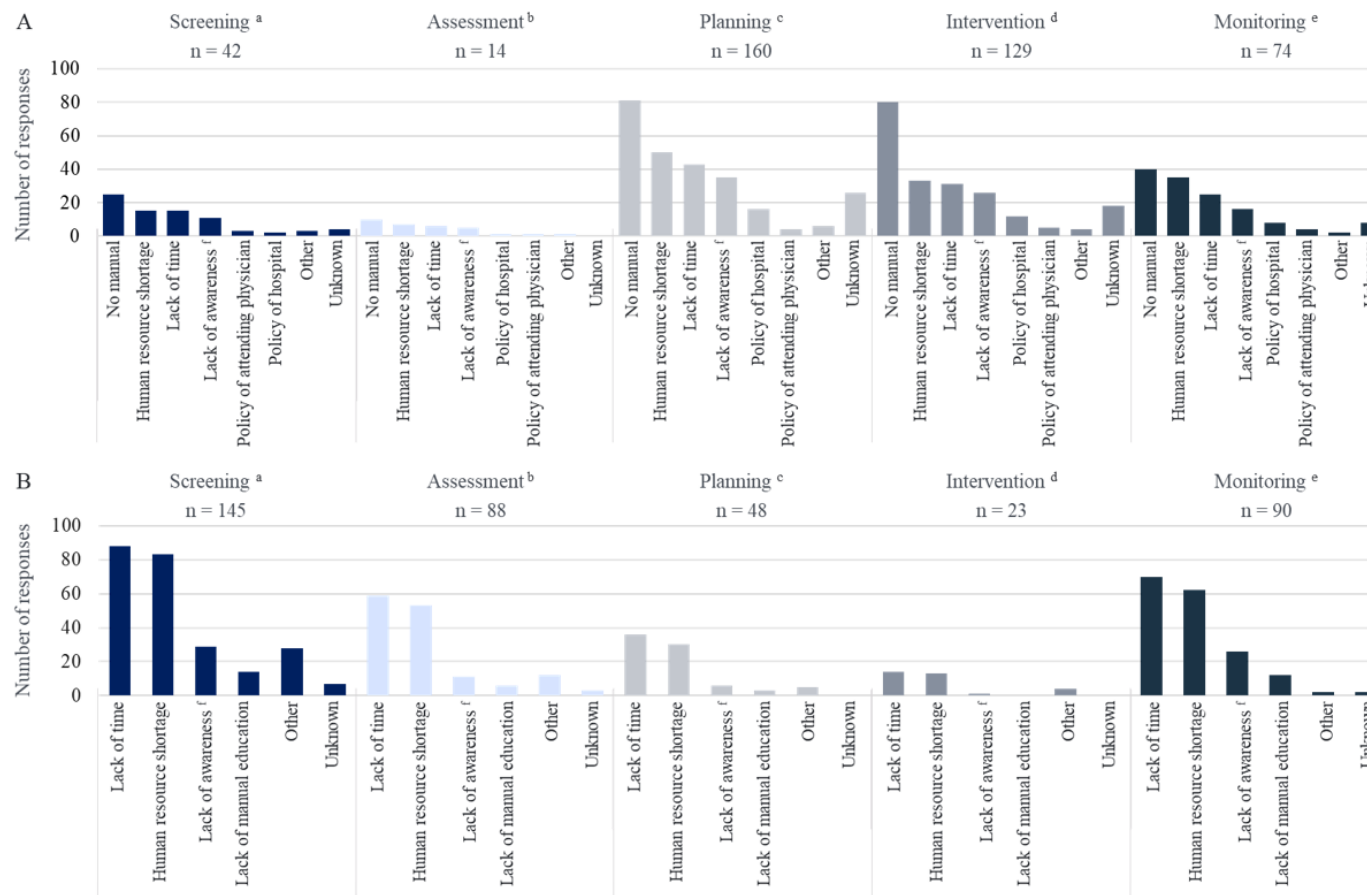


Figure 5. Reasons for lack of, delayed, and infrequent implementation of Nutrition Care Process (NCP) components in clinical practice relative to implementation directed by the instruction manuals for each component. (A) Bar graphs show frequencies of reasons reported by the 14 to 160 study institutions 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^a, Assessment^b, Planning^c, and Intervention^d) or inadequate frequency of (Monitoring^e) implementation, as compared to the directions for timing and frequency provided by those instruction manuals. Multiple answers were allowed for all surveys. ^a Identification of patients with malnutrition or suspected malnutrition. ^b Detailed evaluation of nutritional status of patients done by nutrition experts. ^c Planning of nutritional management and of nutritional interventions for patients. ^d Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. ^e Monitoring nutritional status of patients to determine whether goals of nutritional management are reached. ^f Lack of awareness of nutritional management in medical staff.

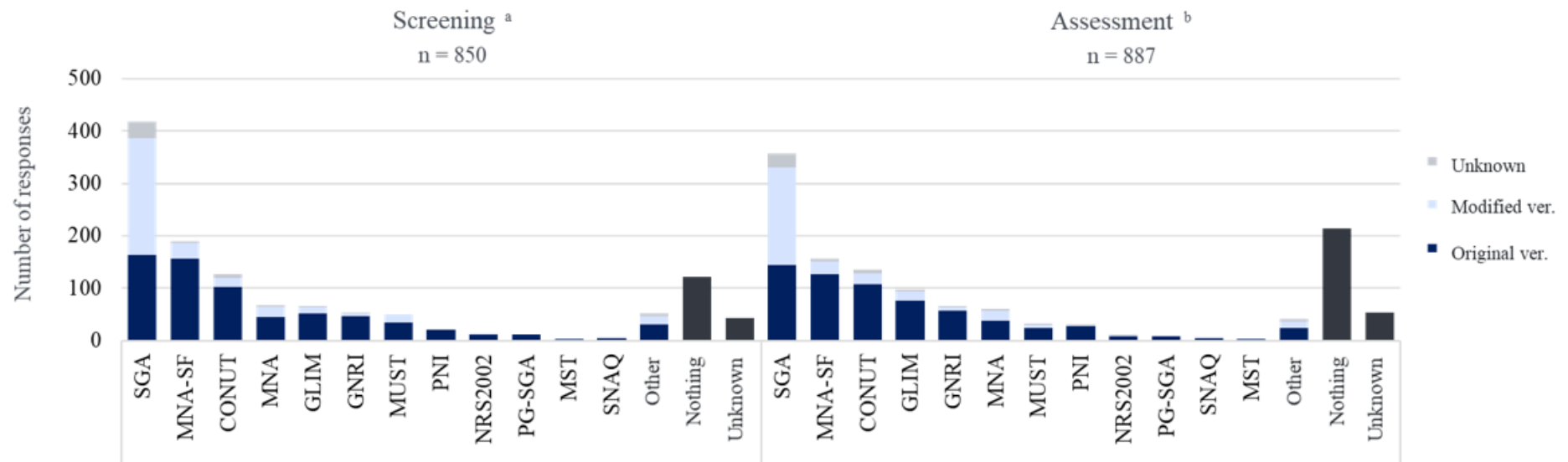


Figure 6. Tools used for the Screening^a and Assessment^b components of the Nutrition Care Process (NCP) in the study institutions that implemented these components. Bar graphs show the frequencies of items reported as tools for Screening^a for malnutrition at the 850 study institutions and for Assessment^b 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^a and Assessment^b. ^a Identification of patients with malnutrition or suspected malnutrition. ^b 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

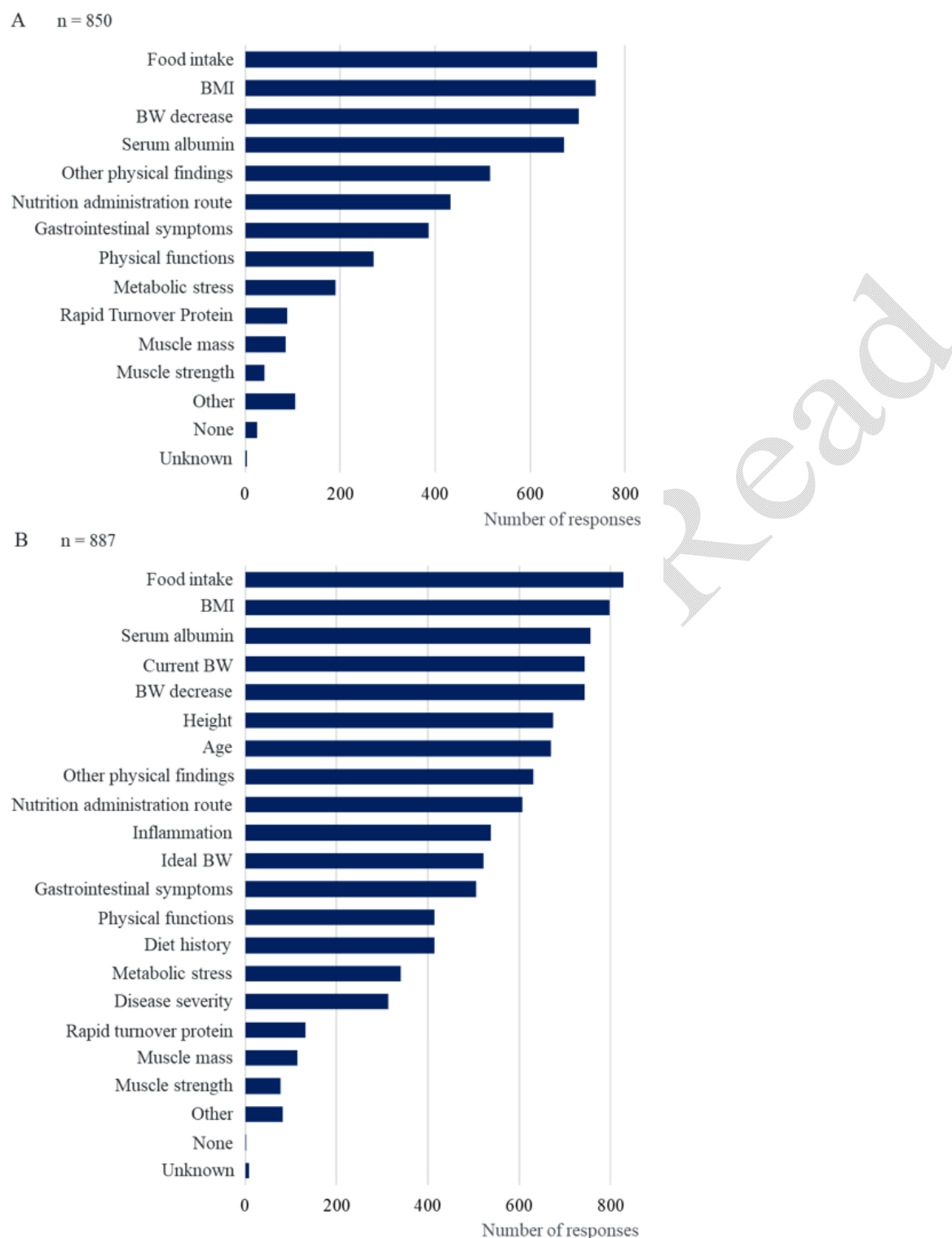
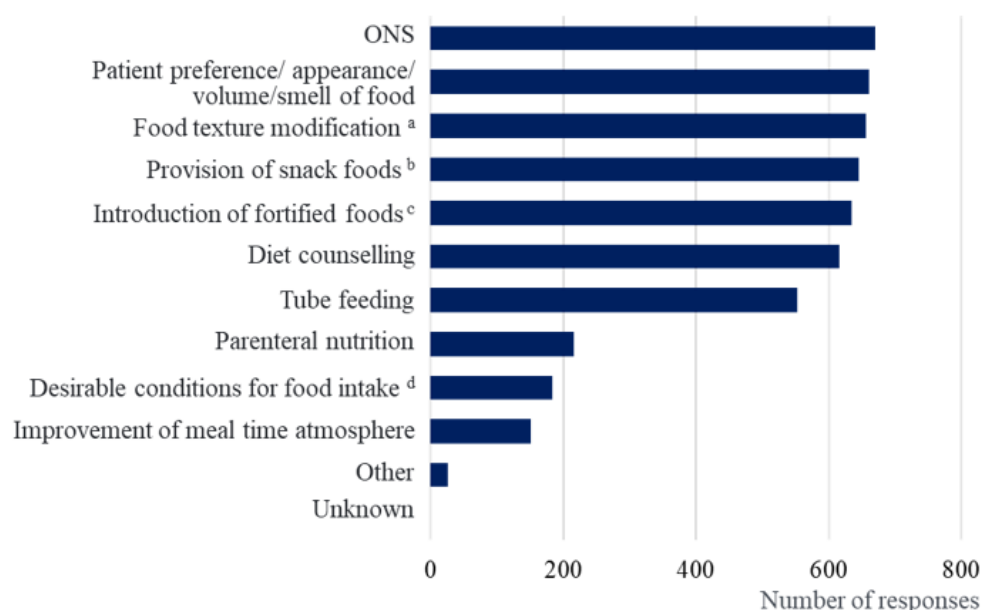


Figure 7. Evaluation items used for the Screening and Assessment components of the Nutrition Care Process (NCP) in the study institutions that implemented these components. (A) Bar graph shows frequencies of items reported as evaluation items (other than tools) for Screening for malnutrition at the 850 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. a Identification of patients with malnutrition or suspected malnutrition. b Detailed evaluation of nutritional status of patients done by nutrition experts. BMI, body mass index; BW, body weight

A n = 722



B n = 800

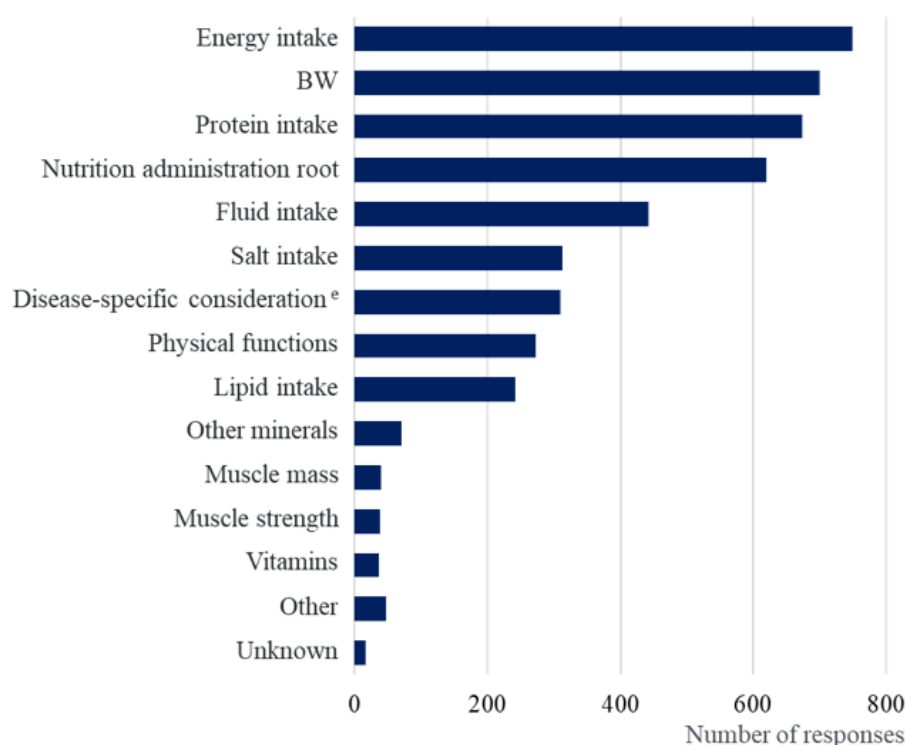
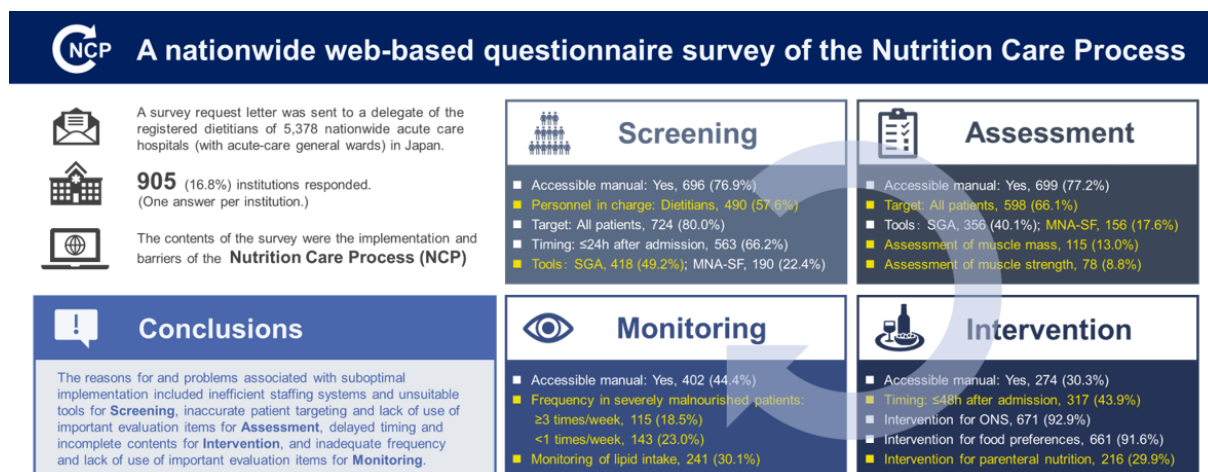


Figure 8. Interventions^f by registered dietitians and Monitoring^g considered to be essential at the institutions which implemented these components of the Nutrition Care Process (NCP). (A) Bar graph shows the frequencies of Interventions^f implemented by registered dietitians at the 722 study institutions. (B) Bar graph shows frequencies of items reported as essential for nutritional Monitoring^g at the 800 study institutions. Multiple answers were allowed for the surveys of both Interventions^f and Monitoring^g items. a Modifying food texture (e.g., Softening and mincing). b Adding Snack foods (i.e., Between-meal snack to reach nutritional requirements). c Introducing fortified foods (e.g., Protein/oil-fortified foods). d Identifying and providing desirable conditions for food intake (i.e., To allow patients to concentrate on eating). e 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.. f Performing actions aimed at changing patient behaviors, activities, risk factors, and environments pertaining to nutrition and medical conditions. g Monitoring nutritional status of patients to determine whether goals of nutritional management are reached. BW, body weight



Graphical Abstract