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Hospital food service strategies to improve food intakes among inpatients: A systematic review
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Abstract

This review aims to identify hospital food service strategies to improve food consumption among hospitalized patients. A systematic search that met the inclusion and exclusion criteria was manually conducted through Web of Science and Scopus by an author, and the ambiguities were clarified by two senior authors. The quality assessment was separately conducted by two authors, and the ambiguities were clarified with all the involved authors. Qualitative synthesis was used to analyze and summarized the findings. A total of 2432 articles were identified by searching the databases, and 36 studies were included. The majority of the studies applied menu modifications and meal composition interventions ($n = 12$, 33.3%), or included the implementation of the new food service system ($n = 8$, 22.2%), protected mealtimes, mealtime assistance and environmental intervention ($n = 7$, 19.4%), and attractive meal presentation ($n = 3$, 8.3%). Previous studies that used multidisciplinary approaches reported a significant improvement in food intake, nutritional status, patient satisfaction and quality of life ($n = 6$, 16.7%). In conclusion, it is suggested that healthcare institutions consider applying one or more of the listed intervention strategies to enhance their food-service operation in the future. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Author Keywords

Food intake; Foodservice; Hospital; Intervention; Malnutrition

References

- Saunders, J., Smith, T., Stroud, M.
Malnutrition and undernutrition
(2018) *Medicine*, 47, pp. 152-158.
- Agarwal, E., Ferguson, M., Banks, M., Batterham, M., Bauer, J., Capra, S., Isenring, E.
Malnutrition and poor food intake are associated with prolonged hospital stay, frequent readmissions, and greater in-hospital mortality: Results from the Nutrition Care Day Survey 2010
(2013) *Clin. Nutr.*, 32, pp. 735-745.
- Barker, L.A., Gout, B.S., Crowe, T.C.
Hospital Malnutrition: Prevalence, Identification and Impact on Patients and the Healthcare System
(2011) *Int. J. Environ. Res. Public Health*, 8, pp. 514-527.
- Van Ancum, J.M., Scheerman, K., Jonkman, N.H., Kruizinga, R.C., Meskers, C.G., Maier, A.B.
Change in muscle strength and muscle mass in older hospitalized patients: A systematic review and meta-analysis

(2017) *Exp. Gerontol.*, 92, pp. 34-41.

- Allard, J.P., Keller, H., Teterina, A., Jeejeebhoy, K.N., Laporte, M., Duerksen, D.R., Gramlich, L., Da-vidson, B.
Factors associated with nutritional decline in hospitalised medical and surgical patients admitted for 7 d or more: A prospective cohort study
(2015) *Br. J. Nutr.*, 114, pp. 1612-1622.
- Kontogianni, M.D., Anna, K., Bersimis, F., Sulz, I., Schindler, K., Hiesmayr, M., Chourdakis, M.
Exploring factors influencing dietary intake during hospitalization: Results from analyzing nutritionDay's database (2006–2013)
(2020) *Clin. Nutr. ESPEN*, 38, pp. 263-270.
- Norshariza, J., Siti Farrah Zaidah, M., Basmawati, B., Leow, C., Lina, I., Norafidza, A., Khalizah, J., Lim, S.M.
Evaluation of Factors Affecting Food Wastage among Hospitalized Patients on Therapeutic Diet at Ministry of Health (MOH) Hospitals
(2019) *Asian J. Diet*, 1, pp. 111-120.
- Keller, H., Allard, J., Vesnaver, E., Laporte, M., Gramlich, L., Bernier, P., Davidson, B., Payette, H.
Barriers to food intake in acute care hospitals: A report of the Canadian Malnutrition Task Force
(2015) *J. Hum. Nutr. Diet*, 28, pp. 546-557.
- Sun, H., Zhang, L., Zhang, P., Yu, J., Kang, W., Guo, S., Chen, W., Chen, L.
A comprehensive nutritional survey of hospitalized patients: Results from nutritionDay 2016 in China
(2018) *PLoS ONE*, 13, pp. 1-16.
- Palmer, M., Huxtable, S.
Aspects of protected mealtimes are associated with improved mealtime energy and protein intakes in hospitalized adult patients on medical and surgical wards over 2 years
(2015) *Eur. J. Clin. Nutr.*, 69, pp. 961-965.
- Guenter, P., Jensen, G., Patel, V., Miller, S., Mogensen, K.M., Malone, A., Corkins, M., Dimaria-Ghalili, R.A.
Ad-dressing Disease-Related Malnutrition in Hospitalized Patients: A Call for a National Goal
(2015) *Jt. Comm. J. Qual. Patient Saf.*, 41, pp. 469-473.
- Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Brennan, S.E.
The PRISMA 2020 statement: An updated guideline for reporting systematic reviews
(2021) *Syst. Rev.*, 10, pp. 1-11.
- *Evidence Analysis Manual: Steps in the Academy Evidence Analysis Process*, Academy of Nutrition and Dietetics. (accessed on 10 September 2020)
- Handu, D., Moloney, L., Wolfram, T., Ziegler, P., Acosta, A., Steiber, A.
Academy of Nutrition and Dietetics Methodology for Conducting Systematic Reviews for the Evidence Analysis Library

(2016) *J. Acad. Nutr. Diet*, 116, pp. 311-318.

- Beelen, J., Vasse, E., Janssen, N., Roos, N.M.D., De Groot, L.C.P.G.M.
Protein-enriched familiar foods and drinks improve protein intake of hospitalized older patients: A randomized controlled trial
(2018) *Clin. Nutr.*, 37, pp. 1186-1192.
- Munk, T., Bruun, N., Nielsen, M.A., Thomsen, T.
From Evidence to Clinical Practice: Positive effect of implementing a protein-enriched hospital menu in conjunction with individualized dietary counseling
(2017) *Nutr. Clin. Pract.*, 32, pp. 420-426.
- Navarro, D.A., Shapiro, Y., Birk, R., Boaz, M.
Orange napkins increase food intake and satisfaction with hospital food service: A randomized intervention
(2019) *Nutr. X*, pp. 1-4.
3–6
- Porter, J., Haines, T.P., Truby, H.
The efficacy of Protected Mealtimes in hospitalised patients: A stepped wedge cluster ran-domised controlled trial
(2017) *BMC Med.*, 15, pp. 1-10.
- Rüfenacht, U., Ruhlin, M., Wegmann, M., Imoberdorf, R., Ballmer, P.E.
Nutritional counseling improves quality of life and nutrient intake in hospitalized undernourished patients
(2010) *Nutrition*, 26, pp. 53-60.
- Ingadottir, A.R., Hilmisdottir, H.B., Ramel, A., Gunnarsdottir, I.
Energy-and Protein Intake of Surgical Patients after The Implementation of Energy Dense Hospital Menus
(2015) *Clin. Nutr. ESPEN*, 10, pp. e107-e111.
- Holst, M., Beermann, T., Mortensen, M.N., Skadhauge, L.B., Lindorff-larsen, K., Rasmussen, H.
Multi-modal intervention improved oral intake in hospitalized patients. A one-year follow-up study
(2015) *Clin. Nutr.*, 34, pp. 315-322.
- Beermann, T., Mortensen, M.N., Skadhauge, L.B., Høgsted, R.H., Rasmussen, H.H., Holst, M.
Protein and energy intake improved by breakfast intervention in hospital
(2016) *Clin. Nutr. ESPEN*, 13, pp. e23-e27.
- van der Zanden, L.D.T., van Essen, H., van Kleef, E., Wijk, R.A. De., van Trijp, H.C.M.
Using a verbal prompt to increase protein consumption in a hospital setting: A field study
(2015) *Int. J. Behav. Nutr. Phys. Act.*, 12, pp. 1-10.
- Campbell, K.L., Webb, L., Vivanti, A., Varghese, P., Ferguson, M.
Comparison of three interventions in the treatment of malnutrition in hospitalised older adults: A clinical trial
(2013) *Nutr. Diet*, 70, pp. 325-331.

- Barrington, V., Maunder, K., Kelaart, A.
Engaging the patient: Improving dietary intake and meal experience through bedside terminal meal ordering for oncology patients
(2018) *J. Hum. Nutr. Diet*, 1, pp. 1-7.
- Doorduijn, A.S., van Gameren, Y., Vasse, E., de Roos, N.M.
At Your Request® room service dining improves patient satisfaction, maintains nutritional status, and offers opportunities to improve intake
(2016) *Clin. Nutr.*, 35, pp. 1174-1180.
- Hickson, M., Connolly, A., Whelan, K.
Impact of Protected Mealtimes on Ward Mealtime Environment, Patient Experience and Nutrient Intake in Hospitalised Patients
(2011) *Hum. Nutr. Diet*, 24, pp. 370-374.
- Holst, M., Beerman, T., Mortensen, M.N., Skadhauge, L.B., Køhler, M., Lindorff-larsen, K., Rasmussen, H.H.
Optimizing Protein and Energy Intake in Hospitals by Improving Individualized Meal Serving, Hosting and the Eating Environment
(2017) *Nutrition*, 34, pp. 14-20.
- Chan, C., Koo, H., Auyeung, T.-W., Liu, T.-Y., Sin, K.-L., Man, S.-P., Woo, C.-C., Chiu, L.-P.
Use of condiments to increase oral food intake of older patients
(2017) *Asian J. Gerontol. Geriatr.*, 12, pp. 47-52.
- McCray, S., Maunder, K., Barsha, L., Mackenzie-Shalders, K.
Room service in a public hospital improves nutritional intake and increases patient satisfaction while decreasing food waste and cost
(2018) *J Acad Nutr Diet*, 112, pp. 284-293.
- Roberts, S., Williams, L.T., Sladdin, I., Neil, H., Hopper, Z., Jenkins, J., Spencer, A., Marshall, A.P.
Improving nutrition care, delivery, and intakes among hospitalised patients: A mixed methods, integrated knowledge translation study
(2019) *Nutrients*, 11, p. 1417.
- Calleja-fernández, A., Velasco-gimeno, C., Vidal-casariego, A., Pintor-de-la-Maza, B., Frías-Soriano, L., Villar-Taibo, R., García-Peris, P., Ballesteros-Pomar, M.D.
Impact of kitchen organization on oral intake of malnourished inpatients: A two-center study
(2017) *Endocrinol. Diabetes Nutr.*, 64, pp. 409-416.
- Sathiaraj, E., Priya, K., Chakraborty, S., Rajagopal, R.
Patient-Centered Foodservice Model Improves Body Weight, Nutritional Intake and Patient Satisfaction in Patients Undergoing Cancer Treatment
(2019) *Nutr. Cancer*, 71, pp. 418-423.
- Young, A.M., de Jersey, S.J., Ellick, J., Lewis, C., Banks, M.
Comparison of Patient Food Intake, Satisfaction and Meal Quality Between Two Meal Service Styles in a Geriatric Inpatient Unit
Meal Quality Between Two Meal Service Styles in a Geriatric Inpatient Unit
(2018) *J. Nutr. Gerontol. Geriatr.*, 37, pp. 158-168.

- Collins, J., Porter, J., Truby, H., Huggins, C.E.
A foodservice approach to enhance energy intake of elderly subacute patients: A pilot study to assess impact on patient outcomes and cost
(2017) *Age Aging*, 46, pp. 486-493.
- Dijxhoorn, D.N., IJmker-Hemink, V., Wanten, G.J.A., van den Berg, M.G.A.
Strategies to increase protein intake at mealtimes through a novel high-frequency food service in hospitalized patients
(2019) *Eur. J. Clin. Nutr.*, 73, pp. 910-916.
- Goeminne, P.C., De Wit, E.H., Burtin, C., Valcke, Y.
Higher food intake and appreciation with a new food delivery system in a Belgian hospital. Meals on Wheels, a bedside meal approach q A prospective cohort trial
(2012) *Appetite*, 59, pp. 108-116.
- Young, A.M., Banks, M.D., Mudge, A.M.
Improving nutrition care and intake for older hospital patients through system-level dietary and mealtime interventions
(2018) *Clin. Nutr. ESPEN*, 24, pp. 140-147.
- Munk, T., Seidelin, W., Rosenbom, E., Nielsen, A.L., Klausen, T.W., Nielsen, M.A., Thomsen, T.
A 24-h a la carte food service as support for patients at nutritional risk: A pilot study
(2012) *Hum. Nutr. Diet*, 26, pp. 268-275.
- Markovski, K., Nenov, A., Ottaway, A., Skinner, E.
Does eating environment have an impact on the protein and energy intake in the hospitalised elderly?
(2017) *Nutr. Diet*, 74, pp. 224-228.
- Farrer, O., Olsen, C., Mousley, K., Teo, E.
Does presentation of smooth pureed meals improve patients consumption in an acute care setting: A pilot study
(2015) *Nutr. Diet*, 73, pp. 405-409.
- Lindman, A., Brygger, H., Frost, N.
Food caregivers influence on nutritional intake among admitted haematological cancer patients—A prospective study
(2013) *Eur. J. Oncol. Nurs.*, 17, pp. 827-834.
- Maudner, K., Lazarus, C., Walton, K., Williams, P., Ferguson, M., Beck, E.
Energy and protein intake increases with an electronic bedside spoken meal ordering system compared to a paper menu in hospital patients
(2015) *Clin. Nutr. ESPEN*, 10, pp. e134-e139.
- Mortensen, M.N., Larsen, A.K., Skadhauge, L.B., Høgsted, R.H., Beermann, T., Cook, M.E., Holst, M.
Protein and energy intake improved by in-between meals: An intervention study in hospitalized patients
(2019) *Clin. Nutr. ESPEN*, 30, pp. 113-118.
- Navarro, D.A., Boaz, M., Krause, I., Elis, A., Chernov, K., Giabra, M., Levy, M., Mouhieddine, M.
Improved meal presentation increases food intake and decreases readmission rate

in hospitalized patients(2016) *Clin. Nutr.*, 35, pp. 1153-1158.

- Manning, F., Harris, K., Duncan, R., Walton, K., Bracks, J., Larby, L., Vari, L., Chan, M.
Additional feeding assistance improves the energy and protein intakes of hospitalised elderly patients. A health services evaluation
(2012) *Appetite*, 59, pp. 471-477.
- Keller, H.H., Chambers, L.W., Fergusson, D.A., Niezgoda, H., Parent, M., Caissie, D., Lemire, N.
A mix of bulk and ready-to-use modified-texture food: Impact on older adults requiring dysphagic food
(2012) *Can. J. Aging*, 31, pp. 335-348.
- Laur, C., Butterworth, D., Nasser, R., Bell, J., Marcell, C., Murphy, J., Valaitis, R., Keller, H.
Impact of Facilitated Behavior Change Strategies on Food Intake Monitoring and Body Weight Measurements in Acute Care: Case Examples From the More-2-Eat Study
(2019) *Nutr. Clin. Pract.*, 34, pp. 459-474.
- Ofei, K.T., Holst, M., Rasmussen, H.H., Mikkelsen, B.E.
Effect of meal portion size choice on plate waste generation among patients with different nutritional status. An investigation using Dietary Intake Monitoring System (DIMS)
(2015) *Appetite*, 91, pp. 157-164.
- Capra, S., Wright, O., Sardie, M., Bauer, J., Askew, D.
The Acute Hospital Foodservice Patient Satisfaction Questionnaire: The Development of a Valid and Reliable Tool to Measure Patient Satisfaction with Acute Care Hospital Foodservices
(2005) *Foodserv. Res. Int.*, 16, pp. 1-14.
- Schindler, K., Themessl-huber, M., Hiesmayr, M., Kosak, S., Lainscak, M., Laviano, A., Pichard, C.
To eat or not to eat? Indicators for reduced food intake in 91,245 patients hospitalized on nutritionDays 2006–2014 in 56 countries worldwide: A descriptive analysis
(2016) *Am. J. Clin. Nutr.*, 104, pp. 1393-1402.
- Maia, I., Xará, S., Vaz, D., Shiang, T., Amaral, T.F.
Undernutrition risk at hospital admission and length of stay among pulmo-nology inpatients
(2018) *Pulmonology*, 24, pp. 330-336.
- Nigatu, Y.D., Gebreyesus, S.H., Allard, J.P., Endris, B.S.
The effect of malnutrition at admission on length of hospital stay among adult patients in developing country: A prospective cohort study
(2021) *Clin. Nutr. ESPEN*, 41, pp. 217-224.
- Hartwell, H., Johns, N., Edwards, J.S.A.
E-menus—Managing choice options in hospital foodservice
(2016) *International Int. J. Hosp. Manag.*, 53, pp. 12-16.

- Prgomet, M., Li, J., Li, L., Georgiou, A., Westbrook, J.I.
The impact of electronic meal ordering systems on hospital and patient outcomes: A systematic review
(2019) *Int. J. Med. Inform.*, 129, pp. 275-284.
- Hartwell, H., Edwards, J.S.A.
A Preliminary Assessment of Two Hospital Food Service Systems Using Parameters of Food Safety and Consumer Opinion
(2001) *J. R. Soc. Promot. Health*, 4, pp. 236-242.
- Hartwell, H.J., Edwards, J.S.A., Beavis, J.
Plate versus Bulk Trolley Food Service in a Hospital: Comparison of Patients' Satisfaction
(2007) *Nutrition*, 23, pp. 211-218.
- Jamaluddin, R., Manan, N.A.A., Basri, A.M., Karim, M.S.A.
Patients' Satisfaction with the Bulk Trolley System in a Government Hospital in Malaysia
(2010) *Leadersh. Health Serv.*, 27, pp. 229-315.
- Johns, N., Edwards, J.S.A., Hartwell, H.J.
Hungry in hospital, well-fed in prison? A comparative analysis of food service systems
(2013) *Appetite*, 68, pp. 45-50.
- British Dietetics Association. (accessed on 18 March 2021)
- Pullen, K., Collins, R., Stone, T., Carter, H., Sadler, H., Collinson, A.
Are energy and protein requirements met in hospital?
(2017) *J. Hum. Nutr. Diet*, 1, pp. 1-10.
- Jayadevappa, R., Chhatre, S.
Patient Centered Care—A Conceptual Model and Review of the State of the Art Identification of Studies
(2011) *Open Health Serv. Policy J.*, 4, pp. 15-25.
- Nichani, S., Fitterman, N., Lukela, M., Crocker, J.
Team Approach and Multidisciplinary Care. Hospital Medicine Revised Core Competencies
(2017) *J. Hosp. Med.*, 12, p. S81.
- Leary, K.J.O., Sehgal, N.L., Terrell, G., Williams, M.V.
Interdisciplinary Teamwork in Hospitals: A Review and Practical Recommendations for Improvement
(2012) *J. Hosp. Med.*, 7, pp. 48-54.
- Tappenden, K.A., Quatrara, B., Parkhurst, M.L., Malone, A.M., Fanjiang, G., Ziegler, T.R.
Critical Role of Nutrition in Improving Quality of Care: An Interdisciplinary Call to Action to Address Adult Hospital Malnutrition
(2013) *J. Acad. Nutr. Diet*, 113, pp. 1219-1237.
- Walton, K., Williams, P., Tapsell, L., Hoyle, M., Shen, Z.W., Gladman, L., Nurka, M.
Observations of mealtimes in hospital aged care rehabilitation wards
(2013) *Appetite*, 67, pp. 16-21.

- Green, S.M., Martin, H.J., Roberts, H.C., Sayer, A.A.
A systematic review of the use of volunteers to improve mealtime care of adult patients or residents in institutional settings
(2011) *J. Clin. Nurs.*, 20, pp. 1810-1823.
- Munk, T., Beck, A.M., Holst, M., Rosenbom, E., Rasmussen, H.H., Nielsen, M.A., Thomsen, T.
Positive effect of protein-supplemented hospital food on protein intake in patients at nutritional risk: A randomised controlled trial
(2014) *J. Hum. Nutr. Diet.*, 27, pp. 122-132.
- Zaid, Z.A., Lim, V., Chiann, C., Jamhuri, N.
Plate Wastage among Hospitalized Cancer Patients
(2019) *Malays. J. Med. Heal. Sci.*, 15, pp. 84-89.
- Abdelhafez, A.M., Al Qurashi, L., Al Ziyadi, R., Kuwair, A., Shobki, M., Mograbi, H.
Analysis of Factors Affecting the Satisfaction Levels of Patients Toward Food Services at General Hospitals in Makkah, Saudi Arabia
(2012) *Am. J. Med. Med. Sci.*, 2, pp. 123-130.
- Messina, G., Fenucci, R., Vencia, F., Niccolini, F., Quercioli, C., Nante, N.
Patients' Evaluation of Hospital Foodservice Quality in Italy: What Do Patients Really Value?
(2013) *Public Health Nutr.*, 16, pp. 730-737.
- Sahin, B., Demir, C., Celik, Y., Teke, A.K.
Factors Affecting Satisfaction Level with The Food Services in a Military Hospital
(2006) *J. Med. Syst.*, 30, pp. 381-387.
- Wright, O.R.L., Connelly, L.B., Capra, S.
Consumer Evaluation of Hospital Foodservice Quality: An Empirical Investigation
(2006) *Int. J. Health Care Qual. Assur.*, 19, pp. 181-194.
- Donnelly, R., Wei, C., Koechl, J.M., Keller, H.
The effect of blue dishware versus white dishware on food intake and eating challenges among residents living with dementia: A crossover trial
(2020) *BMC Res. Notes*, 13, pp. 1-6.
- Falagas, M.E., Pitsouni, E.I., Malietzis, G.A., Pappas, G.
Comparison of PubMed, Scopus, Web of Science, and Google Scholar: Strengths and weaknesses
(2014) *FASEB J.*, 22, pp. 338-342.
- Higgins, J., Green, S.
Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 (updated Ma)
(2015),
The Cochrane Collaboration. (accessed on 25 March 2021)
- West, S.L., Gartlehner, G., Mansfield, A.J., Poole, C., Tant, E., Lenfestey, N., Lux, J.L., Carey, T.C.
(2010) *Comparative Effectiveness Review Methods: Clinical Heterogeneity*,
Rockville (MD): Agency for Healthcare Research and Quality (US). September (accessed on 23 March 2021)

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